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LICHEN FLORA OF THE MALHAM TARN AREA

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ABSTRACT

A checklist of lichens, lichenicolous fungi and associated fungi recorded from an area within 5 km of the Malham Tarn Field Centre, Yorkshire is accompanied by background information on the ecology and the history of recording there. In all, 346 taxa (including *Lecidea obluridata* Nyl., new to Britain) have been recorded from the area; 48 are based on old records, most of which are presumed extinct, but some are questionable in the absence of supporting herbarium material.

COLLECTORS

The earliest lichen records from Malham are attributable to Richard Richardson (1663-1741) of North Bierley, the first Yorkshireman to collect lichens; his localised material, used by Johann Jacob Dillenius (1684-1747) for his revision of Ray's *Synopsis* (1724) and his own *Historia Muscorum* (1742), is to be found in the Dillenian and Sherardian Herbaria at Oxford University (OXF).

Other botanists contributing to our knowledge of Malham lichens in the 18th and 19th centuries include John G. Baker (1834-1920), William Borrer (1781-1862), Benjamin Carrington (1827-1893), Samuel Hailstone (1768-1851), Thomas Hebden (1849-1931), William Hudson (1734-1793), Frederic A. Lees (1847-1921), John Nowell (1802-1867), Abraham Shackleton (1830-1916), Abraham Stansfield (1802-1880), William West (1848-1914) and John Windsor (1787-1868). Hailstone's Malham records appear in Whitaker (1805), but many are unlocalised, being expressed as occurring in 'the Craven area'. Publications containing Malham lichen records over this period (albeit often repeatedly citing previous ones) include Hudson (1778, 1798), Withering (1796 and later editions), Turner & Dillwyn (1805), Mudd (1861), Miall & Carrington (1862), Miall (1865), Leighton (1879), West (1883), Lees (1888) and Rotheray (1900). Further biographical and bibliographical details in respect of the lichenological activities of most of the above are to be found in Seaward (1987) and a full checklist of Yorkshire lichens in Seaward (1994).

Very little lichenology was undertaken at Malham, or indeed in Britain as a whole, during the first half of the twentieth century, but records of Malham lichens, based on 19th century recording, are to be found in monographs (*e.g.* Smith, 1918, 1926). The Yorkshire Naturalists' Union held five field meetings based on Malham in 1883, 1890, 1910, 1925 and 1948, but the reports of these meetings, published in *The Naturalist*, contain no lichen records; a report of the Union's meeting in 1999 (which does contain lichen records) is in press. The only Yorkshire checklist published contains sketchily presented localised records (Watson, 1946).

However, the lichen courses first run at Malham Tarn Field Centre by Arthur E. Wade (1895-1989) in the late 1950s added considerably to the revitalisation of lichenology in this

country, and more particularly led to the formation of the British Lichen Society. Many of those who attended these innovative and stimulating courses, including K. A. Alvin, F. H. Brightman, D. H. Brown, J. R. Laundon and J. H. Tallis, were to become key figures in British lichenology. At this time, Charles Sinker, the Assistant Warden of the Centre, showed great interest in lichens, his work contributing to the first published list for the Malham area (Sinker, 1960); specimens collected by Wade and Sinker, used for its compilation, are now in the herbarium of the first author (MRDS).

Peter W. James added many records, mainly through his week-long field courses at the Field Centre in the 1960s; during this time many students attended his courses, among them the Rev. Gordon G. Graham who added his own list of lichen records. Oliver L. Gilbert's appointment as Assistant Warden at the Field Centre provided the opportunity for him to study the lichens, more particularly his interesting work on the mural flora of Tarn House (Raistrick & Gilbert, 1963).

Mark R. D. Seaward first visited Malham as a teacher in the early 1960s, but visited the area on a more regular basis once he had taken up a lecturing position in Yorkshire, acting first as tutor to his own students and later running annual lichen courses at the Field Centre.

Allan Pentecost first visited Malham as an undergraduate when he attended a field course in July 1969, adding lichen records on this and subsequent occasions connected with his PhD research on freshwater algae; he has maintained his lichen recording, more recently in the course of his studies of lichen growth rates on limestone.

Other lichenologists who have worked on the Malham lichen flora in recent decades include Andre Aptroot, Brian J. Coppins, Anthony Fletcher, Alan Fryday, Albert Henderson, Christopher J. B. Hitch and Jack R. Laundon.

TOPOGRAPHY, GEOLOGY AND CLIMATE.

The area surveyed within five kilometres of the Malham Tarn Field Centre encompasses 78.5 km^2 which is mostly open moorland and pasture used as sheepwalk. Woodland is sparse, covering about 90 ha (just over 1% of the total area). Permanent streams are numerous, totalling about 45 km in length, about 70% of them being neutral or alkaline with a high calcium content. There are several ponds or lakes but only Malham Tarn, with an area of 62 ha, is of any significance. The highest and lowest points in the area are Fountains Fell (664 m) and Aire Head (190 m) respectively and the area is therefore predominantly upland; only 5.5% of it lies below 1000 feet (305 m), with 61% lying between 1000-1500 feet (305-457 m) and 33.5% above 1500 feet (Fig. 1).

The region is underlain by several kinds of sedimentary rocks. The most important both floristically and topographically is the Carboniferous 'Mountain' Limestone which covers 85% of the area. This massive well-jointed limestone is exposed in many places, either as cliffs ('scars'), pavements or glacial erratics. It is also the major constituent of stone walls which are common in this area. Owing to the preferential and rapid dissolution of the rock along joints and bedding planes, the surface of the limestone is deeply and irregularly gouged, providing a wide range of microhabitats for cryptogams. In some places the limestone contains veins of lead and zinc ores which have been extensively mined. The limestones vary considerably in composition (O'Connor, 1964) and become darker and more organic higher in the sequence. They range in altitude from 200 m (Malham village) to 570 m (Fountains Fell). The highest cliffs occur at Malham Cove and Gordale Scar

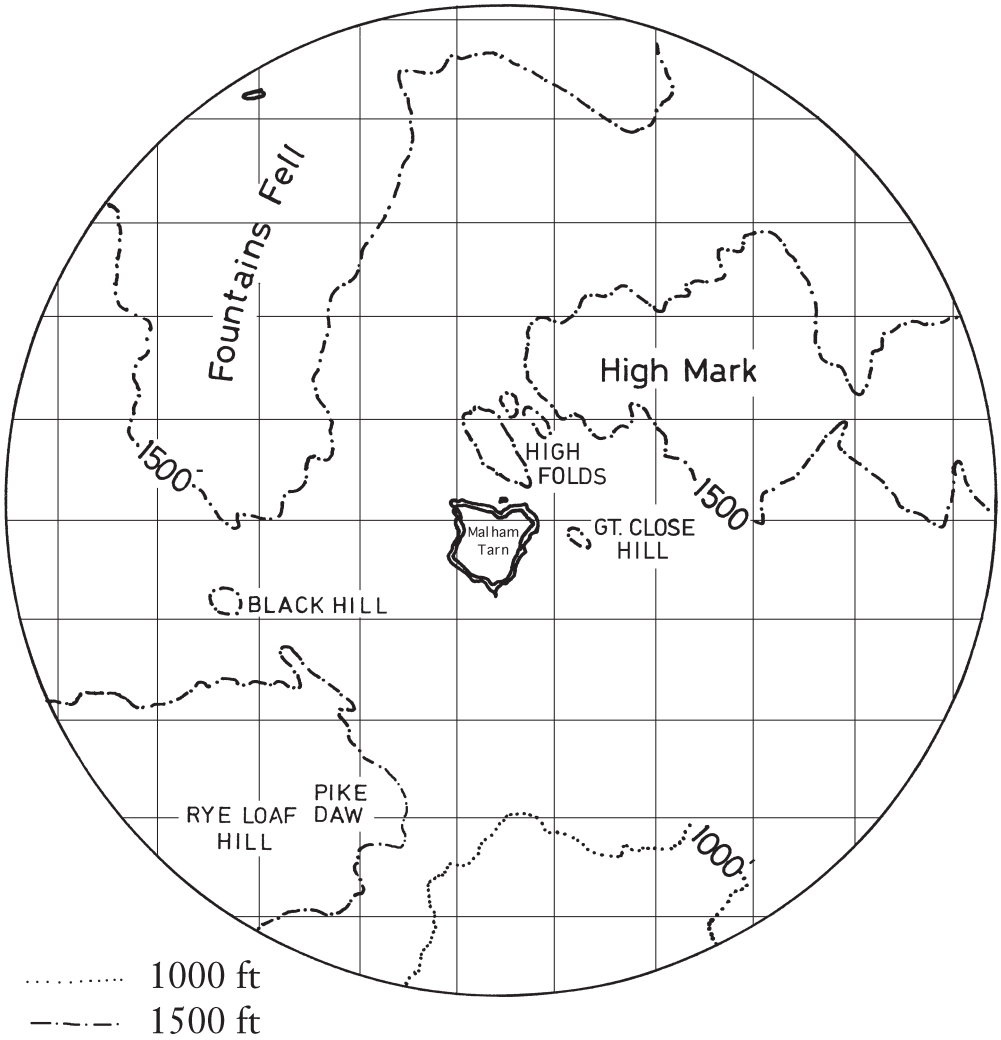

FIG.1. Topography of the Malham Tarn area

where they reach 80 m in height. The most extensive pavements occur at Malham Lings and Highfolds.

The remaining rocks consist of siltstones, sandstones and shales, but these are exposed more locally than the limestone. The Millstone Grit, which consists mainly of a coarse massive sandstone and occupies most of the highest ground, is the predominant member; erratics of this rock are, however, widely distributed. Similar sandstones occur in the Yoredale Series interlayered with sandstones. Shales belonging to the underlying (Silurian) rocks occur locally in Upper Gordale.

The surface geology is complicated by extensive deposits of glacial drift consisting of sands, clays and fragments of the above rock formations and occasionally exotic rocks from the north and west. The drifts have developed thin to thick brown earth soils in most areas whose rate of drainage is dependent upon the clay content. The Carboniferous limestones

are covered by soils ranging from thin rendzinas (<10 cm) to thick brown earths (750 cm) (Bullock, 1971) which can be particularly good for calcicolous lichens. Blanket peat is extensive on the upper moors where it forms a layer, now much eroded, up to 3 m in thickness on the Millstone Grit and Yoredale rocks. Tarn Moss at the western margin of Malham Tarn is a well known raised bog consisting of three domes of peat up to 5 m in thickness.

Situated in the Pennines, the climate of the area reflects the upland nature of the region and its exposure to Atlantic weather systems. The air is humid and cloudy with measurable rainfall recorded on more than 200 days in most years. The number of 'rain days' appears to be an important factor controlling lichen distribution (Coppins, 1976), with the richest areas of Britain having in excess of 200 rain days. Total precipitation averaged 1365 mm per year in the period 1992-1997. The average annual air temperature recorded at Malham Tarn Field Centre (altitude 395 m) for the period 1921-1950 was 7.0°C (Manley, 1956), the hottest and coldest months being July (mean 13.5°C) and January (mean 1.5°C) respectively. Temperature records are also available for Fountains Fell (Manley, 1979), where the high ground is frequently cloud-covered; for example, in 1995, cover was observed on 129 days.

During the period 1949-1955 the average number of 'frost' days was 91. Snowfall was recorded on about 47 days of the year and snow-lie on about 40 days. However, in recent years, snow-lie has been less frequent and the mean temperature between 1992 and 1997 showed a slight increase to 7.2°C. Less is known of windspeed for the area because the meteorological station is sheltered by Highfolds Scar and tends to underestimate windspeed. However, the average windspeed is probably around 25 km h^{-1} with prevailing westerlies often reaching gale force. Relative humidity has not been routinely measured at the Field Centre but must be high for most of the year. Annual sunshine hours averaged 995 in the period 1992-1997.

Lichen distribution patterns are strongly influenced by the substratum and climatic variables. The saxicolous lichen flora of the area is predominantly a calcicolous one and calcareous rock surfaces provide the greatest opportunity for lichen colonisation in the district

CORTICOLOUS FLORA

Just over 1% of the area is covered by woodland which is well below the average for the county and England as a whole (Fig. 2). Extensive woodland clearances probably took place over the past three centuries to increase grazing land and there has been little replanting. Of the remaining woodland, which totals about 90 ha, the largest single area is the Malham Tarn estate woodland (25 ha). There are about 30 separate woodland enclosures of which 33 ha (38%) are conifer plantation and 54 ha (62%) broadleaf. The woods below Janet's Foss (220 m) and the trees below Highfolds Scar (450 m) are respectively the lowest and highest broadleaf woodland areas. It is likely that the areas of fen-carr adjacent to Tarn Moss represent the historically oldest woodland area but even this has been disturbed by flooding when the Tarn level was raised in the late 18th century. The oldest trees are probably to be found close to the Field Centre where plantings were undertaken in the late 18th century. Most of the small woodland enclosures appear to be more recent than this as they do not appear on the first Ordnance Survey map of 1850-1851. The commonest woodland trees are sycamore, ash, beech, Scots pine and larch. In the carr, alder and several

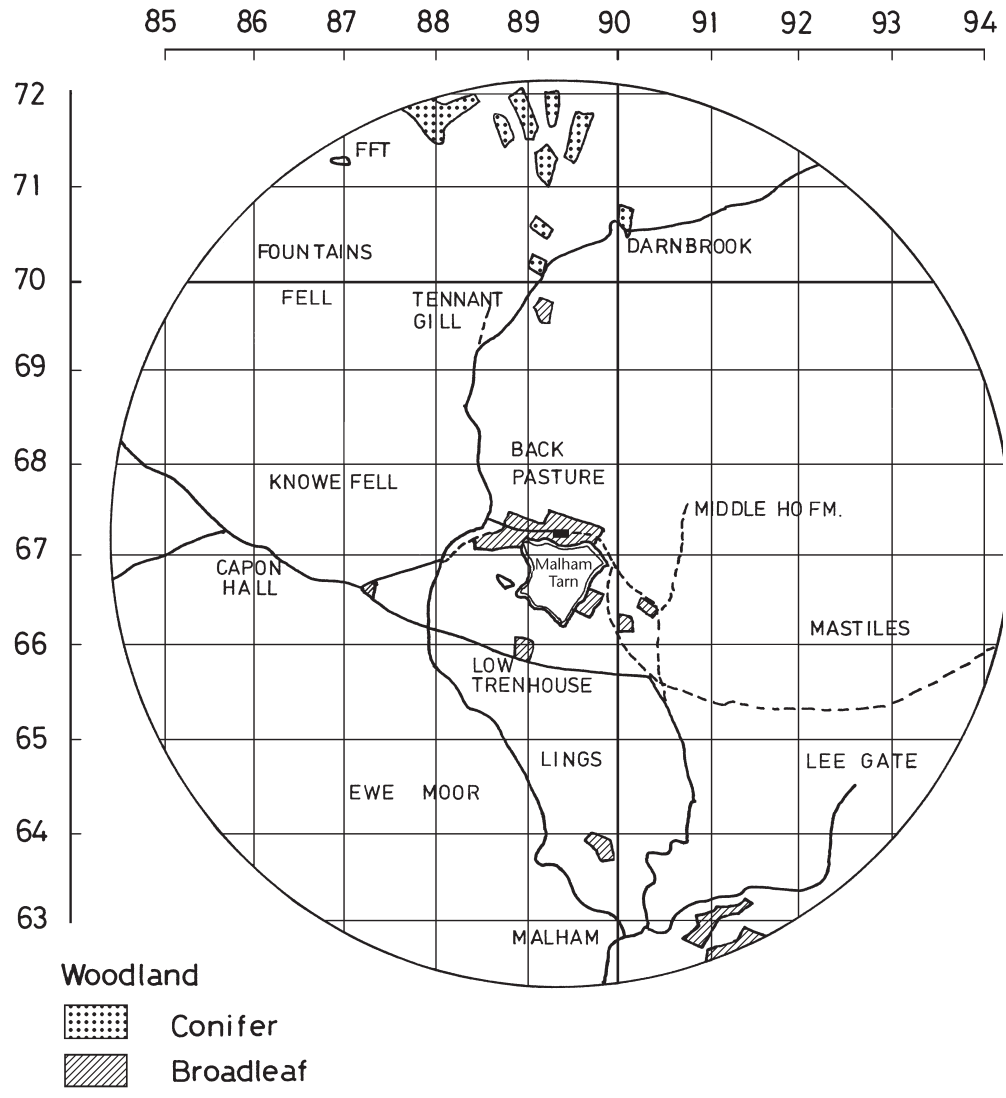

FIG. 2. Woodland within a 5 km radius of Malham Tarn Field Centre, with the 1 km National Grid superimposed

species of willow occur and a wide range of other trees, mainly planted, can be found in smaller numbers. The white-beam, *Sorbus aria*, occurs as scattered individuals on the limestone pavements.

The corticolous lichen flora totals 102 species and is not particularly rich. However, it is substantial when compared with the saxicolous flora which implies that it has been comparatively well studied. Of the corticolous species, 23 are old records and may well be extinct. The number of listed macrolichens is also small, totalling just 29 species of which only 22 appear to be extant. A useful measure of 'richness' in the corticolous lichen flora is the 'Revised Index of Ecological Continuity' (RIEC) of Rose (1976), which is derived from a small list of faithful 'old woodland' lichens. The RIEC values of the woodlands in the

district are all low (0-20), indicating depauperate floras throughout. Even the 19th century records provide few RIEC indicators and show that the corticolous flora has been poor for more than a century.

To provide an overview of the common corticolous species three small plantations close to Malham Tarn, namely Great Close, Ha Mire and Lings were surveyed in 1999 (Table 1). All three woodlands are between one and two hundred years old and contain some mature sycamore and ash. The sycamores were mainly planted at the margins and it is here that most of the lichens are best developed. The lichen floras of these woods are all fairly poor and are similar in terms of species composition and richness. In all of the woods, the three commonest foliose species are *Hypogymnia physodes*, *Parmelia sulcata* and *Platismatia glauca* where they grow low on the tree trunks or branches. These species, along with *Parmeliopsis ambigua*, are widely distributed in Britain, particularly in areas subject to some atmospheric pollution with sulphur dioxide levels of around 60-70 $\mu g.m^{-3}$ (Seaward & Hitch, 1982). All four are characteristic of acidic substrata but *P. sulcata* is more frequent on ash which often has less acidic bark. The other conspicuous foliose lichens are *Parmelia saxatilis* and *Pseudevernia furfuracea* var. *ceratea*. These species are also tolerant of low levels of atmospheric pollution and are widely distributed in Britain. Other foliose species occur on trees used by roosting birds which enrich the bark with faeces and include species of *Phaeophyscia*, *Physcia* and *Xanthoria*. Fruticose lichens, apart from *Cladonia* species, which grow on the tree bases, are scarce and represented only by *Evernia prunastri* and *Ramalina farinacea*. Several species of *Ramalina* no longer occur here, *e. g. R. calicaris*, *R. fastigiata* and *R. fraxinea*. Sixteen species out of the total of 37 were crustose lichens. The commonest of these are *Lecanora conizaeoides*, *Lepraria incana* and *Mycoblastus sterilis*, all of which are tolerant of atmospheric pollution and grow on a wide range of trees. Again, some species such as *Buellia punctata* and *Lecania cyrtella* are characteristic of nutrient enrichment.

While the corticolous flora as a whole is poor, a number of interesting finds have been made. Among the foliose species is *Parmelia caperata* which has been found on a very small number of tree bases. This species is scarce and while it is less tolerant of atmospheric pollution when compared with the above mentioned species, it is also sensitive to frost damage and may be partly limited by the rather harsh climate. *Usnea subfloridana* is likewise rare and restricted to the most humid, sheltered sites where light levels are moderate to high. Most of the woodlands, being of limited area, are exposed throughout to strong winds, reducing the surface temperature for most of the year. Among the crustose lichens, *Arthonia spadicea*, *Calicium viride*, *Enterographa crassa* and *Graphis* species are characteristic of old established woodlands although all are scarce; most of these occur on old ash trees. There are early records for a number of 'old forest' species such as *Normandina pulchella* and *Parmeliella triptophylla*, suggesting that at least small fragments of old woodland existed in the nineteenth century.

Ochrolechia tartarea, the 'Cudbear lichen', once used for dyeing, was also recorded. Today this is a western species which has disappeared from most of the Pennines, probably as a result of air pollution and substrate disturbance. Other corticolous losses from a variety of habitats include *Pachyphiale carneola*, *Parmelia perlata*, *Pertusaria hymenea*, *P. multipuncta*, *Physcia aipolia*, *Physconia distorta*, *Psoroma hypnorum*, *Pyrenula* species and *Thelotrema lepadinum*.

Over a dozen lichens have been recorded from lignum. Again this is a small number and there are no rarities excepting *Thelocarpon laureri* which is easily overlooked on account

TABLE 1. Corticolous lichens of three plantations near Malham Tarn (c = common, f = frequent and p = present on a few trees).

	Great Close	**Ha Mire**	**Lings**
Nat. grid. ref.	34/904664	34/897664	34/898664
Area (ha)	1. 0	4. 7	0. 6
Altitude (m)	390	380	385
Approximate age (yr)	100-150	150-200	100-150
Main trees	*Acer*, *Fagus* *Fraxinus*	*Acer*, *Alnus*, *Fraxinus*, *Larix*	*Acer*, *Crataegus*, *Fraxinus*, *Pinus*
Lichen species:			
Arthonia punctiformis			p
Arthopyrenia punctiformis		p	
Buellia punctata			p
Cladonia coniocraea	c	c	c
Cladonia digitata	p		
Cladonia fimbriata	f	p	p
Cladonia floerkeana		p	
Cladonia macilenta			p
Cladonia ochrochlora			p
Cladonia subulata			p
Evernia prunastri	p		
Fuscidea lightfootii	p		
Hypogymnia physodes	c	c	c
Hypogymnia tubulosa	p	p	f
Lecania cyrtella	p		f
Lecanora chlarotera		p	
Lecanora conizaeoides	f	c	f
Lepraria incana	c	c	c
Micarea lignaria			p
Micarea melaena		p	
Mycoblastus sterilis	c	f	c
Ochrolechia inversa	p		
Ochrolechia turneri		p	p
Opegrapha herbarum		p	
Parmelia saxatilis	f	f	
Parmelia sulcata	c	c	c
Parmeliopsis ambigua	f	f	f
Peltigera praetextata		p	
Pertusaria albescens	p		
Pertusaria amara	p		
Phaeophyscia orbicularis	p		
Physcia adscendens			p
Physcia tenella	p		
Platismatia glauca	c	c	c
Pseudevernia furfuracea	f	f	f
Ramalina farinacea	p		p
Xanthoria parietina	f		p
Total lichen species	23	19	22

of its small size. Common species on lignum are *Lecanora conizaeoides*, *Hypogymnia physodes*, *Mycoblastus sterilis* and two species of *Placynthiella*; also widespread are *Micarea lignaria*, *Parmeliopsis ambigua*, *Pseudevernia furfuracea* and *Trapeliopsis flexuosa*. On lignum which has been eutrophicated by birds (*e.g.* fence posts and railings), *Buellia punctata* and *Candelariella vitellina* are often found. Old, rotting wood frequently supports a range of *Cladonia* species, for example *C. coniocraea*, *C. floerkeana*, *C. macilenta*, *C. ochrochlora*, *C. ramulosa* and *C. squamosa*, occasionally with *Trapeliopsis flexuosa*.

SAXICOLOUS FLORA

a) **Carboniferous limestone**

Water relations, irradiance and eutrophication are the important factors controlling the distribution of species. Jointing patterns in the limestone result in the exposures frequently presenting vertical faces at right angles, but the angles are usually rounded due to weathering. Flat pavements are a conspicuous feature of the area and have resulted from soil stripping during glaciation. The pavements have been subject to both sub-soil and surface weathering along joints, resulting in a network of deep 'grikes' (widened joints) and rounded or flattened 'clints' (upstanding islands of pavement). The clints often exhibit small depressions which may fill with water during wet periods. The whole surface has a complex microtopography providing contrasts in aspect (affecting irradiance) and water relations. While both pavements and scars have been examined by many lichenologists, quantitative studies are lacking. Lichens are abundant on limestone surfaces, but most are small and inconspicuous and the thalli of many are largely endolithic. Sampling is also difficult and any detailed work would be extremely time consuming. However, the lichen flora as a whole is well known and fairly rich. The rock surface itself (excluding soil crevices, and bryophyte surfaces to be considered later) supports a total of 111 species; of these, the majority (74%) are crustose species and the remainder mostly strongly attached placodioid species. The flora is considered in terms of exposed surfaces, more or less dry sheltered surfaces and damp sheltered surfaces respectively.

i) *Exposed rock*

Exposed, well-illuminated surfaces support the largest number of species (69), particularly those of *Caloplaca*, *Collema*, *Lecanora*, *Protoblastenia* and *Verrucaria*. Some of the commonest and most conspicuous species where there is negligible eutrophication are *Aspicilia calcarea*, *Caloplaca citrina*, *C. flavovirescens*, *C. holocarpa*, *Clauzadea monticola*, *Collema crispum*, *C. cristatum*, *Lecanora albescens*, *L. dispersa*, *Protoblastenia rupestris*, *Thelidium decipiens*, *Verrucaria baldensis* and *V. nigrescens*. These species are common on limestone throughout the country. Foliose species belong only to the genus *Collema* whose thalli become much expanded and more noticeable when wet. The photobiont of *Collema* is the cyanobacterium *Nostoc* and it is therefore a cyanolichen. However, the photobionts of most of the limestone lichens are green algae and cyanolichens make up only 14% of the total limestone flora. Other frequent and conspicuous species include *Caloplaca aurantia*, *C. ochracea*, *Rhizocarpon umbilicatum*, *Solenopsora candicans* and *Squamarina cartilaginea*. Mosaic-forming species are infrequent and on many surfaces it can be difficult to determine the limits of the thalli. The crustose lichens include 19 pyrenolichens belonging to the genera *Polyblastia*, *Thelidium*, *Staurothele* and *Verrucaria*. Some species of *Verrucaria*, such as *V. baldensis* and *V. nigrescens*, are particularly common. Few of these lichens can be identified in the field so details of their distribution and ecology are lacking at present.

Although a large proportion of the limestone appears to be colonised by lichens, senescent plants can account for a considerable area of the surface. The limestone also has abundant free-living algae such as *Gloeocapsa*, which sometimes overgrow lichen thalli.

In areas of nutrient-enrichment by birds there are several characteristic species; these include *Lecania erysibe*, *Phaeophyscia orbicularis*, *Physcia adscendens*, *P. caesia*, *Xanthoria parietina* and, less frequently, *Caloplaca chalybeia*, *C. variabilis*, *Candelariella medians*, *Lecanora muralis* and *Xanthoria calcicola*. Slight nutrient enrichment is likely to favour further species such as *Aspicilia calcarea* and *Caloplaca decipiens*. The distribution of six species of ornithocoprophilous lichens was investigated in the area by Jaggard *et al.* (1974) who found a positive correlation between the number of species and the height of limestone boulders. The same species (*Caloplaca flavescens*, *C. citrina*, *Lecanora dispersa*, *Physcia adscendens*, *P. caesia*, *Xanthoria parietina*) had a preference for wall tops rather than the sides and, in some cases, all the stones examined in a wall were colonised by one of these species. A similar observation was made on the scars at the edge of limestone pavements where these species predominated. All these sites tend to be preferred by some bird species as song posts or lookouts.

ii) *Sheltered rock*

Vertical dry cliffs sheltered from the sun are sometimes colonised by lichens. A total of 30 species has been found from such sites and include some rarities. Again, a group of common species can be recognised which includes *Acrocordia conoidea*, *Gyalecta jenensis*, *Lepraria lesdainii*, *Leproplaca chrysodeta*, *Opegrapha dolomitica*, *Thelidium incavatum*, *Verrucaria muralis* and *V. viridula*. Inevitably there is some overlap with the 'exposed' species; for example, in the road cutting by the Field Centre, which was excavated early in the last century, the commonest species are *Belonia nidarosiensis* (sterile), *Gyalecta jenensis*, *Protoblastenia rupestris*, *Verrucaria baldensis* and *V. nigrescens*. This habitat is dominated by crustose and placodioid lichens; foliose species do not normally occur. Placodioid species include *Caloplaca cirrochroa* and *Placynthium subradiatum*, neither of which is common; the crustose species are characteristic of such dry limestone but, nevertheless, are rarely recorded in this country, for example, *Poeltinula cerebrina*.

Stone walls are widespread in the area and are a conspicuous feature of the Dales scenery. The earliest walls are late Medieval with most dating from the 16th to early 17th century (T. C. Lord, pers. comm.). Wall dating is difficult but could be aided by lichenometry. Colonisation of much of the stone will be comparatively recent when compared with the scars and pavements. However, they appear to support a similar lichen flora although the wall tops are often covered with ornithocoprophilous species as noted above. Many walls contain both acidic and basic rock with the lichen flora clearly differentiating between them. In some areas, farmers have topped the walls with galvanised wire and the toxic effect of zinc on the lichen flora is evident, with only green algae growing where the rain runoff from the fencing meets the wall.

iii) *Wet rock*

Limestone which remains permanently damp or wet is usually covered in free-living algae, but some lichens are also found. Runnels on steep cliffs are sometimes colonised by the foliose species *Dermatocarpon miniatum* and, more rarely, *Collema fuscovirens* and *Leptogium plicatile*. Crustose lichens of damp sheltered rock include many of those colonising drier sheltered rock, but occasionally with *Ionaspis epulotica* and *Petractis clausa*. One of the

commonest crustose species, which also grows on rock close to the ground, is the cyanolichen *Placynthium nigrum*. Pools forming in small hollows on the limestone pavement sometimes support a specialist cyanolichen flora of *Lempholemma botryosum* and *L. cladodes*. Submerged limestone is infrequently colonised by lichens. However, pebbles below calcareous springs are occasionally blackened by *Verrucaria aquatilis. Thelidium zwackii* has been found growing on travertine deposits in the area, an unusual substratum since this rock 'grows' in the stream beds, presumably taking the lichen with it (Pentecost & Fletcher, 1974).

iv) *Bryophytes*

Several lichens grow preferentially upon bryophytes on top of bare limestone. A good range of mosses provide suitable substrata for lichens but there have been no studies on the relationships between the bryophyte and lichen species. About a dozen lichen species are more or less confined to this substratum, the most frequently recorded being *Cladonia pocillum*, *C. rangiformis*, *Collema crispum*, *C. tenax*, *Leptogium gelatinosum* and *L. schraderi.* All of these species form small rosettes and are frequently found on walls, but *Peltigera* species, the largest macrolichens in the district, are locally frequent in moist situations, particularly *P. lactucifolia. P. leucophlebia*, a species with a green photobiont, was recorded in 1955 but has not been seen since. In moderately sheltered sites a range of microlichens occur. The most frequent are *Agonimia tristicula* and *Bacidia sabuletorum*. Much less common lichens include *Bacidia bagliettoana*, *B. delicata*, *Caloplaca cerina*, *Chromatochlamys muscorum* and *Toninia lobulata*. In dry sheltered sites, *Lepraria* species commonly overgrow bryophytes.

v) *Soil*

Accumulations of soil in close contact with limestone provide another well-defined habitat for a small group of lichens. Damp soil crevices between small bedding planes and joints are often good places to find these species. For such lichens, the thallus consists of small squamules or lobules, the most frequent being *Collema crispum*, *C. tenax* (both cyanolichens), *Agonimia tristicula*, *Catapyrenium lachneun*, *Toninia sedifolia* and *Squamarina cartilaginea*. Much less frequent are *Catapyrenium cinereum* and *Dermatocarpon luridum*.

The effects of lichens on soil formation in the area was investigated by Syers (1964) who found that a succession of lichens on limestone from crustose to foliose species (*e.g. Physcia adscendens*) lead to the leaching of calcium and iron and the formation of a rudimentary soil through the activities of the associated invertebrates. The process is illustrated by Bullock (1971). Wood (1967) has also investigated the soil fauna associated with limestone lichens in the area, finding *Anurophorus laricis* (Collembola) particularly common.

Non-calcareous rock

i) *Exposed and sheltered sites*

A range of non-calcareous sedimentary rocks occur and most exposures are in montane areas above 400 m altitude. Sandstones of the Millstone Grit and Yoredale Series form small isolated outcrops on Fountains Fell and elsewhere. At lower altitudes, these rocks also occur commonly as glacial erratics and are often encountered in dry stone walls. Shales are also widespread near Pikedaw and the Silurian inlier at Gordale. The acid rock flora currently totals 65 species and includes a mixture of lowland and montane lichens. A few species are associated with weakly calcareous rock, or acid rock which has been influenced

by calcareous water or dust. Typical species of these rocks are *Caloplaca flavovirescens*, *Lecanora rupicola*, *Lecidea fuscoatra*, *Lecidella scabra*, *Ochrolechia parella* and *Tephromela atra*. Another group of species is associated with nutrient enrichment, mainly by birds; they include *Acarospora fuscata*, *Aspicilia caesiocinerea*, *Buellia aethalea*, *Candelariella vitellina*, *Lecanora sulphurea*, *Parmelia sulcata*, *P. omphalodes*, *Umbilicaria polyphylla* and *Xanthoria parietina*.

On exposed acidic oligotrophic rocks, the common lowland species are *Lecanora intricata*, *L. polytropa*, *Parmelia saxatilis*, *Pertusaria corallina*, *Porpidia cinereoatra*, *P. tuberculosa*, *Pseudevernia furfuracea* var. *furfuracea*, *Rhizocarpon geographicum* and *Trapelia coarctata*. Sheltered, dry rock supports a poorer flora consisting of *Catillaria chalybeia*, *Lepraria incana*, *Opegrapha gyrocarpa* and *Psilolechia lucida*. On the higher slopes, a more 'montane' flora becomes apparent with many species common to the Lake District mountains; these include on exposed rocks *Fuscidea cyathoides*, *F. lygaea*, *Lecidea lapicida*, *Miriquidica leucophaea*, *Parmelia incurva*, *Placopsis gelida*, *Porpidia macrocarpa*, *Protoparmelia badia*, *Schaereria cinereorufa*, *Stereocaulon evolutum* and *Umbilicaria polyphylla*.

A small group of lichens occurs on inundated acid rocks and includes *Bacidia inundata*, *Porpidia hydrophila*, *Verrucaria aethiobola* and *V. elaeomeleana*.

ii) *Bryophytes and soils*

In contrast with the limestone, the bryophilous flora of the acidic rock is more limited and consists mainly of a small number of *Cladonia* species such as *C. cervicornis*, *C. chlorophaea*, *C. pyxidata* and *C. subcervicornis*. Further species, however, occur on metalliferous soils (see below).

iii) *Spoil tips*

Small-scale mining of lead, zinc and copper has resulted in several significant metalliferous spoil tips dating from the last century. The greatest concentration is at Pikedaw where a large deposit of calamine was mined (Raistrick, 1954). Here the tips contain secondary iron, zinc and copper minerals in addition to quartz, dolomite and much broken limestone. A specialised flora often develops on tips and, at Pikedaw, much of the material is covered with the small herb *Minuartia verna* and the moss *Weissia controversa*. Much of the limestone is devoid of lichens, but some areas support large, often sterile patches of *Verrucaria nigrescens*, with occasional crusts of *Aspicilia contorta*, *Lecanora crenulata*, *L. dispersa*, *Verrucaria baldensis* and, rarely, *V. murina*. On some rock, the bird-manure species *Physcia caesia* is common, suggesting that it too may be tolerant of heavy metals. Several lichens also colonise *Weissia controversa* perhaps because, in such habitats, moss growth is reduced, allowing more competition. The most frequently recorded lichen species are *Cladonia pocillum*, *C. rangiformis* (K-strain), *C. furcata* and *Bacidia sabuletorum*, with scarce *Gyalidea subscutellaris* and *Vezdaea aestivalis*. The acidic and visually more metalliferous rock is colonised principally by *Lecidea obluridata* which covers large areas of the rock in places. Other frequent crustose lichens are *Aspicilia caesiocinerea*, *Porpidia macrocarpa*, *P. tuberculosa* and *Rhizocarpon obscuratum*, with *Acarospora veronensis*, *Micarea lignaria*, *Stereocaulon pileatum* and *S. vesuvianum* more local. Fragments of barytes are occasionally colonised by *Miriquidica leucophaea*. This flora is characteristic of such spoil but is not particularly rich, possibly because of the relative scarcity of copper minerals and the preponderance of base minerals such as calcite and dolomite. However, it is only a provisional list and further searches should prove rewarding.

Deep soils and peat

Deeper soils, including deposits of peat, are widespread; their leaching by rainwater usually ensures an acidic reaction (Bullock, 1971). On the raised bog of Tarn Moss, west of Malham Tarn, the peat attains a thickness in excess of 5 m. Most of the peat is colonised by vascular plants and lichens are excluded, but on the unstable cliff margins near the Tarn and the eroding edges of old peat cuttings and 'hags', bare peat is exposed and frequently colonised by lichens and bryophytes. The most conspicuous lichens belong to the genus *Cladonia*, the commonest species being *C. chlorophaea*, *C. fimbriata*, *C. floerkeana*, *C. humilis*, *C. polydactyla*, *C. portentosa*, *C. pyxidata* and *C. uncialis*. The rarest species so far discovered are *C. strepsilis* (a lichen of damp peat) and *C. sulphurina* (a local montane species). The commoner *Cladonia* species are sometimes accompanied by *Coelocaulon aculeatum* and, more rarely, *C. muricatum*. On Fountains Fell, the 'Iceland Moss' *Cetraria islandica* is sometimes found associated with *Cladonia* species; it is locally frequent among *Calluna* and *Vaccinium* but has so far been found only above 600 m altitude.

A few common crustose lichens also grow on peat and well leached soil, and include *Baeomyces rufus*, *Plancynthiella uliginosa* and *Trapeliopsis granulosa*. Two basidiolichens, namely *Omphalina ericetorum* and *O. hudsoniana*, have also been identified. They are usually only seen in their sterile '*Botrydina*' state. *Icmadophila ericetorum*, a characteristic lichen of undisturbed peat, now appears to be extinct and also seems to be decreasing in other parts of the country.

AIR POLLUTION

The Malham area is on the northwestern edge of a complex of large towns and industries, including several fossil fuel-burning power stations. Easterly winds are frequent and are often laden with air pollutants. Raistrick & Gilbert (1963) estimated that one third of all winds recorded at the Field Centre during the period 1952-1961 passed over the dense conurbations of the West Riding and Lancashire. In the 1950s, Dr J. W. G. Lund (pers. comm.) observed that the limestone pavement pools were frequently blackened with soot. This is not apparent today due to legislation controlling coal fires. Most lichens are sensitive to air pollution and their relative sensitivity has been used to develop a semi-quantitative scale of sulphur dioxide pollution (Hawksworth & Rose, 1970). The scale ranges from zero, with no epiphytes present on tree bark, to ten where a number of sensitive macrolichens such as *Lobaria* are present. The corticolous flora of the Malham woods corresponds closely to scale 5 which is equivalent to an estimated 60 $\mu g.m^{-3}$ mean winter sulphur dioxide, indicating a significant level of pollution.

From 1986 to 1989, acid precipitation was monitored at the Field Centre by Warren Springs Laboratory and a range of pollutants were measured. During this period, the 90 percentile summertime sulphate and nitrate concentrations in the precipitation were 14-94 µM and 7-106 µM respectively. The annual mean acidity fell in the range 30-50 $\mu eq.l^{-1}$ which is high when compared with the west of Britain (<20) but lower than the most highly polluted regions where the value exceeds 60. Rainfall pH frequently fell below 4.5. However the estimated wet acid deposition was among the highest in Britain and exceeded 0. 05g $H^+ m^{-1}$. Lichens are affected by acidity and sulphite and also, probably, by soot.

Endolithic lichens such as *Verrucaria baldensis* may receive protection from acidity through the buffering action of the limestone, whereas epilithic species such as *Solenopsora candicans* receive direct rainfall upon their thalli and may be more susceptible. However, in

the absence of detailed monitoring this remains speculative. While an improvement in air quality has been documented in some parts of the country with the re-establishment of some lichen species, this has not been done for the Malham area. Although there have been some improvements in the lichen flora over recent years, these have been less significant than for many areas of England where clean air legislation has been implemented.

Herbaria Consulted

Malham lichen material is to be found in numerous herbaria, including the following which have been consulted: The Natural History Museum, London (BM), Oxford University (OXF), Bristol University (BRIST), Keighley Museum (KGY), Bradford Museum (CMM), Leeds University (LDS), Royal Botanic Garden, Edinburgh (E), Yorkshire Museum (YRK), and the private herbaria of the first author (MRDS) and Dr A. Aptroot (ABL).

Checklist

Only those old records which can be definitely localised within the defined area (*i.e.* within 5 km of Malham Tarn Field Centre) have been included. Those given as occurring in "Craven" by Whitaker (1805), Miall & Carrington (1862), and Lees (1888), many of which no doubt occur in the defined area, have been excluded. Nomenclature is according to Purvis *et al.* (1994); lichenicolous fungi are indicated by [LF], and several non-lichenised taxa, indicated by [F], have been included since they are traditionally recorded by lichenologists. Listed taxa given in squared brackets are old records which are either presumed extinct or questionable in the absence of supporting herbarium material.

Acarospora fuscata (Schrader) Th. Fr.
Sinker 1955 (herb. MRDS); Gilbert 1963; James 1970; Seaward 1977; Henderson and Seaward 1999
On nutrient-enriched siliceous rocks and walls; locally frequent.

Acarospora glaucocarpa (Ach.) Körber
Graham 1965; James 1970; Pentecost 1970
On hard limestone; occasional.

Acarospora veronensis Massal.
Pentecost 1999
On acidic mineral-rich spoil; local.

Acrocordia conoidea (Fr.) Körber
Rotheray (1900); Sinker 1955, (1960); Graham 1965; James 1969; Seaward 1977; Fryday 1990
On hard limestone; common.

Agonimia tristicula (Nyl.) Zahlbr.
Graham 1965; James 1970; Seaward 1985; Henderson and Seaward 1999
On mosses over limestone; occasional, but overlooked.

Anisomeridium biforme (Borrer) R. Harris
Lees (1888); James 1965
On *Acer*; rare.

[*Arthonia radiata* (Pers.) Ach.
Carrington, in Miall & Carrington (1862); Shackleton & Hebden (1893 as *A. astroidea*)]

Arthonia spadicea Leighton
Fryday 1990
On *Fraxinus*; rare.

Arthopyrenia lapponica Anzi [F]
James 1970
On young *Quercus* and *Fraxinus*; uncommon.
Arthopyrenia punctiformis Massal. [F]
Carrington, in Miall & Carrington (1862 as *Verrucaria capnodes*); Sinker (1960); Seaward 1985; Pentecost 1999
On smooth-barked trees; locally frequent.
[*Arthopyrenia rhyponta* (Ach.) Massal. [F]
Carrington, in Mudd (1861) and Miall (1865)]
Aspicilia caesiocinerea (Nyl. ex Malbr.) Arnold
? Hebden, in Rotheray (1900 as *A. gibbosa*); Graham 1965
On nutrient-enriched rock; rare.
Aspicilia calcarea (L.) Körber
Carrington, in Lees (1888); Rotheray (1900); Laundon 1954 (herb. MRDS); Sinker 1955, (1960); Graham 1965; James 1970; Seaward 1977; Henderson and Seaward 1999
On calcareous rocks & stonework; common.
Aspicilia contorta (Hoffm.) Krempelh.
Carrington, in Miall & Carrington (1862) (and in Lees, 1888); Shackleton & Hebden (1893); James 1970; Seaward 1977; Henderson and Seaward 1999
On calcareous rocks and stonework; occasional.
Bacidia arnoldiana Körber
Seaward 1985; Fryday 1990
On *Fraxinus*; uncommon.
Bacidia bagliettoana (Massal. & de Not.) Jatta
Carrington, in Miall & Carrington (1862); James 1970; Seaward 1979
On moss over calcareous rock; uncommon.
Bacidia delicata (Larbal. ex Leighton) Coppins
James 1970
On mosses near the Tarn; rare.
Bacidia inundata (Fr.) Körber
Graham 1965; James 1965
On siliceous rocks in stream; uncommon.
Bacidia naegelii (Hepp) Zahlbr.
James 1970
On *Sambucus*; rare.
[*Bacidia rubella* (Hoffm.) Massal.
Carrington, in Lees (1888) (and in Watson, 1946 as *B. luteola*)]
Bacidia sabuletorum (Schreber) Lettau
Sinker 1955 (herb. MRDS), (1960); Gilbert 1963; Graham 1965; James 1970; Seaward 1977; Fryday 1990; Henderson and Seaward 1999; Pentecost 1999
On mosses over limestone and spoil tips; common.
Baeomyces roseus Pers.
James 1970
On acidic soil; rare.
Baeomyces rufus (Huds.) Rebent.
Sinker 1955 (herb. MRDS); James 1970
On weathered sandstone; uncommon.
Belonia nidarosiensis (Kindt) P. M. Jörg. & Vezda
James 1970; Seaward 1999; Henderson and Seaward 1999
On shaded limestone; locally frequent.
[*Biatora sphaeroides* (Dickson) Körber
Carrington, in Miall & Carrington (1862 as *Biatorina sphaeroides* and *Bilimbia sphaeroides*)]
[*Brigantiaea fuscolutea* (Dickson) R. Sant.

Carrington, in Miall & Carrington (1862 as *Lopadium fuscoluteum*)]

Buellia aethalea (Ach.) Th. Fr.
Gilbert 1963; Seaward 1999
On acid stonework; occasional.

[*Buellia disciformis* (Fr.) Mudd
Shackleton & Hebden (1893) (and in Rotheray, 1900)]

[*Buellia ocellata* (Flot.) Körber
Shackleton & Hebden (1893) (and in Rotheray, 1900 as *Lecidea verruculosa*)]

Buellia punctata (Hoffm.) Massal.
Shackleton & Hebden (1893) (as *Lecidea myriocarpa* forma *areolata*; and in Rotheray, 1900 as *L. myriocarpa*); James 1974; Seaward 1985; Fryday 1990
On *Fraxinus* and fence posts; locally frequent.

Calicium viride Pers.
Fryday 1990
On *Quercus*; rare.

Caloplaca aurantia (Pers.) Steiner
Carrington, in Miall & Carrington (1862 as *Placodium callopismum*); Graham 1965; James 1970.
On well-lit limestone; uncommon.

Caloplaca cerina (Ehrh. ex Hedwig) Th. Fr.
incl. var. *chloroleuca* (Sm.) Th. Fr.
Carrington, in Miall & Carrington (1862); Shackleton & Hebden (1893); Sinker (1960); James 1970
On *Sambucus* and on mosses over limestone; uncommon.

Caloplaca chalybaea (Fr.) Müll. Arg.
Shackleton & Hebden (1893); Hebden, in Watson (1946, herb. E); Graham 1965; James 1970
On hard limestone; occasional.

Caloplaca cirrochroa (Ach.) Th. Fr.
Sinker 1955 (herb. MRDS); Wade 1963 (herb. MRDS); Graham 1965; James 1970; Seaward 1985
On dry, shaded and vertical limestone; occasional.

Caloplaca citrina (Hoffm.) Th. Fr.
Hailstone, in Lees (1888); Shackleton & Hebden (1893); Sinker 1955 (herb. MRDS), (1960); Gilbert 1963; Jaggard *et al.* (1974); Seaward 1977
On calcareous rocks and building materials; common.

Caloplaca crenularia (With.) Laundon
Miall (1865 as *Callopisma ferrugineum*); Graham 1965; James 1970; Seaward 1986; Henderson and Seaward 1999
On acid stone walls & rocks; occasional.

Caloplaca decipiens (Arnold) Blomb. & Forss.
Seaward 1977
On dusty calcareous rocks and stonework; uncommon.

Caloplaca flavescens (Huds.) Laundon
West (1883) (herb. CMM); Lees (1888); Sinker 1955 (herb. MRDS), (1960); Graham 1965; James 1970; Jaggard *et al.* (1974); Seaward 1977
On calcareous rocks and stonework; frequent.

Caloplaca flavovirescens (Wulfen) Dalla Torre & Sarnth.
Carrington, in Miall & Carrington (1862 as *Callopisma aurantiacum*); Sinker 1955 (herb. MRDS); Graham 1965; James 1970; Seaward 1981
On acid substrata close to basic rocks; occasional.

Caloplaca holocarpa (Hoffm.) Wade
Sinker 1955, (1960); Graham 1965; Seaward 1977; Henderson and Seaward 1999
On calcareous rocks and stonework; occasional

Caloplaca ochracea (Schaerer) Flagey
Hailstone, in Mudd (1861) (and in Miall & Carrington, 1862); Sinker 1955 (herb. MRDS), (1960); Graham 1965; James 1970; Seaward 1979; Henderson and Seaward 1999
On well-lit hard limestone; locally frequent.

Caloplaca saxicola (Hoffm.) Nordin
James 1970; Seaward 1977; Henderson and Seaward 1999
On calcareous rock and stonework; infrequent.

Caloplaca variabilis (Pers.) Müll. Arg.
Sinker 1955 (herb. MRDS); Wade 1963 (herb. MRDS)
On nutrient-enriched limestone; rare.

Candelaria concolor (Dickson) B. Stein
James 1964 (herb. BM)
On *Acer*; rare.

Candelariella aurella (Hoffm.) Zahlbr.
James 1970; Seaward 1977; Henderson and Seaward 1999
On cement and mortar; occasional.

Candelariella medians (Nyl.) A. L. Sm.
Seaward 1977; Henderson and Seaward 1999
On nutrient-enriched calcareous substrata; uncommon.

Candelariella reflexa (Nyl.) Lettau
James 1970
On *Acer*; rare.

Candelariella vitellina (Hoffm.) Müll. Arg.
Lees (1888); Sinker 1955 (herb. MRDS), (1960); Gilbert 1963; James 1970; Seaward 1977
On siliceous rocks, particularly bird-perches, and on dusty wood, bark and man-made substrata; common.

Catapyrenium cinereum (Pers.) Körber
Carrington, in Mudd (1861, as *Endocarpon cinereum*); Lees (1888, as *Verrucaria tephroides*); James 1970
On soil associated with limestone; rare.

Catapyrenium lachneum (Ach.) R. Sant.
Carrington, in Mudd (1861, as *Endocarpon rufescens*) and Miall (1865); Shackleton & Hebden (1893); Sinker 1955 (herb. MRDS); James 1964, 1970; Graham 1965; Seaward 1985
On soil between limestone outcrops; occasional.

Catillaria chalybeia (Borrer) Massal.
James 1964, 1970; Seaward 1999; Henderson and Seaward 1999
On acid rock in walls; occasional.

Catillaria lenticularis (Ach.) Th. Fr.
Laundon 1954 (herb. MRDS); Wade 1957; Sinker (1960); Gilbert 1963; Graham 1965; James 1970; Seaward 1977; Henderson and Seaward 1999
On calcareous substrata; frequent.

Cetraria chlorophylla (Willd.) Vainio
Sinker 1955 (herb. MRDS), (1960); Graham 1965; Seaward 1977; Henderson and Seaward 1999
On *Acer*, etc.; occasional.

Cetraria islandica (L.) Ach.
Sinker 1955 (herb. MRDS); Graham 1965; Pentecost 1969; Seaward 1977
On mineral acid soil, amongst *Vaccinium*, etc. at altitudes above 600m; local on Fountains Fell where it is currently being mapped (AP).

Chaenotheca ferruginea (Turner ex Ach.) Th. Fr.
Seaward 1990 (herb. MRDS); Fryday 1990
On *Fraxinus*; rare.

Chromatochlamys muscorum (Fr.) H. Mayrhofer & Poelt
James 1970
On mosses over limestone; rare.
Cladonia arbuscula (Wallr.) Flot.
Sinker 1955 (herb. MRDS), (1960); Seaward 1977
On acid soil, amongst *Calluna*; occasional.
Cladonia cervicornis (Ach.) Flot.
Carrington, in Miall & Carrington (1862); Seaward 1986
On thin acid soil over rock; uncommon.
Cladonia chlorophaea (Flörke ex Sommerf.) Sprengel
incl. *C. cryptochlorophaea* Asah.and *C. merochlorophaea* Asah.
Graham 1965; James 1970; Seaward 1977; Henderson and Seaward 1999
On peat soil, particularly amongst rocks; occasional.
Cladonia ciliata Stirton
James 1970
On peaty soils; rare.
Cladonia coccifera (L.) Willd.
incl. *C. diversa* Asperges
Miall (1865); Sinker (1960); James 1970; Seaward 1977
On acid and peaty soils; occasional.
Cladonia coniocraea (Flörke) Sprengel
Sinker (1960); Gilbert 1963; James 1970; Seaward 1977; Fryday 1990; Pentecost 1999; Henderson and Seaward 1999
On stumps and bases of trees; locally frequent.
Cladonia crispata var. *cetrariiformis* (Delise ex Duby) Vainio
Sinker 1955 (herb. MRDS), (1960); James 1965; Seaward 1979
On acid soil, amongst *Calluna*; occasional.
Cladonia digitata (L.) Hoffm.
Seaward 1979
On old tree stumps and fallen trunks; uncommon.
Cladonia fimbriata (L.) Fr.
Sinker 1955 (herb. MRDS); Seaward 1977; Fryday 1990; Pentecost 1999; Henderson and Seaward 1999
On old walls, decaying wood and amongst *Calluna*; locally frequent.
Cladonia floerkeana (Fr.) Flörke
Nowell, in Miall & Carrington (1862); Sinker 1955 (herb. MRDS), (1960); James 1970; Seaward 1977; Pentecost 1999
On disintegrating moorland tussocks, decaying wood, raised bog, etc.; occasional.
[*Cladonia foliacea* (Huds.) Willd.
Carrington, in Miall & Carrington (1862)]
Cladonia furcata (Huds.) Schrader
Lees 1888; Sinker (1960); Graham 1965; James 1970; Seaward 1977
On acid mineral soils; locally frequent.
Cladonia gracilis (L.) Willd.
James 1970
On soil amongst *Calluna*; rare.
Cladonia humilis (With.) Laundon
Graham 1965; James 1970; Seaward 1999
On dry acid soils; occasional.
Cladonia macilenta Hoffm.
Sinker 1955 (herb. MRDS), (1960); Graham 1965 (as *C. bacillaris*); James 1970; Seaward 1977
On mossy bark and acid woodland soils; locally frequent.

Cladonia ochrochlora Flörke
Seaward 1981
On peaty soil and decaying fallen trunks; uncommon.
[*Cladonia phyllophora* Hoffm.
Carrington, in Miall & Carrington (1862, as *C. degenerans*)]
Cladonia pocillum (Ach.) Grognot
Graham 1965; James 1970; Seaward 1977; Pentecost 1999
On calcareous walls, usually mossy capstones, and on zinc-rich spoil; locally frequent.
Cladonia polydactyla (Flörke) Sprengel
Sinker 1955 (herb. MRDS), (1960); Graham 1965; Seaward 1977, 1999 (herb. MRDS); Fryday 1990; Henderson and Seaward 1999
On peaty soils & rotting wood; locally frequent.
Cladonia portentosa (Dufour) Coem.
Sinker 1955 (herb. MRDS), (1960); Graham 1965; James 1970; Seaward 1977
On acid soils, usually amongst *Calluna*; occasional.
Cladonia pyxidata (L.) Hoffm.
West 1883; Sinker 1955 (herb. MRDS), (1960); Wade 1959 (herb. MRDS); Gilbert 1963; Graham 1965; James 1970; Seaward 1977
On mossy wall-tops, peat, etc.; frequent.
Cladonia ramulosa (With.) Laundon
James 1970; Seaward 1979
On acid moorland and decaying wood; occasional.
Cladonia rangiformis Hoffm.
Sinker 1955 (herb. MRDS), (1960); Graham 1965; James 1970; Seaward 1977; Pentecost 1999
On mossy soils over limestone and on zinc-rich spoil; locally frequent.
Cladonia squamosa Hoffm. var. *squamosa*
Sinker (1960); Seaward 1977; Fryday 1990; Henderson and Seaward 1999
On rotting wood, particularly old tree stumps; occasional.
Cladonia squamosa var. *subsquamosa* (Nyl. ex Leighton) Vainio
Seaward 1979
On old tree stumps and decaying wood; rare.
Cladonia strepsilis (Ach.) Grognot
James 1970
On damp acid soils; rare.
Cladonia subcervicornis (Vainio) Kernst.
Seaward 1986
On thin humus pockets in acid rock crevices; uncommon.
Cladonia subulata (L.) Weber ex Wigg.
Sinker 1955 (herb. MRDS); James 1970; Seaward 1979; Fryday 1990; Pentecost 1999
On acid soils and on stumps and fallen branches of *Larix*; occasional.
Cladonia sulphurina (Michaux) Fr.
Graham 1965
On decaying humus; rare.
Cladonia uncialis ssp. *biuncialis* (Hoffm.) M. Choisy
Windsor (1858, and in Leighton, 1879); Carrington, in Miall & Carrington (1862); West (1883); Sinker 1955, (1960); Seaward 1977
On dry or damp acid soils, particularly moorland; occasional.
Clauzadea immersa (Hoffm.) Hafellner & Bellem.
Hailstone (in Whitaker 1805); Miall (1865); Shackleton & Hebden (1893, as *Lecidea calcivora*, and in Rotheray, 1900); Sinker 1955 (herb. MRDS); Gilbert, 1963; Graham 1965; Seaward

1979; Henderson and Seaward 1999
On hard calcareous rocks; occasional.

Clauzadea metzleri (Körber) Clauzade & Roux ex D. Hawksw.
Shackleton & Hebden (1893, and in Rotheray, 1900); James 1970; Seaward 1979; Pentecost 1985
On hard limestone; occasional.

Clauzadea monticola (Ach.) Hafellner & Bellem.
Shackleton & Hebden (1893, as *Lecidea ochracea*); Watson (1946, as *Biatora fuscorubens*); Sinker (1960); Graham 1965; James 1970; Seaward 1985
On calcareous rocks and man-made substrata; frequent.

Cliostomum griffithii (Sm.) Coppins
James 1970; Seaward 1985; Fryday 1990
On *Acer* and *Fraxinus*; uncommon.

Coelocaulon aculeatum (Schreber) Link
Carrington, in Mudd (1861) and Miall (1865); Sinker 1955 (herb. MRDS); Graham 1965; Seaward 1977
On acid mineral soils; occasional.

Coelocaulon muricatum (Ach.) Laundon
Seaward 1977 (herb. MRDS)
On thin mineral soil over rock; rare.

Collema auriforme (With.) Coppins & Laundon
Borrer, in Lees (1888, as *Leptogium dermatinum*); Graham 1965; James 1970; Seaward 1977; Henderson and Seaward 1999
Amongst mosses over limestone rocks and walls; locally frequent.

Collema crispum (Huds.) Weber ex Wigg.
Graham 1965; James 1970; Seaward 1977
On limestone rocks and walls, and on crumbling mortar; locally frequent.

Collema cristatum (L.) Weber ex Wigg. var. *cristatum*
Richardson, in Ray (1724); Hailstone, in Mudd (1861, and in Miall & Carrington 1862); Sinker 1955 (herb. MRDS), (1960); Graham 1965; James 1970; Seaward 1977
On limestone rocks and walls; locally frequent.

Collema cristatum var. *marginale* (Huds.) Degel.
Sinker (1960)
On limestone; rare.

[*Collema dichotomum* (With.) Coppins & Laundon
Richardson (1704, herb. OXF; in Ray, 1724 as *Lichenoides gelatinosum opuntioides*; in Dillenius, 1742 as *Lichenoides gelatinosum*, *foliis angustioribus tuniformibus*; in Hudson 1778, 1798, Turner & Dillwyn 1805, and Withering 1792, 1796, 1830 as *Lichen fluviatilis*); Windsor (1858) and Baker, in Mudd (1861, as *Collema fluviatile*); the authenticity of all these records is questioned by Church *et al.* (1996)]

[*Collema* cf. *flaccidum* (Ach.) Ach.
Hailstone, in Whitaker (1805); Carrington, in Miall & Carrington (1862); West (1883)]

Collema fuscovirens (With.) Laundon
James 1965; Seaward 1999; Henderson and Seaward 1999
Rocks by the Tarn; occasional.

Collema multipartitum Sm.
Shackleton & Hebden (1893 and in Rotheray, 1900); Wade 1963 (herb. MRDS); James 1970
On exposed limestone; uncommon.

Collema polycarpon Hoffm.
Shackleton & Hebden (1893); James 1970; Seaward 1976 (herb. MRDS)
On limestone rock and walls; occasional.

Collema tenax (Sw.) Ach. var. *tenax*
Carrington, in Miall & Carrington (1862); Graham 1965; James 1970; Seaward 1977; Henderson and Seaward 1999
On calcareous soils and mortar; locally frequent.

Collema tenax var. *ceranoides* (Borrer) Degel.
Henderson and Seaward 1999
On loose soil; infrequent.

Collema undulatum Laurer ex Flot.
Carrington, in Miall & Carrington (1862); Wade 1957; Sinker (1960); Graham 1965
On exposed hard limestone; occasional.

Dermatocarpon luridum (With.) Laundon
Dillenius, in Withering (1796 and in Watson, 1946 as *D. aquaticum*); Seaward 1985
On soil associated with limestone; rare.

Dermatocarpon miniatum (L.) Mann. var. *miniatum*
Hailstone, in Whitaker (1805); Carrington, in Miall & Carrington (1862); West, in Lees (1888); Sinker 1955 (herb. MRDS), (1960); Graham 1965; James 1970; Seaward 1977; Henderson and Seaward 1999
In vertical crevices of hard limestone rocks; locally frequent, but declining.

Dermatocarpon miniatum var. *complicatum* (Lightf.) Hellbom
Hailstone, in Whitaker (1805); Carrington, in Miall & Carrington (1862); Seaward 1985; Henderson and Seaward 1999
In vertical crevices of hard limestone rocks; occasional.

Dimerella pineti (Ach.) Vezda
Fryday 1990
On *Fraxinus*; rare.

Diploicia canescens (Dickson) Massal.
Seaward 1979
On nutrient-enriched calcareous stonework; occasional.

Diploschistes gypsaceus (Ach.) Zahlbr.
James 1970
On sheltered vertical limestone faces; rare.

Diploschistes muscorum (Scop.) R. Sant.
Carrington, in Miall & Carrington (1862); Henderson and Seaward 1999
Over mosses in calcareous walls; rare.

Diploschistes scruposus (Schreber) Norman
Carrington, in Miall & Carrington (1862); Laundon 1954 (herb. MRDS); Sinker 1955 (herb. MRDS), (1960); Graham 1965; James 1970; Seaward 1977
On calcareous rocks and walls; occasional.

Diplotomma alboatrum (Hoffm.) Flot.
Carrington, in Miall (1865); Seaward 1999; Henderson and Seaward 1999
On mortar and stone of farm buildings; uncommon.

Dirina massiliensis forma *sorediata* (Müll. Arg.) Tehler
James 1970
On shaded limestone near a stream; rare.

Enterographa crassa (DC.) Fée
Fryday 1990
On *Fraxinus*; rare.

Evernia prunastri (L.) Ach.
Lees (1888); Sinker 1955 (herb. MRDS); Wade 1955; Seaward 1981; Fryday 1990; Henderson and Seaward 1999

On *Fraxinus*, etc.; occasional.

Farnoldia jurana (Schaerer) Hertel

Laundon 1954 (herb. MRDS); Sinker 1955 (Herb. MRDS); Graham 1965; James 1970; Pentecost 1969; Seaward 1999

On hard limestone boulders and pavement; occasional.

Fuscidea cyathoides (Ach.) V. Wirth & Vezda

Carrington, in Miall & Carrington (1862, as *Lecidea rivulosa*); Sinker 1955 (herb. MRDS), (1960); Graham 1965; Seaward 1999

On siliceous rocks and boulders; locally frequent

*Fuscidea lightfooti*i (Sm.) Coppins & P. James

Graham 1965

On ? *Salix*; rare.

Fuscidea lygaea (Ach.) V. Wirth & Vezda

Shackleton & Hebden (1893 as *Lecidea tenebrica*); West, in Rotheray (1900); and in Watson (1946); James 1970

On sheltered sides of acid rock outcrops; uncommon.

[*Graphina anguina* (Mont.) Müll. Arg.

Carrington, in Miall & Carrington (1862 as *Graphis anguina* var. *pulverulenta*)]

Graphis elegans (Borrer ex Sm.) Ach.

Wade 1959 (herb. MRDS)

On *Fraxinus*; rare.

Graphis scripta (L.) Ach.

Miall (1865); West, in Lees (1888); Shackleton & Hebden (1893); Fryday 1990

On *Fraxinus*; rare.

Gyalecta jenensis (Batsch) Zahlbr.

Hailstone, in Whitaker (1805); Carrington, in Miall & Carrington (1862); West 1879 (herb. CMM); West & Carrington, in Lees (1888); Laundon 1954 (herb. MRDS); Sinker 1955 (herb. MRDS), (1960); Gilbert 1963; Graham 1965; James 1970; Seaward 1977

On hard limestone rocks, pavement and old tufa; common.

Gyalecta subscutellaris (Vezda) Vezda

Pentecost 1999

Over bare soil associated with the moss *Weissia* on spoil tips; rare.

[*Haematomma ochroleucum* s. lat.

Carrington, in Miall & Carrington (1862); Lees (1888)]

Hymenelia prevostii (Duby) Krempelh.

Graham 1965; James 1967

On hard limestone; uncommon.

Hypocenomyce scalaris (Ach. ex Lilj.) M. Choisy

Sinker 1955 (herb. MRDS), (1960); Seaward 1977 (herb. MRDS); Fryday 1990

On *Betula* and *Crataegus* and, more rarely, on siliceous stonework; uncommon.

Hypogymnia physodes (L.) Nyl.

Carrington, in Mudd (1861) and Miall (1865); Sinker 1955 (herb. MRDS), (1960); Gilbert 1963; Graham 1965; James 1970; Seaward 1977; Fryday 1990; Pentecost 1999; Henderson and Seaward 1999

On various trees, *Calluna* stems and siliceous rocks; common.

Hypogymnia tubulosa (Schaerer) Havaas

Sinker (1960); Graham 1965; Seaward 1977; Fryday 1990; Pentecost 1999; Henderson and Seaward 1999

On various deciduous trees; frequent.

[*Icmadophila ericetorum* (L.) Zahlbr.

Carrington, in Miall & Carrington (1862)]

Ionapsis epulotica (Ach.) Arnold

Wade 1963 (herb. MRDS)
On calcareous rock; rare.

Lecania cuprea (Massal.) v. d. Boom & Coppins
James 1970
On shaded limestone; rare.

Lecania cyrtella (Ach.) Th. Fr.
[Record on limestone, Shackleton & Hebden (1893 as *Lecidea cyrtella*) and in Rotheray (1900) - not this taxon]; Seaward 1977; Fryday 1990
On ? *Fraxinus*; rare.

Lecania erysibe (Ach.) Mudd
Shackleton & Hebden (1893 as *Lecanora erysibe*); Sinker (1960); James 1965; Seaward 1979; Henderson and Seaward 1999
On nutrient-enriched calcareous stonework; occasional.

Lecanora albescens (Hoffm.) Branth & Rostrup
Shackleton & Hebden (1893 as *L. livida*); Sinker (1960); Gilbert 1963; Seaward 1977; Henderson and Seaward 1999
On well-lit calcareous rocks and stonework; common.

Lecanora campestris (Schaerer) Hue
Wade c. 1959 (herb. MRDS); Graham 1965; James 1970; Seaward 1977; Henderson and Seaward 1999
On calcareous and siliceous rocks and stonework; locally frequent.

Lecanora chlarotera Nyl.
Carrington, in Miall & Carrington (1862 as *L. subfusca*); Sinker 1955 (herb. MRDS); James 1970; Seaward 1985; Fryday 1990; Pentecost 1999; Henderson and Seaward 1999
On *Fraxinus* and *Acer*; infrequent.

Lecanora conizaeoides Nyl. ex Crombie
Sinker (1960); Gilbert 1963; James 1970; Seaward 1977
On bark, wood and siliceous rocks; very common.

Lecanora crenulata Hook.
Carrington, in Miall (1865), Watson (1946) and Rotheray (1900); Sinker 1955; Graham 1965; Seaward 1977
On calcareous rocks and mortar; frequent.

Lecanora dispersa (Pers.) Sommerf.
Sinker (1960); Graham 1965; Jaggard *et al.* (1974); Seaward 1977
On wide variety of calcareous substrata; common.

Lecanora expallens Ach.
Graham 1965; James 1970; Seaward 1977; Fryday 1990
On deciduous tree bark; locally frequent.

Lecanora intricata (Ach.) Ach.
Gilbert 1963
On siliceous stone; rare.

Lecanora muralis (Schreber) Rabenh.
Carrington, in Miall & Carrington (1862); Sinker 1955 (herb. MRDS); Gilbert 1963; Seaward 1977; Henderson and Seaward 1999
On nutrient-enriched calcareous rocks and a wide variety of man-made substrata; locally frequent.

Lecanora polytropa (Hoffm.) Rabenh.
Carrington, in Miall & Carrington (1862); Sinker 1955 (herb. MRDS), (1960); Gilbert 1963; Graham 1965; James 1970; Seaward 1977; Henderson and Seaward 1999
On siliceous rocks and walls; locally frequent.

Lecanora pulicaris (Pers.) Ach.
James 1970
On fence posts; rare.

Lecanora rupicola (L.) Zahlbr.
Carrington, in Miall & Carrington (1862 as *L. glaucoma*); Sinker 1955 (herb. MRDS)
On hard siliceous rocks; rare.

Lecanora soralifera (Suza) Räsänen
Graham 1965; James 1970; Seaward 1977 (herb. MRDS); Henderson and Seaward 1999
On siliceous rocks and walls; locally frequent.

Lecanora sulphurea (Hoffm.) Ach.
Hailstone, in Whitaker (1805); West, in Lees (1888); Sinker (1960); Gilbert 1963; James 1970; Seaward 1977
Nutrient-enriched siliceous rocks and walls; occasional.

[*Lecidea confluens* (Weber) Ach.
Shackleton & Hebden (1893 as *L. confluens* forma *laevigata*)]

Lecidea fuscoatra (L.) Ach.
? Hebden, in Rotheray (1900); James 1970; Seaward 1977; Henderson and Seaward 1999
On acid rock outcrops; occasional.

Lecidea lapicida (Ach.) Ach.
Shackleton & Hebden (1893 as *L. lapicida* and *L. luteoatra*); Sinker 1955 (herb. MRDS); James 1970; Seaward 1999
On Millstone grit; occasional.

[*Lecidea lithophila* (Ach.) Ach.
Shackleton & Hebden (1893 as *L. ochracea*); and in Rotheray (1900 as *L. spilota* var. *ochracea*)]

Lecidea obluridata Nyl.
Pentecost 1999
On iron-rich rocks of Pikedaw spoil tip; locally common. New to Britain.

Lecidella elaeochroma (Ach.) M. Choisy
Shackleton & Hebden (1893 as *Lecidea enteroleuca*); and in Rotheray (1900); James 1970
On *Crataegus*; rare.

Lecidella scabra (Taylor) Hertel & Leuckert
Graham 1965; James 1970; Seaward 1977; Henderson and Seaward 1999
On siliceous rocks and walls; occasional.

Lecidella stigmatea (Ach.) Hertel & Leuckert
Sinker 1955 (herb. MRDS); Wade 1963 (herb. MRDS); Graham 1965; James 1970; Seaward 1977; Henderson and Seaward 1999
On calcareous rocks, walls and mortar; locally frequent.

Lempholemma botryosum (Massal.) Zahlbr.
Graham and James 1965
On hard calcareous rock; rare.

Lempholemma cladodes (Tuck.) Zahlbr.
Graham and James 1965
On calcareous rock; rare.

Lempholemma polyanthes (Bernh.) Malme
Hitch 1976 (herb. MRDS)
On moss over drystone wall; rare.

Lepraria incana s. lat.
Sinker (1960 as *Crocynia aeruginosa*); Gilbert 1963; Graham 1965; Seaward 1977; Henderson and Seaward 1999
On shaded acid bark, rocks and walls; common.

Lepraria lesdainii (Hue) R. Harris
James 1965; Seaward 1985
In shady limestone crevices; occasional.

Lepraria lobificans Nyl.
Seaward 1985; Fryday 1990
On shaded rock, sometimes on mosses; occasional.

Lepraria nivalis Laundon
Graham and James 1965; Seaward 1975 (herb. MRDS)
In shady limestone crevices; frequent.

Leproloma cf. *membranaceum* (Dickson) Vainio
Gilbert 1963; James 1965
On shaded rocks and mortar; uncommon.

Leproloma vouauxii (Hue) Laundon
Seaward 1985; Fryday 1990
On shaded bark; occasional.

Leproplaca chrysodeta (Vainio ex Räsänen) Laundon
Gilbert 1963 (mistakenly given as *L. xantholyta*); James 1970; Seaward 1981; Fryday 1990
On dry shaded vertical limestone rocks and walls; locally frequent.

Leproplaca xantholyta (Nyl.) Harm.
Wade 1955, 1963 (herb. MRDS); Graham 1965; James 1970; Hitch 1976 (herb. MRDS); Seaward 1985; Fryday 1990
On damp vertical limestone rocks and walls; locally frequent.

Leptogium gelatinosum (With.) Laundon
Hailstone, in Whitaker (1805); Carrington, in Watson (1946) (and in Rotheray 1900); Sinker (1960); Graham 1965; James 1970; Seaward 1977; Henderson and Seaward 1999
Amongst mosses on limestone rocks and soil; locally frequent.

Leptogium lichenoides (L.) Zahlbr.
Hailstone, in Whitaker (1805); West (1883), and in Lees (1888 as *L. lacerum*); Wade 1961 (herb. MRDS); Sinker (1960); Gilbert 1963; Graham 1965 - many if not all of these records are probably referable to the previous taxon
Amongst mosses over limestone rocks & walls; ? uncommon.

Leptogium plicatile (Ach.) Leighton
Hailstone 1807 (herb. YRK, in Coppins & Seaward, 1976); James 1970
On wet limestone rocks; uncommon.

Leptogium schraderi (Ach.) Nyl.
Shackleton & Hebden (1893), and in Rotheray (1900); Sinker 1955; Graham 1965; James 1970; Seaward 1979; Fryday 1990
On mossy limestone rocks and soils; locally frequent.

Leptogium turgidum (Ach.) Crombie
Carrington, in Miall (1865); Henderson and Seaward 1999
On calcareous walls; rare.

[*Leptorhaphis epidermidis* (Ach.) Th. Fr. [F]
? Hebden, in Rotheray (1900)]

[*Megalaria grossa* (Pers. ex Nyl.) Hafellner
? Hebden, in Rotheray (1900)]

Micarea denigrata (Fr.) Hedl.
Henderson and Seaward 1999
On wooden posts; uncommon.

Micarea lignaria (Ach.) Hedl.
Sinker 1955; Graham 1965; Seaward 1999; Pentecost 1999
On acid soils and over mosses and plant debris; occasional.

Micarea melaena (Nyl.) Hedl.
Aptroot 1996 (herb. ABL); Pentecost 1999
On lignum of *Alnus* and *Larix*; uncommon.

Micarea prasina Fr.
James 1970; Fryday 1990; Seaward 1999
On decaying tree stumps; rare, but overlooked.

[*Micarea submigrata* (Nyl.) Coppins & Kilias
Shackleton & Hebden (1893 as *Lecidea submigrata*), and in Rotheray (1900)]
Miriquidica leucophaea (Rabenh.) Hertel & Rambold
Wade 1959 (herb. MRDS); Gilbert 1963; Pentecost 1999
On siliceous walls and on barytes of spoil tip; uncommon.
Mycoblastus sterilis Coppins & P. James
Seaward 1985; James 1988; Fryday 1990; Pentecost 1999
On bark and lignum of various coniferous and deciduous trees; locally frequent.
[*Normandina pulchella* (Borrer) Nyl.
Stansfield, in Miall & Carrington (1862 as *Endocarpon laetevirens*)]
Ochrolechia androgyna (Hoffm.) Arnold
Wade 1959 (herb. MRDS); Seaward 1977; Henderson and Seaward 1999
On *Fraxinus*, etc. and on siliceous rocks and walls; occasional.
Ochrolechia parella (L.) Massal.
Sinker 1955 (herb. MRDS), (1960); James 1970; Seaward 1977; Henderson and Seaward 1999
On siliceous rocks and walls; locally frequent.
Ochrolechia subviridis (Hoeg) Erichsen
Wade 1963 (herb. MRDS); Sinker (1960); Graham 1965; James 1970; Seaward 1999
On bark of plantation trees; occasional.
[*Ochrolechia tartarea* (L.) Massal.
Carrington, in Miall & Carrington (1862)]
Ochrolechia turneri (Sm.) Hasselrot
Pentecost 1999
On lignum; rare.
Omphalina ericetorum (Fr.) M. Lange ex H. Bigelow
Sinker 1955 (herb. MRDS), (1960)
On bare damp peat; uncommon.
Omphalina hudsoniana (Jennings) H. Bigelow
Sinker 1955 (herb. MRDS), (1960)
On a damp eroded peat bank; rare.
Opegrapha dolomitica (Arnold) Clauzade & Roux
Carrington, in Lees (1888) (and in Watson, 1946 as *O. saxicola*); Sinker 1955 (herb. MRDS), (1960); Wade 1959 (herb. MRDS)
On shady limestone; frequent.
Opegrapha gyrocarpa Flot.
Graham and James 1965
On shaded acid rock faces; rare.
Opegrapha herbarum Mont.
Fryday 1990; Pentecost 1999
On ? *Fraxinus* and lignum of *Acer*; rare.
Opegrapha ochrocheila Nyl.
Fryday 1990
On ? *Fraxinus*; rare.
Opegrapha parasitica (Massal.) H. Olivier [LF]
Graham and James 1965
Parasitic on *Verrucaria hochstetteri*; rare.
Opegrapha saxatilis auct.
Carrington, in Mudd (1861 as *O. chevallieri*) and Miall (1865); Graham and James 1965; Seaward 1999
On shaded limestone; uncommon.
[*Opegrapha varia* Pers.
Carrington, in Miall & Carrington (1862)]

Opegrapha vermicellifera (Kunze) Laundon
Fryday 1990
On ? *Fraxinus*; rare.
[*Opegrapha viridis* (Ach.) Nyl.
Carrington, in Miall & Carrington (1862 as *O. rubella*)]
Opegrapha vulgata (Ach.) Ach.
Shackleton & Hebden (1893 as *O. amphotera*); and in Rotheray (1900); James 1970; Fryday 1990
On *Acer*, etc ; uncommon.
[*Pachyphiale carneola* (Ach.) Arnold
Carrington, in Miall & Carrington (1862 as *Bacidia carneola*)]
Parmelia caperata (L.) Ach.
Carrington, in Miall & Carrington (1862); Pentecost 1969; Seaward 1985
On *Fraxinus*, etc.; uncommon.
Parmelia conspersa (Ehrh. ex Ach.) Ach.
Sinker 1955 (herb. MRDS)
On siliceous rock; rare.
Parmelia glabratula (Lamy) Nyl. ssp. *glabratula*
Sinker 1955 (herb. MRDS); Hitch 1976 (herb. MRDS); Seaward 1977; Fryday 1990
On *Acer*, *Fraxinus*, etc.; occasional.
Parmelia glabratula ssp. *fuliginosa* (Fr. ex Duby) Laundon
Shackleton & Hebden (1893 as *P. fuliginosa*); Wade 1955; Seaward 1977; Henderson and Seaward 1999
On siliceous rocks and stonework; more rarely on wooden fence rails; infrequent.
Parmelia incurva (Pers.) Fr.
Seaward 1977
On Millstone grit; uncommon.
Parmelia laciniatula (H. Olivier) Zahlbr.
Seaward 1981 (herb. MRDS)
On a single *Acer*; rare.
[*Parmelia mougeotii* Schaerer ex D. Dietr.
Hailstone, in Whitaker (1805); Carrington, in Miall & Carrington (1862)]
Parmelia omphalodes (L.) Ach.
Sinker 1955 (herb. MRDS); Wade 1959 (herb. MRDS); Seaward 1977
On siliceous rocks and boulders; occasional.
[*Parmelia perlata* (Huds.)Ach.
West, in Lees (1888)]
Parmelia saxatilis (L.) Ach.
Sinker 1955 (herb. MRDS), (1960); Gilbert 1963; Graham 1965; Seaward 1977; Pentecost 1999; Henderson and Seaward 1999
On siliceous rocks and walls, and on *Acer*, *Fraxinus* and *Sorbus*; locally frequent.
Parmelia subaurifera Nyl.
Shackleton & Hebden (1893); Wade 1955; Seaward 1977
On tree bark, particularly of branches; occasional.
[*Parmelia subrudecta* Nyl.
Shackleton & Hebden (1893 as *P. borreri*); and in Rotheray (1900)]
Parmelia sulcata Taylor
Sinker 1955 (herb. MRDS), (1960); Wade 1955; Gilbert 1963; Graham 1965; Seaward 1977; Pentecost 1999
On deciduous trees, and on acid rocks and walls; common.
[*Parmeliella triptophylla* (Ach.) Müll. Arg.
Shackleton & Hebden (1893 as *Pannaria triptophylla*); and in Rotheray (1900)]

Parmeliopsis ambigua (Wulfen) Nyl.
Hebden, in Watson (1946); Sinker 1955 (herb. MRDS), (1960); Graham 1965; Seaward 1977; Fryday 1990; Pentecost 1999
On bark, particularly bases of plantation *Acer*; more rarely on siliceous outcrops above 600m and on wooden fencework; occasional.

Peltigera didactyla (With.) Laundon
Seaward 1986
On disturbed roadside bank; rare.

Peltigera lactucifolia (With.) Laundon
Carrington, in Miall & Carrington (1862 as *P. polydactyla*); West (1883 as *P. polydactyla*); Sinker (1960 as *P. polydactyla*); James 1970; Seaward 1979
On mosses and soil; occasional.

Peltigera leucophlebia (Nyl.) Gyelnik
Sinker 1955 (herb. MRDS)
On mosses amongst limestone boulders; rare.

Peltigera membranacea (Ach.) Nyl.
West (1883 as *P. canina*); James 1970; Seaward 1977, 1999 (herb. MRDS)
In mossy, grassy places; occasional.

Peltigera praetextata (Flörke ex Sommerf.) Zopf
Sinker 1955 (herb. MRDS); James 1970; Fryday 1990; Pentecost 1999; Henderson and Seaward 1999
On mosses over limestone rocks and walls, and on mature tree boles; occasional.

Peltigera rufescens (Weiss) Humb.
Graham 1965; James 1970; Seaward 1977
On basic soils; occasional.

Pertusaria albescens (Huds.) M. Choisy & Werner var. *albescens*
Carrington, in Mudd (1861) and Miall (1865); Fryday 1990
On *Fraxinus*; rare.

Pertusaria albescens var. *corallina* (Zahlbr.) Laundon
Graham 1965
On ? *Fraxinus*; rare.

Pertusaria amara (Ach.) Nyl.
Laundon 1954 (herb. MRDS); Sinker 1955 (herb. MRDS), (1960); Seaward 1977; Fryday 1990
On *Fraxinus*, *Acer*, etc. and on mosses over limestone; occasional.

Pertusaria aspergilla (Ach.) Laundon
James 1970
On siliceous walls; rare.

Pertusaria coccodes (Ach.) Nyl.
Seaward 1981 (Herb. MRDS)
On *Acer* and *Fraxinus*; rare.

Pertusaria corallina (L.) Arnold
Wade 1959 (herb. MRDS); James 1970; Seaward 1977; Henderson and Seaward 1999
On dry siliceous rocks, boulders and walls; occasional.

[*Pertusaria hymenea* (Ach.) Schaerer
Lees (1888 as *P. fallax*)]

Pertusaria lactea (L.) Arnold
Wade 1963 (herb. MRDS)
On weakly calcareous rock; rare.

[*Pertusaria multipunctata* (Turner) Nyl.
Carrington, in Mudd (1861) and in Leighton (1879)]

Pertusaria pertusa (Weigel) Tuck.
Seaward 1979; Fryday 1990
On *Fraxinus* and *Acer*; occasional.

Pertusaria pseudocorallina (Lilj.) Arnold
James 1965, 1970; Seaward 1979
On acid rocks; locally frequent.

Petractis clausa (Hoffm.) Krempelh.
Hailstone 1805, in Whitaker (1805); Withering (1830 as *Lichen exanthematicus*); Carrington, in Miall & Carrington (1862 as *P. exanthematica*); Wade 1963 (herb. MRDS); Seaward 1979
On damp shaded limestone; uncommon.

Phaeophyscia orbicularis (Necker) Moberg
Sinker 1955 (herb. MRDS), (1960); Wade 1963 (herb. MRDS); Gilbert 1963; Graham 1965; Seaward 1977
On nutrient-enriched bark and calcareous substrata; common.

Phlyctis argena (Sprengel) Flot.
Seaward 1985; Fryday 1990
On *Fraxinus*, etc.; uncommon.

Physcia adscendens (Fr.) H. Olivier
Gilbert 1963; Graham and James 1965; Jaggard *et al.* (1974); Seaward 1977; Henderson and Seaward 1999
On nutrient-enriched bark and calcareous substrata; locally frequent; occasionally fertile.

[*Physcia aipolia* (Ehrh. ex Humb.) Fürnr.
Nowell, in Lees (1888 as *P. stellaris*); see Watson (1946)]

Physcia caesia (Hoffm.) Fürnr.
Shackleton & Hebden (1893) and in Rotheray (1900); Sinker 1955 (herb. MRDS), (1960); Wade 1963 (herb. MRDS); Gilbert 1963; Graham 1965; Jaggard *et al*. (1974); Seaward 1977
On nutrient-enriched calcareous rocks and walls; locally frequent.

Physcia tenella (Scop.) DC.
West, in Lees (1888); Sinker (1960); Seaward 1977; Henderson and Seaward 1999
On nutrient-enriched bark and stonework; locally frequent.

[*Physconia distorta* (With.) Laundon
Carrington, in Miall & Carrington (1862) and in Lees (1888 as *Physcia pulverulenta* forma *pityrea*)]

Physconia grisea (Lam.) Poelt
Carrington, in Watson (1946); James 1970; Seaward 1977
On calcareous walls and dust-impregnated tree trunks; occasional.

Placopsis gelida (L.) Lindsay
Hudson (1778, 1798); West 1881 (herb. CMM); Sinker 1955 (herb. MRDS), (1960)
On boathouse roof slates; rare.

Placynthiella icmalea (Ach.) Coppins & P. James
Seaward 1986; Henderson and Seaward 1999
On acid wood; occasional, but overlooked.

Placynthiella uliginosa (Schrader) Coppins & P. James
Carrington, in Miall & Carrington (1862); Sinker 1955 (herb. MRDS), (1960); Seaward 1979
On peaty soil of raised bog and on decaying wood; locally frequent.

Placynthium nigrum (Huds.) Gray
Hailstone, in Whitaker (1805); Carrington, in Miall & Carrington (1862 as *Leucothecium nigrum*); Sinker 1955 (herb. MRDS), (1960); Gilbert 1963; Graham 1965; Seaward 1977
On limestone outcrops, pavements and walls; locally frequent.

Placynthium subradiatum (Nyl.) Arnold
James 1970
On vertical limestone rocks; uncommon.

Platismatia glauca (L.) Culb. & C. Culb.
Carrington, in Miall & Carrington (1862); Laundon 1954 (herb. MRDS); Sinker 1955 (herb. MRDS), (1960); Gilbert 1963; Graham 1965; Seaward 1977; Pentecost 1999; Henderson and Seaward 1999
On various deciduous trees; locally common.

Poeltinula cerebina (DC.) Hafellner
Carrington, in Miall & Carrington (1862 as *Melanospora cerebrina*); Sinker (1960); James 1967, 1970
On hard limestone; uncommon.

Polyblastia albida Arnold
Graham 1965; James 1965, 1970
On hard limestone; uncommon.

Polyblastia cupularis Massal.
Shackleton & Hebden (1893 as *Verrucaria fuscoargillacea*); and in Rotheray (1900); Graham 1965; James 1970
On hard limestone; uncommon.

Polyblastia deminuta Arnold
Shackleton & Hebden (1893 as *Verrucaria deminuta*); and in Rotheray (1900); Wade 1955; Sinker (1960); Graham 1965; James 1970
On hard limestone; uncommon.

Polyblastia dermatodes Massal.
Laundon 1954 (herb. MRDS); Sinker (1960); Seaward 1977
On well-lit, hard limestone rocks and pavement; uncommon.

Porina aenea (Wallr.) Zahlbr.
Fryday 1990
On *Fraxinus*; rare.

Porina chlorotica (Ach.) Müll. Arg.
Shackleton & Hebden (1893 as *Verrucaria chlorotica*); and in Rotheray (1900); Wade 1955; Seaward 1985 (herb. MRDS)
On hard limestone; uncommon.

Porina linearis (Leighton) Zahlbr.
Sinker 1955 (herb. MRDS); Graham 1965
On shaded hard limestone; uncommon.

Porpidia cinereoatra (Ach.) Hertel & Knoph
[Carrington, in Miall & Carrington (1862 as *Lecidea albocaerulescens* on limestone rocks is, doubtfully, this]; Seaward 1977
On exposed acid rocks; rare.

Porpidia crustulata (Ach.) Hertel & Knoph
Sinker 1955 (herb. MRDS); Seaward 1977; Henderson and Seaward 1999
On acid rocks and stones; occasional.

Porpidia hydrophila (Fr.) Hertel & Schwab
Smith (1926; herb. BM), and in Watson (1946 as *Lecidea petrosa*); Sinker (1960); Gilbert 1963
On siliceous rocks in streams; occasional.

Porpidia macrocarpa (DC.) Hertel & Schwab
Sinker 1955 (herb. MRDS), (1960); Gilbert 1963; Graham 1965; Seaward 1977; Henderson and Seaward 1999
On siliceous rocks and stones; locally frequent.

[*Porpidia speirea* (Ach.) Krempelh.
Carrington, in Watson (1946)]

Porpidia tuberculosa (Sm.) Hertel & Knoph
Laundon 1954 (herb. MRDS); Seaward 1977; Henderson and Seaward 1999
On Millstone grit; locally frequent.

Protoblastenia calva (Dickson) Zahlbr.
Hailstone, in Whitaker (1805); Graham 1965; James 1970; Seaward 1977; Henderson and Seaward 1999
On hard limestone; occasional.

Protoblastenia cyclospora (Hepp ex Körber) Poelt
Shackleton & Hebden (1892, 1893, as *Lecidea rubidula*); and in Rotheray (1900); James 1970
On limestone rock; rare.

Protoblastenia incrustans (DC.) Steiner
Graham 1965; James 1970; Seaward 1985
On hard limestone; occasional.

Protoblastenia rupestris (Scop.) Steiner
Lees (1888); Laundon 1954 (herb. MRDS); Sinker 1955 (herb. MRDS), (1960); Gilbert 1963; Graham 1965; James 1970; Seaward 1977; Henderson and Seaward 1999
On limestone, concrete and mortar; locally frequent.

Protoparmelia badia (Hoffm.) Hafellner
Wade 1959 (herb. MRDS); Sinker 1955; Seaward 1977
On siliceous rocks; occasional.

Pseudevernia furfuracea (L.) Zopf var. *furfuracea*
Seaward 1977 (herb. MRDS)
On *Calluna*, and siliceous outcrops and stonework; occasional.

Pseudevernia furfuracea var. *ceratea* (Ach.) D. Hawksw.
West (1883); Laundon 1954 (herb. MRDS); Sinker 1955 (herb. MRDS), (1960); Gilbert 1963; Seaward 1970, 1977 (herb. MRDS); Fryday 1990; Pentecost 1999; Henderson and Seaward 1999
On Millstone grit, *Acer*, *Alnus*, *Betula* and coniferous trees; locally common.

Psilolechia lucida (Ach.) M. Choisy
Gilbert 1963; Seaward 1977
On shady acid stonework; occasional.

Psora lurida (Ach.) DC.
Carrington, in Mudd (1861) and Miall (1865); Sinker 1955 (herb. MRDS), (1960); Graham 1965; James 1970; Seaward 1977; Henderson and Seaward 1999
On soil in crevices of limestone rocks; locally frequent.

[*Psoroma hypnorum* (Vahl) Gray
Carrington, in Miall & Carrington (1862)]

Pyrenocollema monense (Wheldon) Coppins
James 1970; Aptroot 1996 (herb. ABL)
On sheltered damp limestone; uncommon.

Pyrenocollema saxicola (Massal.) Coppins
James 1970
On shaded limestone; rare.

[*Pyrenula dermatodes* (Borrer) Schaerer
Carrington, in Miall & Carrington (1862)]

[*Pyrenula laevigata* (Pers.) Arnold
Carrington, in Miall & Carrington (1862) as interpreted by Watson (1946)]

Pyrrhospora quernea (Dickson) Körber
Fryday 1990
On *Quercus*; rare.

[*Ramalina calicaris* (L.) Fr.
Miall (1865); West, in Lees (1888)]

Ramalina farinacea (L.) Ach.
West (1883); Henderson and Seaward 1999; Pentecost 1999
On *Acer*; uncommon.

[*Ramalina fastigiata* (Pers.) Ach.
West, in Lees (1888)]
[*Ramalina fraxinea* (L.) Ach.
West (1883) and in Lees (1888)]
Rhizocarpon concentricum (Davies) Beltr.
Carrington, in Miall & Carrington (1862 as *R. petraeum*); Shackleton & Hebden (1893 as *Lecidea parapetraea* and *L. excentrica*); Hitch 1976 (herb. MRDS); James 1970; Seaward 1977
On hard acid rocks; occasional.
Rhizocarpon geographicum (L.) DC.
Sinker 1955 (herb. MRDS), (1960); Seaward 1977; Henderson and Seaward 1999
On siliceous rocks and a slatestone gatepost; infrequent.
Rhizocarpon obscuratum (Ach.) Massal. [as *R. reductum*]
Sinker 1955 (herb. MRDS), (1960); Graham 1965; James 1970; Seaward 1977; Henderson and Seaward 1999
On Millstone grit boulders and walls; locally frequent.
Rhizocarpon oederi (Weber) Körber
Sinker 1955 (herb. MRDS); James 1970; Seaward 1979; Henderson & Seaward 1999
On iron-rich Millstone grit; occasional.
Rhizocarpon umbilicatum (Ramond) Flagey
Carrington, in Miall & Carrington (1862 as *Diplotomma calcarea*); Carrington, in Lees (1888 as *Lecidea rimosa*); Sinker (1960); Graham 1965; James 1965, 1970; Seaward 1985
On hard limestone; locally frequent.
Rinodina bischoffii (Hepp) Massal.
Graham 1965; James 1970
On hard limestone; uncommon.
Rinodina gennarii Bagl.
Sinker (1960 as *R. demissa*); Seaward 1977
On nutrient-enriched calcareous substrata; occasional.
Rinodina immersa (Körber) Zahlbr.
James 1970; Seaward 1985
On calcareous rocks and boulders; occasional.
Sarcogyne regularis Körber
Sinker (1960); James 1970; Seaward 1977; Henderson and Seaward 1999
On calcareous rocks and walls; occasional.
[*Schaereria cinereorufa* (Schaerer) Th. Fr.
Shackleton & Hebden (1893) and in Rotheray (1900 as *Lecidea subfurva*)]
Scoliciosporum chlorococcum (Graewe ex Stenhammar) Vezda
Seaward 1985; Henderson and Seaward 1999
On deciduous trees; uncommon.
Scoliciosporum umbrinum (Ach.) Arnold
Seaward 1999; Henderson and Seaward 1999
On calcareous stone; uncommon.
Solenopsora candicans (Dickson) Steiner
Carrington, in Miall & Carrington (1862); Sinker (1960); Graham 1965; James 1970; Seaward 1977 (herb. MRDS)
On well-lit, hard limestone; locally frequent.
Solorina saccata (L.) Ach.
Carrington, in Miall & Carrington (1862); West (1883); Sinker 1955 (herb. MRDS), (1960); Wade 1959 (herb. MRDS); Graham 1965; James 1970; Seaward 1977; Pentecost 1972, (monitored at two sites to 1998)
On limestone outcrops; occasional.

[*Solorina spongiosa* (Ach.) Anzi
West (1883) and in Lees (1888) and Watson (1946)]
Squamarina cartilaginea (With.) P. James
Withering (1792, 1796) and in Hudson (1798), Turner & Dillwyn (1805 as *Lichen crassus*); Hailstone, in Whitaker (1805); Carrington, in Miall (1865); Laundon 1954 (herb. MRDS); Sinker (1960); Seaward 1977; Henderson and Seaward 1999
On soil in shady crevices of limestone outcrops; locally frequent, but appears to be declining.
Staurothele caesia (Arnold) Arnold
James 1970
On dry limestone boulders, etc.; uncommon.
Staurothele fissa (Taylor) Zwackh
Graham 1965
On hard siliceous rock by stream; rare.
Staurothele hymenogonia (Nyl.) Th. Fr.
Shackleton & Hebden (1892, 1893, as *Verrucaria spurcella*); Hebden, in Watson (1946 as *Polyblastia spurcella*; herb. BM); James 1970
On dry limestone outcrops; uncommon.
Stereocaulon evolutum Graewe
Wade 1957 (herb. MRDS)
On slaty rocks; rare.
Stereocaulon pileatum Ach.
Pentecost 1999
On acidic iron-rich spoil; local.
Stereocaulon vesuvianum Pers.
Pentecost 1999
On acidic iron-rich spoil; local.
Synalissa symphorea (Ach.) Nyl.
Carrington, in Miall & Carrington (1862); Sinker (1960); James 1970
On more or less flat limestone surfaces; uncommon.
Tephromela atra (Huds.) Hafellner ex Kalb
Hailstone, in Whitaker (1805); Sinker 1955 (herb. MRDS); Gilbert 1963; Graham 1965; James 1970; Seaward 1977; Henderson and Seaward 1999
On siliceous and calcareous rocks and walls; locally frequent.
Thelidium decipiens (Nyl.) Krempelh.
Laundon 1954 (herb. MRDS); Wade 1961 (herb. MRDS); Sinker (1960); Graham 1965; Seaward 1979; Henderson and Seaward 1999
On limestone rocks and pavement; infrequent, but overlooked.
Thelidium incavatum Mudd
James 1970; Seaward 1979; Henderson and Seaward 1999
On more or less moist limestone below vertical outcrops; occasional, but overlooked.
Thelidium pyrenophorum (Ach.) Mudd
Shackleton & Hebden (1893 as *Verrucaria pyrenophora*); and in Rotheray (1900); Graham 1965; Aptroot 1996 (herb. ABL)
On limestone; uncommon.
Thelidium zwackhii (Hepp) Massal.
Pentecost & Fletcher (1974 as *T. microcarpum*)
On tufa; rare.
Thelocarpon laureri (Flot.) Nyl.
Graham 1965
On ? lignum; rare.
[*Thelotrema lepadinum* (Ach.) Ach.
Carrington, in Miall & Carrington (1862); Miall (1865)]

[*Thrombium thelostomum* (Ach. ex Harriman) A. L. Sm.
Shackleton & Hebden (1893 as *Verrucaria thelostoma*)]
Toninia aromatica (Sm.) Massal.
Sinker (1960); Graham 1965; Seaward 1977 (herb. MRDS)
On limestone; occasional.
Toninia lobulata (Sommerf.) Lynge
Sinker 1955 (herb. MRDS); Graham 1965; James 1965, 1970
On mosses in sheltered faces of limestone outcrops; uncommon.
Toninia sedifolia (Scop.) Timdal
Hailstone, in Whitaker (1805); Carrington, in Miall & Carrington (1862); Lees 1870 (herb. CMM); Sinker 1955 (herb. MRDS), (1960); Graham 1965; James 1970; Seaward 1977; Henderson and Seaward 1999
On soil in crevices of limestone outcrops; locally frequent, but appears to be declining.
[*Toninia verrucarioides* (Nyl.) Timdal
? Hebden, in Rotheray (1900 as *Lecidea carbonacea*)]
Trapelia coarctata (Sm.) M. Choisy
? Hebden, in Rotheray (1900); Sinker 1955 (herb. MRDS); Graham 1965; Seaward 1977; Henderson and Seaward 1999
On siliceous rocks, stones and walls; infrequent.
Trapelia involuta (Taylor) Hertel
James 1965, 1970; Seaward 1985; Henderson and Seaward 1999
On siliceous rocks and stones; infrequent.
Trapeliopsis flexuosa (Fr.) Coppins & P. James
Seaward 1985; Fryday 1990; Henderson and Seaward 1999
On lignum; occasional.
Trapeliopsis granulosa (Hoffm.) Lumbsch
Laundon 1954 (herb. MRDS); Sinker 1955 (herb. MRDS), (1960); Seaward 1977; Fryday 1990; Henderson and Seaward 1999
On eroded peat, acid soils and decayed wood; locally frequent.
Trapeliopsis pseudogranulosa Coppins & P. James
Seaward 1999
On rotting wood; rare.
[*Umbilicaria deusta* (L.) Baumg.
Carrington, in Miall & Carrington (1862)]
Umbilicaria polyphylla (L.) Baumg.
Pentecost 1993
On gritstone outcrops; rare.
Usnea subfloridana Stirton
West (1883 as *U. barbata*); and in Rotheray (1900); Sinker 1955 (herb. MRDS), (1960 as *U. comosa*); James 1970; Seaward 1968, 1981; Fryday 1990; Henderson and Seaward 1999
On a few *Fraxinus* and *Acer* trees; uncommon.
Verrucaria aethiobola Wahlenb.
Shackleton & Hebden (1892, 1893 as *V. cataleptoides*, incl. forma *ferruginosa)*; and in Rotheray (1900) and Watson (1946; herb. BM); Sinker 1955 (herb. MRDS); Pentecost 1985
On submerged boulders in stream; rare.
Verrucaria aquatilis Mudd
Carrington, in Miall & Carrington (1862; incorrectly given in Lees, 1888, as *V. margacea*); Pentecost 1985
On submerged cobbles of gritstone and limestone in stream; rare.
Verrucaria baldensis Massal.
Sinker (1960); Gilbert 1963; Graham 1965; James 1970; Seaward 1977; Henderson and Seaward 1999
On hard limestone and mortar; common.

Verrucaria caerulea DC.
Carrington, in Miall & Carrington (1862 as *V. plumbea*); and in Lees (1888 as *V. fuscella* var. *plumbea*); Shackleton & Hebden (1893 as *V. plumbea*); Sinker (1960); Graham 1965; James 1970
On shaded hard limestone; occasional.

[*Verrucaria calciseda* DC.
Lees (1888); ? Hebden, in Rotheray (1900)]

[*Verrucaria cyanea* Massal.
Shackleton & Hebden (1892, 1893, as *V. limitata*); Hebden, in Watson (1946; herb. BM)]

[*Verrucaria* cf. *dolosa* Hepp
Shackleton & Hebden (1893 as *V. mutabilis*)]

Verrucaria dufourii DC.
Carrington, in Miall & Carrington (1862); Shackleton & Hebden (1892, 1893, as *V. malhamensis*); Sinker 1955 (herb. MRDS); Wade 1959 (herb. MRDS); Graham 1965; Seaward 1979
On hard limestone, including pavement; occasional.

Verrucaria elaeomeleana (Massal.) Arnold
James 1970; Pentecost 1985 (herb. MRDS)
On submerged cobbles in stream; uncommon.

Verrucaria glaucina auct.
Shackleton & Hebden (1893 as *V. canella* - cf. *A. aspiciliicola* R. Sant.); and in Rotheray (1900); Graham 1965; James 1970; Seaward 1979; Henderson and Seaward 1999
On limestone; locally frequent.

Verrucaria hochstetteri Fr.
Sinker (1960); Graham 1965; James 1970; Seaward 1979; Henderson and Seaward 1999
On limestone and mortar; locally frequent.

Verrucaria muralis Ach.
Graham 1965; Seaward 1977; Henderson and Seaward 1999
On calcareous rocks, walls and mortar; infrequent.

Verrucaria murina Leighton
Shackleton & Hebden (1893 as *V. myriocarpa*); and in Rotheray (1900); Pentecost 1999
On hard limestone; rare.

Verrucaria nigrescens Pers.
Laundon 1954 (herb. MRDS); Sinker 1955 (herb. MRDS), (1960); Gilbert 1963; Graham 1965; James 1970; Seaward 1977; Pentecost 1999
On a variety of calcareous substrata, including pavement, and siliceous rocks; common.

Verrucaria pinguicula Massal.
Shackleton & Hebden (1892, 1893 as *V. peloclita*, incl. forma *continuella*); Hebden, in Watson (1946); Coppins late 1960s; James 1970
On hard limestone, including sheltered boulders.

Verrucaria viridula (Schrader) Ach.
Shackleton & Hebden (1893 as *V. mauroides*); and in Rotheray (1900); Sinker 1955 (herb. MRDS); Graham 1965; James 1970; Seaward 1977; Henderson and Seaward 1999
On calcareous rocks, walls and mortar; locally frequent.

Vezdaea aestivalis (Ohl.) Tsch. -Woess & Poelt
Pentecost 1999
Over decaying *Weissia* on spoil tips; rare.

Xanthoria calcicola Oxner
Seaward 1986; Henderson and Seaward 1999
On nutrient-enriched calcareous walls; uncommon.

Xanthoria candelaria (L.) Th. Fr.
Carrington, in Miall & Carrington (1862); Seaward 1985; Henderson and Seaward 1999
On *Fraxinus*, etc.; occasional.

Xanthoria elegans (Link) Th. Fr.
Seaward 1986
On cement; rare.

Xanthoria parietina (L.) Th. Fr.
Sinker (1960); Gilbert 1963; Graham 1965; James 1970; Jaggard *et al*. (1974); Seaward 1977
On wide variety of nutrient-enriched substrata, including trees, roofing tiles and calcareous stonework, especially near farmyards; common.

Xanthoria polycarpa (Hoffm.) Th. Fr. ex Rieber
Henderson and Seaward 1999
On *Fraxinus* twigs; rare.

Excluded Taxa

The following species included in published accounts have been erroneously recorded from Malham:

Cladonia rangiferina, *C. stricta*, *Collema subflaccidum*, *Lecanora pallida*, *Lempholemma isidioides*, *Leptogium saturninum*, *L. turgidum*, *Parmelia stygia*, *Peltigera aphthosa*, *Physcia stellaris*, *Staurothele rupifraga*, *Teloschistes flavicans* and *Verrucaria margacea*.

Summary

In all, 346 taxa have been recorded from Malham over the past 300 years, of which 48 are based on old records, the majority presumed extinct; of the 298 extant taxa, 187 have been discovered during the past 50 years.

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