A field key to Lichens on Trees

Frank S. Dobson

Acknowledgements:

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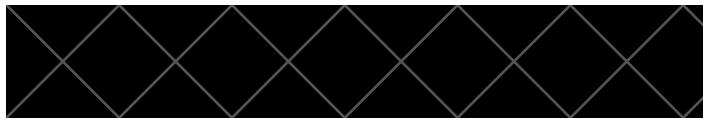

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Cover photograph: Wayside oak (*Quercus robur*) near Blickling Norfolk.

Contents

Also in this series by Frank S. Dobson are:

A field key to common churchyard lichens and the commoner species elsewhere on stone, fences and gates. (3rd ed. 2009).

A field key to coastal and seashore lichens. (2010)

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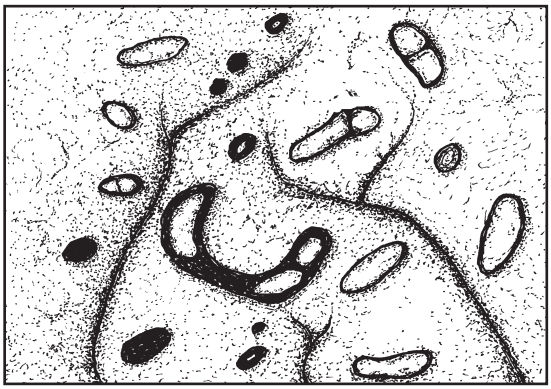
A Field Key to Lichens on Trees

Contents and scope

This book contains illustrated keys to enable the identification in the field of about 500 common lichens that occur on trees. A key to lichens that occur on bare wood is also included and this can be used for lichens growing on sawn wood such as fences and seats. For lichens outside the scope of this book see Dobson (2011), for a comprehensive but requiring more advanced knowledge Smith et al. (2009).

Trees provide a wide range of micro-habitats that are exploited by many species so that about 50% of the nearly 2,000 British lichens may occur on trees. Although many of these lichens may occur in a wide range of tree habitats some are restricted to precise microhabitats for example *Lichenographa lyncea* grows on the lower surface of the branches of ancient oaks.



Illus. 1 *Lecanographa lyncea* x6.

This book contains three methods of identification:

(Method 1) The simplest method is just to use the ***coloured photographs***. Remember that the photographs are not fully comprehensive and your specimen may not be included

(Method 2) The identification may be confirmed by using the ***table of characters*** describing 128 of the most common lichens (See page 29 for information on how to use these methods).

(Method 3) This uses more ***advanced keys*** to about 500 species, subspecies and varieties.

These keys only use characters that are visible in the field, by eye, or under a x10 hand lens. Some information in this book is repeated in order to make the instructions to each type of key more or less independent. However, this information is often given in a slightly different form in each section. If a meaning is not clear, try looking it up in another section.

What is a lichen?

Despite their appearance, lichens are not a single organism but a mutual relationship (symbiosis) between a fungus and an alga (or more rarely a blue-green alga also known as a cyanobacterium).

In most species the alga is located within a thallus (the body of the lichen), often over 90% of which is composed of the fungus. The alga is positioned so that it is best able to obtain the light, moisture and other substances that it requires to produce sugars by photosynthesis. Within the lichen the alga is protected from extremes of climate so enabling it to thrive in situations in which it would otherwise be impossible to survive. The fungal partner, like all fungi, is unable to photosynthesise and, in lichens, is entirely dependent on the alga for its survival and nourishment. The fungal partner achieves this by causing the alga to leak much of the sugars that it makes. This weakens the alga and seems to render it almost incapable of sexual reproduction and it usually only increases through simple cell division. However, this allows the two partners to grow at a similar rate thus producing a stable relationship in which the lichen may live to a considerable age. It is the interaction between the partners that produces a consistent shape to a lichen species, thus enabling identification in the field.

Only a limited number of species of algae can survive being incorporated into a lichen. Conversely, every lichen species consists of a different fungus and it is the name of this fungus that is used for the whole lichen. None of the fungi treated

here are capable of being free-living. The sexual reproductive structures of a lichen are produced solely by the fungus and therefore only contain fungal spores. This means that when spores germinate they must quickly find a suitable algal partner, or die. An exception is that, in a few species, very small algal cells may be found in the fruiting bodies. It is possible that some of these algal cells may adhere to the spores as they are discharged. In some species, if a suitable alga is not available, the lichen may survive by taking over the algae of an already existing lichen on which the spore has come to rest.

The problem of the availability of algae after dispersal is avoided in many species by the lichen producing structures that contain both partners. These structures can become detached and distributed to new potential sites by a number of agencies such as animals, wind or rain. Species that use this vegetative means of reproduction and dispersal usually have few or no fruiting bodies.

Lichens on trees are mainly growing in rather arid conditions as most bark is dry and does not have the water store that soil can provide. In addition lichens do not have specialised mechanisms such as the stomata of plants to regulate water loss. The outer fungal hyphae form a layer (the cortex, see diagram on page 29). which protects the alga from adverse conditions. However, when it rains this layer rapidly absorbs moisture, swells up and becomes translucent, letting in the light and further moisture thus allowing photosynthesis to take place. The algal layer is then often visible and is the reason why many lichens become much greener when wet.The sugars produced are converted by the fungal partner to a form where they can be stored in the medulla. These sugars may be converted into more complex products which in many cases can be detected with the simple spot tests described on page 32). These substances include coloured pigments which are deposited in the cortex and protect the alga from excess UV light. In lichens containing cyanobacteria the majority of the thallus consists of a jelly-like substance produced by the cyanobacteria. On wetting this swells very quickly to as much as 400% of its dry state.

Lichens mainly grow slowly with mature crustose species often expanding by one or less millimetres a year. Foliose and fruticose lichens grow rather faster, frequently up to 5–6 mm a year. As trees only grow vertically from the tips of the trunk or twigs, crustose lichens on smooth barked trees are often drawn out to a narrow band around the expanding girth of the trunk. Some lichens are reputed to be hundreds or even thousands of years old. However, lichens on trees are restricted to the life of the tree on which they grow.

A lack of undergrowth is important for lichens to flourish on the lower part of the trunk as bracken, holly etc shades out the light preventing photosynthesis by the lichens. Grazing animals frequently prove useful in preventing dense undergrowth from forming.

Coppice may support a specialised range of lichens. These are mainly crustose species that have the ability to spread rapidly from the uncoppiced stands.

An important habitat are the 'Caledonian' pinewoods of Scotland. These trees have an acid bark of pH 3.0–4.0. In these woods over 430 different epiphitic lichen species have been recorded. Eighteen of these are restricted in the British Isles to just these woods. The dead pines are especially rich in *Xylographa* species and the 'pin head' fruited *Calicium* genus. (Coppins and Coppins 2006).

Factors affecting lichens on trees

Many lichens have very specific habitats and this is of great assistance in identifying a number of species. Factors that are important in identification include:

Light and humidity

Many lichens have a need for specific conditions of light and humidity. Most require situations in reasonably bright light and therefore occur on exposed

trees in glades or are on the margins of woods. However, there are a limited number that flourish in a more shaded and humid situation such as the interior of a wood. These species often contain the orange coloured alga *Trentepohlia* which may be detected by lightly scratching the lichen so that the orange alga is exposed. Genera that occur in shade include *Arthonia, Enterographa* and *Lecanactis.* Generally, foliose and fruticose species are more abundant along the better lit edges of woods.

At the margins of a wood, especially the south side, the higher light levels and lower humidity provide suitable situations for a wide range of lichens to grow. These species also occur on isolated trees where they are frequently more abundant on the damper north side of the tree, although some species prefer the brighter and dryer south side. There is also variation in the species at different heights up to the top of the canopy. At the lowest level around the damper and more shaded roots species such as *Dimerella pineti* and *Lepraria* grow. Higher up the tree leafy and shrubby species become more common. Some species like *Usnea florida* are mainly found towards the top of the canopy and often can only be seen on fallen branches from this part of the tree. On pines and spruce in Estonia two thirds of the species only occured above 2 metres. (Marmor et al 2013). As a tree grows older the vertical distribution of species is affected by the increasing size and thickening of the crown producing more shading on the lower parts of the tree (Hale 1983). Some other species such as *Lobaria pulmonaria* and *Graphis* species also seem to prefer more shaded conditions. In the increased light higher up, leafy and shrubby species with a green photobiont become more common and appear to be dependent on good illumination. Some species such as *Calicium viride*, *Chrysothrix candelaris*, *Opegrapha varia* and *Pertusaria albescens* occur on the trunks of larger trees (Leppik, Juriado & Liira 2011). There are some lichens such as *Melanohalia* species that frequently occur on twigs and the smaller branches. Each year, in the spring, young twigs grow new shoots from the buds that formed at the tip in the previous year. this produces a 'girdle scar' and by counting these scars along the main twig the age of any part the twig can be determined. As the twig grows older, a succession of species colonise the twig. Many of the early crustose species that occur on young twigs become overgrown by foliose species as the branch matures.

Mature hedgerow trees and especially isolated trees in pastures that are not treated with agricultural spray form one of the most important sites for lichens and should always be carefully inspected. Over 200 species occur in this habitat, especially on shrubs subject to nutrient enrichment from bird droppings. These trees are exposed to wind and this may cause low humidity and lead to the absence of some species. Direct sunlight will raise the temperature of a lichen and this also increases evaporation (Leppik, Juriado & Liira (2011). In gale conditions the wind may cause pieces to break off, especially in fruticose lichens such as *Usnea*. This effect is stronger on dry lichens as they are more brittle. Orange *Xanthoria* species are common on nutrient enriched trees. Near the coast shrubs may be covered in *Usnea* and *Ramalina*. The 'pin-head' *Caliciales* may be found on the dry underside of branches or leaning trunks (Coppins 2001). Very old wooden farm buildings such as barns are rare and they have often been treated with preservative which will kill the lichens but some of those remaining provide the only known sites for several rare lichens.

Humidity is important for lichens as they require water to enable them to photosynthesise. Some species that occur under branches and in deep cracks where rain seldom penetrates are dependent on moisture in the air. The British Isles have frequent rain, driven across from the Atlantic on the westerly winds. The areas with the highest humidity and lowest pollution such as

North West Scotland have one of the richest lichen floras. These areas are also rich in bryophytes which may overgrow and smother crustose lichens. A number lichens such as *Thelotrema lepadinum* and *Pertusaria* species are able to stop this overgrowth, presumably by the lichen products they produce inhibiting the growth of moss. Some species such as *Pertusaria* actually overgrow the moss.

Several nationally rare species such as *Physcia tribacioides*, *Cryptolechia carneolutea* and *Teloschistes flavicans* almost exclusively occur in coastal areas. *Flavoparmelia soredians* used to be restricted to the coast (Benfield 2001) but since the fall in SO_2 levels it has become common inland, especially around London.

Bark

The type of bark greatly affects the lichen species that occur. Bark also changes its characteristics as a tree grows older and with these changes, the lichen species change. Young trees have smooth bark but in many species of tree,as the bark ages, it becomes harder, rougher and more cracked. These conditions are not suitable for many species of lichen. However, small flat areas often remain and these may continue to be the host of some of the early colonisers. On trees the pH and water absorbency of bark may affect colonisation by many species. The different tree species have a range of pH values with the most acid being larch and pine down to pH 3.2 and, in roughly the order of reducing acidity; birch, oak (3.8–5.8 pH), rowan, alder, beech, lime, ash (5.2–6.6 pH), elder, sycamore and field maple, apple, poplar, willow and elm (4.7–7.1 pH). It must be remembered that pollution can affect the pH and that pollution may vary at different heights on the tree. In areas where there was very severe acid pollution this may still cause a reduction in pH many years later as the pollutant very slowly leaches out of the bark. Conversely in areas of high rainfall the nutrients may be leached out of the bark, reducing the pH. In this situation some more acid-loving species such as *Hypogymnia* and *Evernia* may flourish. Where sap has been deposited below a wound it may have a higher pH and several species such as *Bacidia incompta* are most frequently found in this situation. Old trees may have a less acid bark and this is one of the factors that can make ancient oak trees such important habitats for lichens.

Evaluating woodland habitats

A number of attempts have been made to try and value a woodland and to produce an 'index of ecological continuity'. Probably the most useful of these was drawn up by Dr. Francis Rose (Rose 1976) which gives an assessment of the conservation value of a site. and where this value is high, it is probable that there has been a long continuity in the wood and that it has not been clear felled for many centuries.

RIEC – Revised Index of Ecological Continuity

Species included:
Anisomeridium ranunculosporum
Arthonia vinosa
Biatora sphaeroides
Catinaria atropurpurea
Cresponea premnea
Degelia atlantica/or *plumbea*/or *Parmeliella triptophylla*
Dimerella lutea
Enterographa crassa
Lecanographa lyncea
Lobaria amplissima
L. pulmonaria
L. scrobiculata
L. virens
Loxospora elatina
Nephroma laevigatum
Pachyphiale carneola
Pannaria conoplea
Parmotrema crinitum
Peltigera collina
P. horizontalis
Porina leptalea
Punctelia reddenda
Pyrenula chlorospila/or *macrospora*

Rinodina isidioides
Schismatomma quercicola/or *Pertusaria pupillaris*
Stenocybe septata
Sticta limbata
S. fuliginosa/or *sylvatica*
Thelopsis rubella
Thelotrema lepadinum

Maximum total - 30

RIEC is calculated by the number of species n/20 × 100;
e.g. 6 RIEC species gives an RIEC of 30.

Interpretation of RIEC values:
Assuming that atmospheric pollution has not been an overriding factor, the RIEC values can generally be interpreted thus:
0–25 = no indication of ecological continuity; the woodland is either a plantation or has been clear felled and regenerated, or coppiced.
30–45 = evidence of some degree of ecological continuity.
50–70 = strong evidence of ecological continuity.
75–100+ = clear evidence of an ancient woodland with a long history of ecological continuity; the woodland has never been clear-felled or extensively coppiced, although trees may have been felled on a selective basis.

The scope of this index has been widened and refined to include the' New Index of Ecological Continuity' which has 70 species to which can be added 'bonus'species'. This index is suitable for lowland Britain and gives an assessment of the quality of a woodland. In addition, various indices have been produced to cover other more specialised areas of Britain.

A complete account of these indices of ecological continuity may be found in Coppins and Coppins (2002).

A group of lichens forming the *Lobarion pulmonariae* alliance (See lichen communities page 22) indicates ancient woodland characterised by mature trees which have experienced a long period of ecological continuity. (James e*t al* 1977). Old parkland, often formed in the medieval period, frequently has trees that are hundreds of years old. Although they used to be pollarded, most have been untouched for at least 100 years. This gives a very stout trunk and a swollen crown that breaks into numerous vertical branches that have grown since it was last pollarded. It is thought that this earlier pollarding helped to preserve the vigour of the tree. Unlike many old trees those in parkland are not normally subjected to agricultural fertiliser and do not become overly nutrient enriched, They now provide a very rich habitat for lichens and should always be examined closely if the chance arises. A single ancient oak may have a great diversity of species present as it provides a number of niches for distinct communities from acid-barked, well lit twigs to more base-rich shaded trunks (Sanderson & Wolseley 2001). Sheltered old ash trees are also valuable sites for lichens. In the British Isles another very important site is the side of old trees sheltered from direct rainfall. This is the habitat for the association *Lecanactidetum premnae* (see page 23) which includes species such as *Cresponea premnea*, *Lecanographa lyncea* and *Schismatomma* species.

Some trees such as elder (*Sambucus*) have a very porous, deeply cracked and water retaining bark with a PH of 5–7.3. These factors assist in producing a rich lichen flora often consisting mainly of *Xanthoria* and *Physcia* species from bird dropping enrichment. When a tree dies the bark often loosens allowing moisture to penetrate behind it and thereby increasing the humidity. In these conditions some lichens are more prone to produce fruiting bodies. This is to the advantage of the lichens as the spores it disperses may colonise a new habitat before the original lichen dies with the tree. In some situations such as near a limestone quarry, the deposition of dust may greatly affect the species present, even to the extent that normally saxicolous species may be present.

A number of species are normally restricted to one species of trees. These

Typical pH values (Orange 1994)	
Vinegar	2.4
Pine bark	3.0 – 3.5
Orange juice	4.5
Birch bark	3.2 – 5.0
Unpolluted rain	5.0 – 6.0
Ash bark	5.2 –6.6
Elm bark	4.7 – 7.1

Some top parkland lichen sites

Site	Species recorded
Melbury Park, Dorset	218
Arlington Park, Devon	213
Boconnoc Park, Cornwall	191
Parham Park, Sussex	190
Eridge Park, Sussex	185
Brampton Bryan Park, Hereford	176

The number of lichens recorded on some species of trees (after Broad 1989).Recent additions to the British flora will have greatly increased these numbers e.g. in 1974, 259 species were known from old woodlands, in 1997 this had increased to 344 (Gilbert 2000).

Tree	number of associated species	notes
Oak	324	The most species occur on oaks growing in open situations where over 50 species have been recorded on a single tree
Ash	255	A higher pH than oak and can support species that used to occur on elm e.g. *Cryptolechia carneolutea*
Beech	200	Despite its low pH, in some places such as the New Forest and in high rainfall areas it supports a large range of species but in many situations it only has a limited number.
Elm	187	A fairly high pH and soft, water-holding bark made this one of the best tree species for lichens. Unfortunately most of the trees are now lost due to Dutch Elm Disease.
Sycamore	183	It has a high pH and in suitable situations frequently has a good range of species.
Hazel	160	Has a specialised flora, especially good in the high rainfall areas of old coppice in Western Scotland. In active coppicing, often only species on smooth bark are able to grow before the coppice cycle of 10 to 35 years cuts them down.
Willow	160	In humid but polluted areas it often is one of the most important trees for lichen species.
Scots pine	132	The small relic areas of native Caledonian forest has a specialised lichen flora that is absent in replanted pine forests.
Birch	126	It has a low pH and except in high rainfall situations, a rather poor lichen flora.
Lime	83	A hard, smooth bark and a rather poor flora.

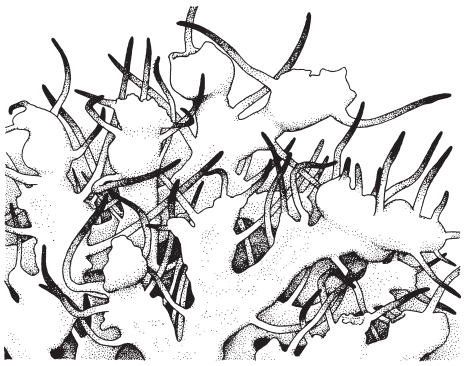
include *Stenocybe septata* on holly (*Ilex*) and *Stenocybe pullatula* on alder (*Alnus glutinosa*) although this genus is not a true lichen as its species do not contain algae. Elm (*Ulmus* species) with its high pH of up to 7 was a very rich habitat with its own specialised lichens. The loss of these trees due to Dutch elm disease has made a number of species such as *Cryptolechia carneolutea* very rare. Yew trees (*Taxus baccata*), often found in churchyards, have few species. This is probably due to the dense canopy shading out much of the light, but they do support some rare species such as *Opegrapha prosodea*.

Pollution

In the latter part of the twentieth century, the most important air pollution came from sulphur dioxide produced by industry, power stations etc. This pollution often dissolved in water vapour to fall as acid rain.

The effects of this on lichens were profound and in the centres of cities and industrial areas lichens were often absent or only represented by *Lecanora conizaeoides*. Even in the outer Royal Parks of London such as Richmond and Bushy Parks most trees would be covered in this lichen with very few other species being present.

In most parts of the British Isles the mean concentration of sulphur dioxide is falling following the Clean Air Acts and the closure of many polluting power stations and heavy industry. Lichens are now recolonizing areas where they have not been seen for many years. For example in the grounds of Buckingham Palace readings of 300 $\mu g/m^3$ SO_2 were often recorded. The level now has dropped as low as about 3 $\mu g/m^3$. The ability to recolonise depends not only on the level of pollution but also on a number of other factors. A lichen with a low rate of recolonisation may be absent from an area although other species, less able to tolerate pollution but better at re-establishing themselves, may be present. Where levels of sulphur dioxide pollution are dropping rapidly, a number of species which need a rather acid bark may never reappear because the substratum has already become too increased in pH to support them.



Alan Orange

Illus. 2 *Physcia adscendens* x12

The Hawksworth and Rose scale (Hawksworth & Rose 1970) gave a good indication of the maximum level of SO_2 from the presence or absence of various lichen species. It was a useful indicator while pollution was increasing or steady but, as has been noted above, did not acccurately predict the order of return of a number of species as the pollution levels fell. A number of species such as *Parmotrema perlatum* and *Physcia aipolia* appeared sooner than would be expected. In contrast, species that grow in sheltered places such as bark cracks do not get wetted very much by the rain, thus the bark may retain high levels of acidity and can produce 'zone dawdlers' such as *Chrysothrix candelaris* and *Lecanactis abietina.*

A study made between 1979 and 1988 in Devon along a transect between the clean air of a wooded valley on Dartmoor (Shaugh Bridge) into the Central Park of Plymouth showed the effect of increasing concentrations of sulphur dioxide. Illus. 3 gives details of the sites chosen.

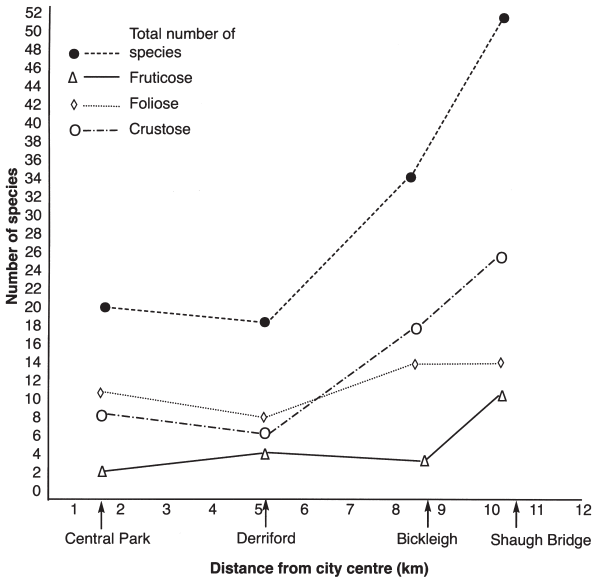
The study compared the number of fruticose, foliose and crustose lichens present at each site. It is clear that with sulphur dioxide pollution there is a decline in the fruticose and foliose groups as the pollution increased. A table showing the results of the 1979 survey is given in Illus. 4 and a chart of the results

Site	Map reference	Distance in km from central Plymouth
Shaugh Bridge	SX 534636	10.6
Bickleigh	SX 520623	8.7
Derriford	SX 495598	5.1
Central Park	SX 469561	1.6

Illus. 3 Sites used in monitoring sulphur dioxide pollution in Devon

	Shaugh Bridge	Bickleigh	Derriford	Central Park
Fruticose	7	1	2	1
Foliose	12	8	7	6
Crustose	25	12	9	4
Total	**44**	**21**	**18**	**11**
% Fruticose	16	5	11	9
% Foliose	27	38	39	55
% Crustose	57	57	50	36
Hawksworth & Rose scale	10	7–8	6–7	4–5

Illus. 4 Results of the 1979 survey of the transect into Plymouth



Illus. 5 Results of the 1988 survey of a transect expanding out from Plymouth

for 1988 in Illus. 5. At Shaugh Bridge in 1979 all the species including the ones most sensitive to pollution were in good condition. However by 1988 a number of these such as *Pannaria* species and *Usnea articulata* appeared to be dying. In 1995 the BLS visited the site and recorded over 130 species including *Parmeliopsis horrescens* and *Hypotrachyna endochlora*. However, on this occasion *Usnea articulata* could not be refound and other more sensitive species seemed to be in poor condition. The reason for this decline is not known. There appeared to be little change to the species at Bickleigh but the site at Derriford could not be

inspected as the trees had been felled to build a new roundabout. There was not time to visit Central Park but a quick visit in 2005 showed a 70% coverage of the trees, mainly with foliose species. During the 1988 survey it was noted that in deep cracks in the bark minute fragments of foliose and even *Usnea* species were surviving. This was particularly common on willows (*Salix* sp.) in a damp hollow. It is probable that the rapid recolonisation started from these small specimens. Frequently it was found that the richest lichen flora occurred on willows in damp situations. This is possibly due to willows having a base rich bark with deep crevices and from the extra humidity in the location. In such a willow carr in the 1970s Brian Fox monitored the return of lichen species as SO_2 levels fell. As expected, the more acid tolerant species such as *Hypogymnia* species and *Parmelia sulcata* returned first to be followed by many other species including *Physcia aipolia*, *Parmotrema perlatum* and *Usnea subfloridana.* It was only later that the returning lichens spread to other trees in the area (Gilbert 2000). It is not unusual for some lichens to disappear again for a period after their return. This may be due to short episodes of increased pollution. It is noticeable that the species that protrude furthest from the tree such as *Usnea* and *Evernia* are most affected by this phenomenon. In these cases it is possible that the thallus has grown beyond the more protected boundary layer of air around the branch and is now exposed to the higher level of pollutants. In the case of Plymouth, the lowering of sulphur dioxide pollution would have been assisted by the closure of Plymouth 'B' power station in 1980. There was also a tar distiller at Catterdown producing 35,000 tons of tar a year until it closed in 1965. It was apparent in the 2005 visit that the affects of nitrogen pollution were apparent with *Physcia* species and other nitrogen oxide resistant species becoming abundant.

The source of this excess nitrogen is partly from artificial fertilisers. In addition ammonia, especially from intensive animal husbandry can, if dissolved in rain or mist, eliminate all but the most resistant lichens such as some *Xanthoria* and *Physcia* species. At the former higher levels of sulphur dioxide pollution, the ammonia was probably counterbalanced by acid rain and the effects therefore were masked. However, as sulphur dioxide levels have fallen and bark has become less acid and enriched with nitrogenous products, the formerly very common species of polluted areas *Lecanora conizaeoides*, has become rare and is now often found only on old sawn wood. Other acid-loving species (acidophiles) such as *Parmeliopsis ambigua* and *Hypogymnia physodes* have also disappeared or become much rarer.

The spread of nitrogen compounds caused by agriculture and exhaust fumes has reduced the presence of a number of species that are unable to tolerate these nitrogen products. These species (nitrophobes) include *Evernia prunastri*, *Usnea* species, *Parmelia saxatilis, Lepraria incana, Cladonia* species and *Hypogymnia physodes*. Some species such as *Lobaria amplissima* and *L. scrobiculata* that grow on well-lit, often isolated trees have declined due to the influence of agricultural pollution (Benfield 2001). There ise a number of other species which flourish in a high nitrogen environment (nitrophiles) such as *Candelariella reflexa*, *Physcia tenella* and *Xanthoria* species. It has been shown that *X. parietina* can accumulate nitrogen inside its thallus but *E. prunasti* does not have this ability and is thus a nitrophobe. Some other lichens such as *Melanelixia*, *Flavoparmelia* and some *Parmelia* species appear to be unaffected by all but the highest level of nitrogen pollution. Other air-borne pollutants such as ozone and fluorine cause damage to lichens but it is the effect of high deposition of nitrogen compounds that is most impoverishing our lichen flora in many parts of the British Isles. In places where dogs are exercised, it is often possible to see a greensh yellow band at the base of an isolated tree. This is at the height at which

a dog can cock its leg. Its urine then adds to the nutrient enrichment of this area and *Xanthoria* and *Candelariella* species predominate. The tree in illus. 6 is at Kingsbridge in Devon and clearly shows this phenomenon. The upper grey area consists of mainly *Physcia* species responding to the nutrient enrichment in the dust thown up by cars on the nearby main road.

Illus. 6 Nutrient enriched tree

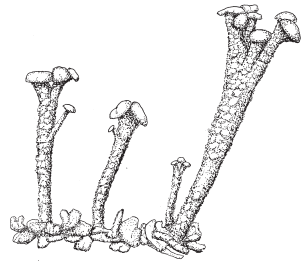
Alkaline dust such as is produced by a cement works can also completely change a lichen flora especially if the nitrogen pollution also increases. Round a cement works in Derbyshire, the more acid loving species have been completely replaced by *Xanthoria* species (Gilbert 1976).

Other air-bourne pollutants such as ozone and fluorine cause damage to lichens but it is the effects of nitrogen compounds that are the most damaging to the lichen flora in many parts of the British Isles.

For reasons that are not clear (global warming?), ivy appears to have become much more abundant in recent years. An example is shown on the cover photograph. This tree once had a good lichen flora but it had now been completely smothered out by ivy.

Bare wood, fences, seats etc.

Bare wood where the bark is no longer present has its own distinctive lichen flora, These include a number of 'pin-head' species such as *Chaenotheca* and *Calicium*. Sawn wood such as in fences or on seats should be carefully examined for the species such as *Micarea denigrata, Trapelia flexuosa, Imshaugia aleurites* and *Parmeliopsis ambigua*. This last species was often abundant in more acid conditions but with the fall in acid pollution it is now rare in many of its old sites. A similar occurrence has happened to *Lecanora conizaeoides* which now often only occurs on fences made from more acid wood. Some species such as *Cyphelium inquinans* are almost entirely restricted to old sawn wood. An interesting species in the South East is *Cyphelium notarisii* where it is most seen on old benches. It is thought that it is often distributed in this situation on clothing of people sitting on the bench. A key to the more common species on bare or sawn wood is given on page 89. As the wood starts to decay it becomes colonised by a number of *Cladonia* species. Eventually it becomes so rotten that it is no longer capable of supporting lichens though *Trapeliopsis granulosa* and T. *pseudogranulosa* may be present. Some very rare species such as *Cladonia botrytes* have very specific habitats on bare wood and this species is almost completely restricted to pine stumps of trees felled 4–10 years ago.



Illus. 6 *Cladonia botrytes*

Lichen communities

Lichen species, with similar ecological requirements growing together in the same habitat and usually on similar substrata, are described as 'communities' and classified into alliances and associations in the same way as flowering plant communities. Alliances may contain one to many associations similar to the relationship

between genus and species. The description is based on species frequency of lichens in typical examples of the community and of a type site described. The range of species found in a community is remarkably consistent, allowing the use of shorthand reporting using community, characteristic or faithful species instead of a full list.
The following should make this clear.

Alliance (suffix 'ion')
Cladonion coniocraeae (two associations)

Association (suffix 'etum')
1. Cladonietum cenotiae (*Cladonia* species on acidic tree bases)

Dominant species:
Cladonia cenotea, C. furcata
and moorland *Cladoniae*

2. Cladonia coniocraeae (*Cladonia* species on shaded tree bases, rotting wood, peat)

Dominant species include:
C. coniocraea (replaced by *C.parasitica* on dry decorticate wood) and *C. macilenta.*
It also includes *Micarea prasina* and *Peltigera* species.

Alliance
Usneion barbatae (five associations of which two are shown below:)

Association:
1. Ramalinetum fastigiatae
(*Ramalina* species on well-lit exposed trees) including *R. canariensis, R. farinacea, R. fastigiata* and *R. fraxinea*

2. *Usneetum articulato-floridae*, var. *ceratinae*
(on horizontal branches of trees)
It includes *Usnea articulata, U. ceratina, U. florida,* and *U. rubicunda*

Most communities comprise many alliances and many associations. Those which have served as examples above (*Cladonion conicraeae* and *Usneion barbatae*) are among the smallest. These associations and alliances are associated with definite ecological niches, so that a knowledge of lichen communities can be of value in field work since it gives guidance on what species are to be expected in which locations. For example, *Cladonion conicraeae* is associated with mossy boles or peaty soil, while the *Usneion barbatae* is associated with well-lit twigs and branches in unpolluted areas. Classification of lichens in terms of habitat is necessarily imprecise and dependent on a wide range of ecological and historical factors as well as observers' subjective assessment. Some species may occur in a wide range of communities whereas others are 'faithful' to a specific association. Only an brief outline of lichen communities can be given here, but a very full guide, on which this section is based, is by James, Hawksworth and Rose. ed. Seaward M.R.D. in *Lichen Ecology*. Academic Press (1977).

Corticolous communities

Examples include the already mentioned *Cladonion coniocraeae* and *Usneion barbatae,* as well as communities characteristic of old established woodland. These fall into two main alliances; the *Lobarion pulmonariae,* the climax community of British deciduous ancient woods. It occurs on well-lit trunks in moist conditions and is dominated by large foliose species of *Lobaria, Sticta* and *Parmelia* s.l. and the *Lecanactidetum premnae* within the *Calicion hyperelli*, an association dominated by crustose species on the dry side of ancient trunks such as *Schismatomma decolorans*, *Cresponea premnea* and *Lecanographa lyncea*. Other characteristic crustose associations are found on smooth bark and twigs where well-lit. The *Arthopyrenietum punctiformis* has pyrenocarpous taxa such as *Arthopyrenia* species which is succeeded on larger branches and trunks by a mosaic of species including *Lecanora chlarotera* and *Lecidella elaeochroma.* In more shaded areas the *Graphidion scriptae* occurs. This

includes the *Graphidetum scriptae* dominated by lirelliform lichens (species of *Graphis* and *Opegrapha*), and the *Pyrenuletum nitidae* a community of deep shade in woodlands with species of *Pyrenula* and *Enterographa*. The *Physcietum adscendentis* (dominated by species of *Physcia* and *Xanthoria*) is characteristic of nutrient enriched bark in the vicinity of farms and intensive agriculture and this community appears be increasing as levels of acid pollution are falling and nitrogen based pollution increases.

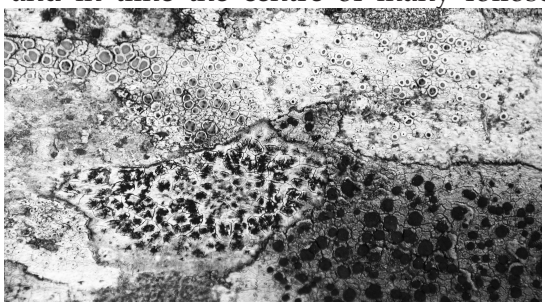
Lichen dispersal and growth

In many species the normal method of dispersal is solely by vegetative means, indeed some species have never been found with sexual fruiting bodies. Vegetative propagules may consist of algal cells and fungal hyphae that are simply broken fragments of thallus or they may be formed in special structures (such as soralia and isidia, see page 30). These propagules are dispersed in many ways, such as wind, rain, insects, birds or other agents. If they alight on a suitable substratum it may be possible for them to develop, forming a new complete lichen. Some genera such as *Usnea* and *Ramalina* often get pieces broken off by a strong wind. If these land on a suitable habitat a new thallus may develop.

Many lichens do produce fruiting bodies. Until recently, the shape and structure of these reproductive parts has formed the basis of most lichen classification. Recently classification has been based largely on genetic characters.

Unlike many other fungi, most lichen fruiting bodies are long-lived and can often produce very large numbers of spores over a period of several years. These fruiting bodies are only produced by the fungal partner and, with a few specialised exceptions, they do not contain any algae. This means that after dispersal, and before the spore can develop following germination, it must quickly obtain suitable algal cells to incorporate into the potential lichen or it will perish. Lichens employ various strategies to help minimize this predicament. Some produce very many small spores to increase the chances of one of them coming to rest at a suitable site for survival. These spores may only have a short life as their food reserves are restricted by their size. An alternative strategy adopted by other species is to produce fewer but larger spores which may have a thick wall and are thus able to remain viable for a longer period during which they may come in contact with a suitable alga. Other lichens produce spores with many nuclei, each of which is capable of germination. In many species the germinating spore develops by parasitizing another lichen which contains a suitable alga and then takes over this alga for its own use. It also appears that, in the early stages, some lichens may develop by associating with an alga that is not the preferred one for that species. This alga may not be able to survive in this association but it does mean that the period is extended during which the correct alga may be contacted. However, despite the considerable number of spores produced, the odds are still against frequent, successful reproduction by this means.

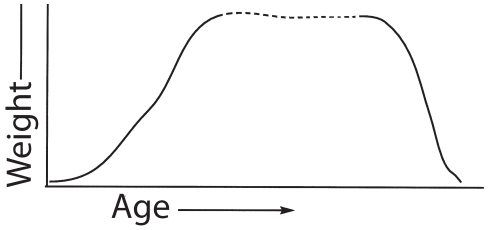
On trees especially when the bark is smooth it is common for several species to form a mosaic which may separate each thallus from its neighbour by a dark line of prothallus. These mosaics are often very stable and last for many years (see Illus. 7). Sometimes these mosaic may be overgrown by foliose species. Lichens only grow around the margin and in time the centre of many foliose



Illus. 7 Lichen mosaic on smooth bark

lichens dies and falls out. This then leaves a bare area which can be colonised by other lichens or by fragments of the same thallus. In some lichens such as *Ochrolechia* and *Pertusaria* the central area thickens and in other genera it develops extra lobes. It is in this area that the vegetative and sexual bodies arise (Hawksworth & Hill 1984).

When a fragment of lichen or a spore lands in a new suitable habitat, and the spore finds the correct alga, a new lichen starts to develop. In the initial stages growth is very slow but as it grows and the algae multiply, the amount of sugars that they can produce by photosynthesis increases and with it the diameter of the lichen. Most lichens show a fairly consistant increase in size and weight for a number of years. With foliose lichens in particular, eventually this growth tails off and they do not or only slightly expand in size. Finally they stop growing and die. This is shown in Illus. 8.



Illus. 8 Growth of a lichen over time

This steady rate of increase varies from species to species and is dependent on the suitability of the habitat in which they grow. A lichen in a well-lit situation with sufficient moisture will grow faster than one that is lacking these factors. In a number of genera such *Ochrolechia* and *Pertusaria* the margin of the lichen often has 'growth rings'. Wider, paler rings are caused by times of more rapid expansion such as when there is sufficient moisture for rapid growth and by narrow, darker rings in a dry period with low growth.

Photography and measurement of *Parmelia* lobes shows that growth takes place in the terminal 2–5 mm of a lobe and that over 50% of growth is restricted to the outer 0.6–1.7 mm of the lobe (Hawksworth & Hill 1984).

It is therefore possible to make some calculation of growth rate when the age is known of a substratum such as a seat or a fence post or a tombstone. Caution is needed with this method as it is not known when the substratum was first colonised and also the initial growth rate of a lichen may be low. As previously mentioned, twigs may be accurately dated as each years growth is shown by a girdle scar.

A study was made at Manobier in Pembroke on the regrowth of a specimen of *Physconia distorta* growing on a small ash tree (*Fraxinus excelsior*) from which the middle third of the lichen was removed in 1984. This tree was one of number forming a narrow thicket overhanging a small stream. This increased humidity which which encouraged the lichen growth but made the photography rather difficult.

In 1989 it was noticed that the wound on the tree was healing (see Illus 9) and that the cut ends of the *Physconia* had regrown lobes and was expanding back across the gap (this demonstrates the importance of not collecting the whole of a specimen!). On the left side of the tree there is a small *Physconia distorta* just below the main thallus, and below that is a specimen of *Parmelia sulcata.* To the right of the *Parmelia* is *Ramalina fastigiata*.

In 1990 the main *Physconia* was growing at the same rate as the tree was healing which was about 5-8 mm a year (all measurement radially) and had reached the lower *Physconia*. The *Parmelia* had grown upwards about 1 cm and the *Ramalina* had also grown about 1 cm.

In 1991 the wound on the tree had healed up over most of the upper part and the two halves of the *Physconia* had almost met having continued to grow at nearly 1 cm a year.

By May 1993 the two pieces of *Physconia* had met in the centre. The *Parmelia sulcata* had grown and was starting to overgrow the lower *Physconia.* The *Ramalina* had continued to grow at about 1 cm a year. Above the main

1989 1990

1991 May 1993

Oct 1993 1995

Illus. 9 Growth of *Physconia distorta*

Physconia a number of *Ramalina fastigiata* thalli had appeared since 1991 and were already 2.5 cm long and fertile. A small *Physconia* just below the right hand main *Physconia* was only just visible in 1990 but is now over 2 cm diameter.

A return visit was made in October 1993. This was after the summer when with the dryer weather many lichens grow very little, the main growing season being during the wetter months in the autumn to spring. Usually there is sufficient light to support growth even in midwinter especially on deciduous trees after the leaves have fallen. The *Parmelia* below the *Physconia* showed the greatest change and has grown to almost cover the small *Physconia*.

In 1995 it was found that the trees in the ash thicket were dying. The main *Physconia* was most affected and was almost dead. Conversely the *Ramalina* and also some *Evernia prunastri* were flourishing and had covered the branch in the next phase of succession. The death of the host tree brought an end to the project.

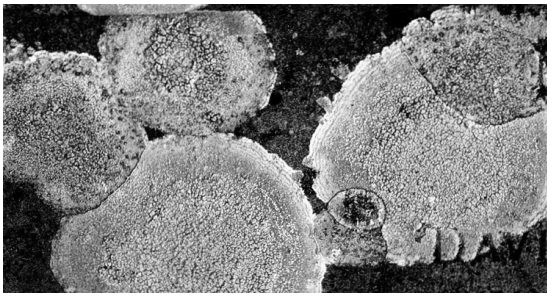
When looking at lichens on trees it will often be found that in a line of trees that appear to be identical, a good lichen flora ocurs only on one or two of them. The reasons for this are not clear but is possibly due to a subtle change in the microclimate at some time in the past, perhaps a nearby tree was felled and has altered the humidity and illumination to the detriment of the lichens. This situation occurred on Box Hill in Surrey where two very large ash trees had supported some of the best lichen flora in the district. They were growing adjacent to the edge of a dense yew wood to the south and east which kept the humidity high. The National Trust had to fell one of the trees as it was diseased. Within two years the thick covering of fruticose lichens and many of the rarities had disappeared on the remaining tree.

As mentioned above, the two remnants of *Physconia distorta* came from the same original thallus and so were genetically identical and could merge when the two parts met. This is clearly shown in another project which ran for 20

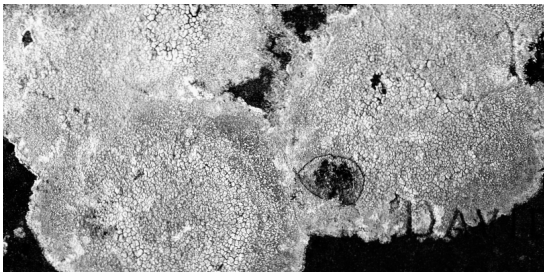
years on various lichens in Carew Cheriton churchyard in Pembroke. The one described below was on a sandstone memorial but it also applies in principle to lichens growing on trees.

The tombstone is dated 1906 and if you assume that it was colonised within a few years of erection the lichens could be almost 100 years old.

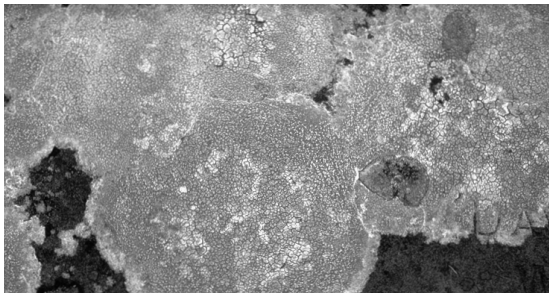
Illus. 10 shows the situation on part of the south side of the stone from 1990 to 2000. In the 1990 illustration the three thalli at the top are slightly darker than the two larger thalli below so that they presumably are slightly different genetically. At the stage shown the thalli have met and the darker one in the top right has maintained its separate identity from the paler one. This is a similar situation between the two darker ones on the left and the paler one below.



1990



1996



2000

Illus. 10 Growth of *Ochrolechia parella*

However, the two darker ones are already merging. The fact that separate thalli can merge means that the possibility of dating stones back for hundreds or even thousands of years by the diameter of their lichens should be approached with caution. It might be that a large thallus is due to the merging of smaller ones.

Tephromela atra is growing just to the right of the centre in the photographs as a separate round thallus, but encroached from the right by the *Ochrolechia*. It continued to grow in the only direction available, to the left so that it became an oval. It was later completely surrounded and unable to expand further. In this situation a lichen is often overgrown by the more vigorous lichen but in this case it has maintained its identity.

Six years later in 1996 the two forms of *Ochrolechia parella* still show a clear division between the thalli. In 1990 there were two thin areas of fungus without alga extending from the right hand main lichen. By 1996 they had bridged the gap over to the left hand lichen as mature lichen containing alga.

All the thalli had grown at a rate of about 1.5 mm a year. They maintained this rate of growth throughout the project. On another stone on the damper north side the growth rate was 2 to 3 mm a year. Environmental conditions can make a considerable difference to the rate of growth (Topham 1977) including the stress of pollution (Seaward 1976). These rates are similar to those reported by others of 0.55–2.5 mm for crustose lichens and up to 3mm for foliose lichens (Hill 1981 and Winchester 1984). In 2000 the thalli continued to grow at the same rate and had now almost covered the substratum. The thin area in 1996 towards the top had now thickened up to an areolate thallus.

Fieldwork

'Safety' must be the first consideration when working in the field. The following rules, together with common sense, will help to ensure your safety:

1. Always inform someone about where you are going and at what time you will return. If possible, do not go alone.

2. Take a mobile phone with you and if you run into difficulties and cannot contact a friend, dial 999.

3. It is easy to trip over a tree root or twist your ankle in a hole overgrown by the grass. When wet, rocks and grass can be very slippery so wear suitable footwear and proceed very carefully.

4. Do not work close to the top of quarries, cliffs etc as sometimes, unknown to you, the cliff edge may be undercut and your weight could be enough to cause it to collapse.

5. If working at the base of cliffs beware of falling stones.

6. Do not be climb up or down cliffs or trees. It is very easy to become stuck and find that you are unable to climb further either up or down. What looks like an interesting patch of lichens usually turns out to be a common species when you reach it. It is never worth risking your life to examine a lichen. A pair of binoculars will often enable you to identify a lichen growing in the canopy of a tree.

7. If you are collecting specimens ensure that you are wearing the correct safety equipment including goggles and gloves. You will find that some form of kneeling pad will make work near the base of trees more comfortable. Take a simple first-aid kit with you to deal with any minor injuries. Further advice is given under equipment on page 32,

Strategy in recording a site

If you are making a list for the whole site, work in a systematic way around it so that no area or tree is overlooked. Do not forget to examine any wooden structures such as fences and gates as these often support interesting lichens. If you are in a site with many trees, there is a strong temptation to rush from tree to tree to see what can be found. However, it is almost always worth examining one tree thoroughly before moving on to the next one as otherwise many small but interesting lichens will be missed. Mature trees usually produce the widest range of species and often the most interesting.

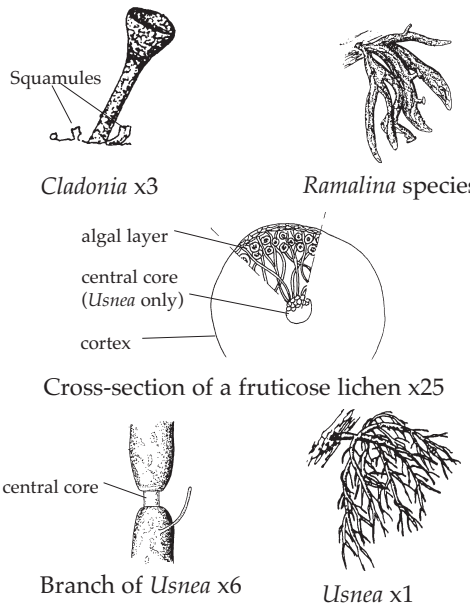
Collecting

This key has been written in such a way that collecting should not be required. It is obviously not permissible to damage important or private property in any way but if, for some very good reason, a lichen must be collected, small portions of powdery, leafy and bushy lichens may be carefully scraped off the surface or taken with a small piece of the underlying bark. It can sometimes be difficult to collect small crustose lichens on important trees but by using the point of a knife, and without damaging the bark, it is often possible to remove a small portion containing the fruiting body. This is all that is needed for microscopical examination. This minute piece can then be collected onto clear sticky tape which, in turn, can be stuck onto a piece of paper or card. This will enable the fragment to be viewed through the clear tape and be safely taken away for later examination. Small samples may be taken but never take the whole of a specimen. Always leave as large a piece as possible so that it may regrow. If possible, collect from part of the tree that cannot be seen from the road and then rub some dirt into the scar to make it less visible. Lichens on fallen branches may be collected as the lichen is no longer in its normal habitat and will almost certainly die. Very often it is already in a poor condition and identification may be becoming difficult. If it is important to identify such a lichen, the spores will probably still be in good condition and may be examined later under a microscope.

Method 1. Quick start to the identification using the photographs

Lichens depicted in the plates are arranged according to their form: fruticose (bushy), foliose (leafy) and crustose (crusty). Plates 4 and 5 include squamulose species and also the *Cladonia* species that frequently grow on trees and wood. Lichens that often occur on bare roots and tree roots are shown on plate 8.

Confirmation of the identification may be assisted by use of the notes in the table of characters. More detailed information about the growth forms and other characters are given in that section.



Cladonia x3 *Ramalina* species x1

Cross-section of a fruticose lichen x25

Branch of *Usnea* x6 *Usnea* x1

Examples of fruticose lichens

Method 2. Using the tables of characters (pages 36 to 40).

Introduction to the table of characters

Before using the table it is intended that the first means of identification should be the coloured photographs. It is important that any tentative naming should be confirmed by using the additional details given in the tables. To assist this, the tables are arranged somewhat differently from the photographs, the initial separation is however, also by growth form. This is shown down the left edge of the tables. To assist in the identification of lichen structures that are too small to be distinguished with a hand-lens, diagrams have been provided in the following notes.

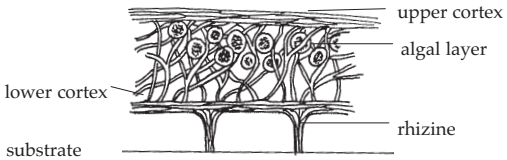
The columns in the tables are arranged as follows.

(1) Growth form: (on left edge of table)

Fruticose: Bushy lichens usually only attached at a single point and, in cross section, have a continuous ring of alga just under the surface. In many *Cladonia* species there are fruticose fruiting bodies growing up from a minute leaf-like (squamule) or granular base (Plate 4 Figs 62–64 and plate 5 Figs 65–69). Other fruticose genera include *Ramalina,* with rather flattened lobes (Plate 1 Figs. 6–9) and *Usnea* which is more rounded and has a central core that becomes visible if a main branch of the lichen is pulled apart (Plate 1 Figs 1–5).

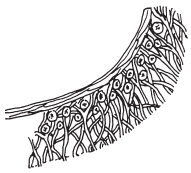
Foliose: Leafy lichens which have both an upper and lower skin-like cortex. These lichens are often attached by, root-like rhizines. It is therefore possible to remove them easily from the substratum to make the lower cortex visible (e.g. Plates 2 and 3).

Foliose lichen x3



Cross-section of a foliose lichen x20

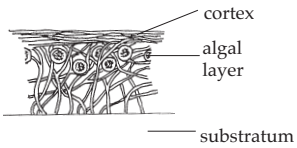
Squamulose: *These* are actually crustose lichens that have peeled up from the substratum raising the tips of the lobes. Therefore, they differ from foliose lichens in



section through a squamulose lichen x8

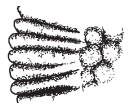
the lack of a lower cortex. The lower surface is the exposed medulla and is most frequently white (e.g. Plate 4 Figs 60–61).

Crustose: Crusty lichens only have an upper cortex and from the lower surface the fungal threads grow directly into small cracks in the surface of the substratum. It is not easy to detach the lichen without removing some of the surface on which it is growing (e.g. Plates 5–8).



Crustose lichen x20

Placodioid: This term describes a crustose lichen in which the margin has finger-like or wider lobes (e.g. Plate 2 Fig. 18). Care must be taken not to confuse this form with foliose lichens. The lobes of placodioid lichens are not easily removed from the substratum.


Placodioid lichen x1

Leprose: powdery lichens consisting of a loose mixture of fungal threads and algal cells. This growth form usually has very little structure and is either powdery or finely granular. Some species have a slightly lobed margin and/or a white medulla, visible if the surface is scratched away. Most of these species do not produce fruiting bodies but rely on vegetative methods of distribution (e.g. Plate 7, Figs. 101, 102). In addition, when well developed and very sorediate, some crustose species may appear leprose (e.g. Plate 7, Fig. 98).


Leprose lichen viewed from above x 10


Cross-section of a leprose lichen x 25

Some species described in this book may appear to have several growth forms and in these cases, to aid identification,they appear under both headings in the table.

(2) Name:

The Latin name of the lichen is used as, unfortunately, very few lichens have English names, but the Latin name is recognised internationally.

(3) Colour:

The colour of lichens can be very variable often depending on whether they are growing in bright sunlight or deep shadow. When they become wet, the cortex may become translucent and the green algae then become visible, tinting the lichens green. The colours given in the table are those that are normally present when dry.

(4) Habitat:

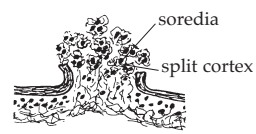
In these tables this column refers to the surface on which the lichen normally grows. Many lichens are specific as to where on a tree it grows and what type of bark it prefers. However, under certain circumstances, many lichens may grow in other situations and these headings should be considered to be a guide to identification and not definitive. For abbreviations used in this section see page 32.

(5) Soredia/isidia:

Many lichens do not produce any fruiting bodies but rely for dissemination on small pieces breaking off and being transported to a suitable situation where the fragment can grow into another complete lichen. A number of lichens produce specialised structures to assist in this distribution and those used in the key are given below:

Soralia are splits in the surface of the lichen through which the mixture of fungal and algal cells escapes.

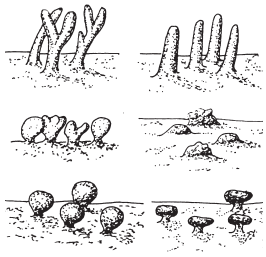
Soredia is the name given to the minute powdery or granular pieces which are liberated from the soralia and then carried away by the



Soralium with soredia x15

wind, rain, insects, gravity etc.

Isidia are firm, minute out-growths from the surface of the lichen where the cortex and algal layer remain unbroken. These break off and can grow into a fully formed lichen if they are deposited by wind, rain, insects etc. onto a suitable habitat. Isidia may sometimes break down into soredia.



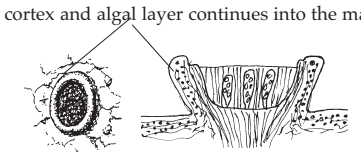
Isidia x10

(6) Reproductive fruits and fruit colour:

Both the colour and the type of fruiting body are important in the identification of lichens. The types are described below:

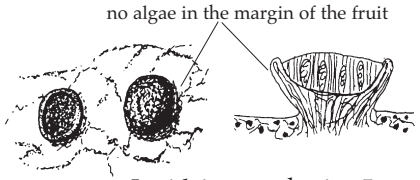
Apothecia are disc- or 'jam tart'-shaped fruits which may be sitting on the surface or sometimes within the thickness of the lichen. Apothecia are of two main kinds:

Lecanorine (Lecan. in the table), in these fruits the cortex and algal layer continue up into the margin of the fruit (the margin is like the pastry edge of a 'jam tart'). This means that the margin of the fruit is more or less the same colour as the surface of the lichen (e.g. Plate 8 Figs. 82 and 95-96).



Lecanorine apothecia x5

Lecideine (Lecid. in the table), in these fruits the cortex and algal layer do not extend into the margin of the fruit. The margin is therefore a different colour from the surface of the lichen (e.g. Plate 5 Fig. 70, 77 and 79).

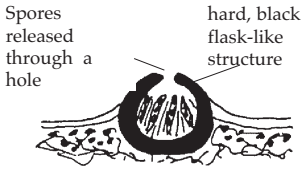


Lecideine apothecia x5
cross-section x15

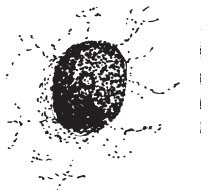
Sometimes these apothecia are drawn out to be slit-like these are then called **lirellate** (lirell. in the table) (e.g. Plate 6 Figs. 90–92).

Lirellate apothecia x20 section x30

Perithecia (perith. in the table) are black, globose structures usually with a hard case forming the outer wall. They may be found almost sitting on the surface of the lichen or buried in its thickness so that only a small black swelling is visible (e.g. Plate 5 Figs 71 and 76).

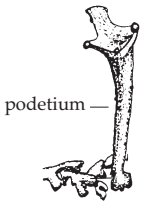


Section through a perithecium x15



View of a perithecium from above x12

Podetia are found in *Cladonia* and some other genera. These are stalks or cup-shaped structures which carry the fruits on their tips (e.g. Plate 5 Figs. 65–69).



Cladonia podetium x2

Arthonioid Apothecia poorly delimited, without a proper margin and often somewhat irregular in outline.

Section through an arthonioid apothecium x15

Colour refers to the colour of the disc in the fruiting body. Sometimes the colour may be obscured by a pale powdery pruina making the disc look white or bluish grey.

(7) Notes:

These contain important additional information about the species and should always be consulted before a final identification is made.

Abbreviations used in the tables:

Lecan: lecanorine
Lecid: lecideine
Light: occurs in well-lit situations.
Lirell: lirellate
Perith: perithecium
Ph: photograph on colour plates
Rgh: rough bark
Sm: smooth bark
Terr: terrestrial
Shade: occurs mainly in shady areas
Squam: squamulose – may appear foliose
Upp: occurs mainly in the upper canopy
Wood: bare or sawn wood.

Method 3. Using the main keys to identify Tree lichens

These keys includes about 500 lichen species which occur on trees, Mosses on trees and bare wood. They include most of the lichens which may be identified without specialised techniques. Sometimes a detail, such as colour, is included against a species to assist in its identification. Then, if the term 'colours various', is used in the other part of a couplet it does not exclude a colour that may be mentioned in the first part of the couplet.

Equipment required

1. A hand lens with a magnification of x8 to x15.
2. **C** = fresh domestic bleach (sodium hypochlorite). Some bleaches contain other substances. It should *not* give a reaction (yellow) if tested on the medulla of *Parmelia sulcata* or *P. saxatilis.* If it does, do not use it.
3. **K** = 5–10% solution of potassium hydroxide (half to one level teaspoon of caustic soda dissolved in 100mls of water gives a similar reaction but test it and it should give a red reaction on a *Xanthoria* species).
4. A knife for removing foliose lichens, but care should be taken in its use. It should have a fixed blade or one that will lock open to prevent it closing on your fingers
5. A hammer and chisel or a stout knife may be needed to collect specimens from old hard bark. If they are used care should be taken not to injure yourself or others and safety glasses and gloves should be worn.
6. A rule with 1/2 mm divisions.
7. A pair of binoculars to view lichens in the canopy

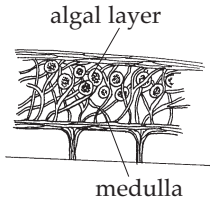
Chemical spot tests

'C' and 'K' chemicals are used in identification as they are able to produce colour changes in parts of the lichen. ***These chemicals should be handled with great care. Hands should always be washed after handling them. Carefully follow all the manufacturer's warnings on the packaging. The chemicals should be carried in small, clearly labelled bottles.***

Care should be taken to avoid spillage on to skin or clothes and they must not make contact with the eyes. They must not be swallowed and also must be kept out of reach of children. If any of these problems occur, you should consider getting medical advice.

Only a minute drop is necessary and this should be placed *on the surface* of the lichen unless the couplet in the key indicates otherwise.

In some leafy lichens the reaction does not take place on the surface but in the medulla (the inner part below the algal layer). In order to test the medulla an area of the upper cortex should be scraped away with a finger-nail or knife to expose the pale medulla. The chemical should be dropped on to this pale area.



Position of the medulla in a lichen

A colour change obtained with K usually appears in a few seconds and then persists. In a few cases (clearly mentioned in the key) the colour changes

over about 1 minute, usually starting as yellow and then slowly turning red.

Colours obtained with C may disappear after a few seconds. Bleach should be replenished after a few weeks as it quickly loses its active ingredient. If it does not have a strong 'bleach' smell, replace it.

Arrangement of the keys

These keys commence with a master key which then leads to the more detailed keys. These keys include growth form and substratum (explained above). It must be remembered that the influence of the sea can alter the substrata of many species, compared with where they grow inland. The main keys (A–D) include all the species included in this book. The fruticose key includes those *Cladonia* species where the podetia are predominant. A supplementary key (E) identifies species growing directly on sawn wood such as fences, benches or posts, but many other species may occur in this habitat. Therefore if you do not obtain an identification use the main key.

Both halves of a couplet must be carefully read and compared before deciding which is the more appropriate course to follow. Remember, every word is important and the decision has to be made by comparing each phrase in the couplet to see which contains the closest match with the lichen being examined. The more important characters are usually printed first. If you are unsuccessful go back to the last couplet where you are sure that you are correct and try the other half of the next couplet to which you are directed. Many species appear several times in the key so that there is still a good chance of an identification even if a wrong decision is made. Determining the colour of lichens can often be difficult and you may have to try both parts of a couplet.

The couplets in the crustose section of the main key run straight through from question one to the end. With experience, it is possible to go immediately to a subsection to shorten the identification process. Using the section headings given on page 41, go into the crustose key at the first section or subsection that agrees with your specimen:

When a species name is reached in the key, there is sometimes a comment in square brackets [ ]. This is only a confirmatory statement and, if the correct identification has been achieved, the bracketed statement should describe your specimen. However, it must not be used to exclude the other half of a couplet as later species in the key may also have some of these characters. The statements in square brackets, therefore, relate only to that species and are not used to compare two alternatives.

When you reach a name for your specimen using the key, it is sensible to check the identification using a full description in a lichen flora.

Microscopic spore details

Microscopic details of spores are not necessary for the use of this key but, in some cases, for confirmation, they are given in round brackets ( ).

Making a squash

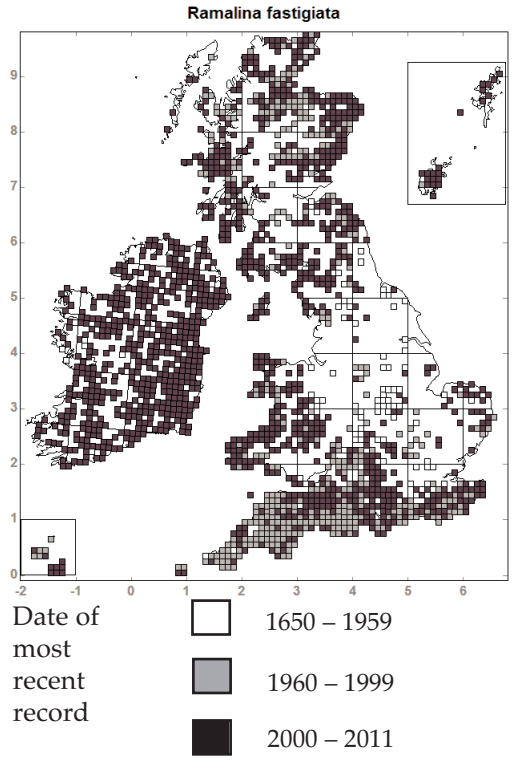
Instruction in the use of a microscope is beyond the scope of this field key but the 'squash' technique is described below as it is an important method for the examination of spores:

Dampen the specimen to be squashed in order to make it soft and pliable. Choose one of the largest fruiting bodies and using a razor blade or very sharp, thin bladed knife (taking great care not to cut yourself as this is easy to do whilst concentrating on making the squash), cut out as thin a vertical slice as possible from the centre of the fruit. This is then placed on a microscope slide in a drop of water. This is then left for a minute or two to be absorbed. K solution will often soften a specimen more easily and rapidly, however; K solution should not be allowed to come into contact with the microscope lens as it may damage it. A cover slip is then lowered gently on top and the blunt end of a pencil is dropped

lightly but repeatedly onto it from a height of about one centimetre. This will usually squash the specimen sufficiently to show the detailed structure and release some of the spores. If needed, more pressure can be applied to the cover slip by thumb or forefinger (covered by a tissue to keep grease off) to spread the specimen on the slide. If the slide is prepared on a white surface it is possible to judge progress during this process more easily. The slide should be repeatedly examined under the microscope as the squashing progresses, as it is a simple matter to continue the process but it cannot be reversed.The secret of a good squash is to take the thinnest vertical slice possible of the fruit body and to use the least amount of liquid. In examining certain structures (e.g. perithecia) a very thin slice is vital as squashing will disturb the arrangement of the parts needed for identification. When examining spores several of them should be studied before deciding the spore type as only mature spores will have fully developed septa or colour. Be aware that some brown spores look greenish in a K solution squash, and measure only those spores which have been discharged from the ascus. Always measure a number of spores and take the average size, excluding any that are unusually large or small. The K solution may cause some spores to swell slightly and therefore K should not be used if the spore size is critical to an identification.

Distribution Maps

The squares on the maps show 10 km squares where a species has been recorded and frequently indicate a clear pattern of distribution, but the lack of a dot may simply be due to an area being under-recorded. The BLS mapping scheme has been recording data for over 50 years and now contains above one million records but there are still some areas of Britain and especially Ireland



which are under-recorded; it should be noted that the maps are only intended to act as an aid to identification. The presence of a square does not indicate how many specimens are found in that square and a group of adjacent squares does not necessarily mean that a species is common in that area. Due to cost the maps had to be reproduced on a small scale but with a hand lens it is usually possible to separate the older recorded squares from the more recent ones.

Many factors, such as a lack of a suitable substratum or too high a pollution level will result in the absence of a species.

The distribution maps included in this book are based on the latest information available and are reproduced by kind permission of The British Lichen Society. There is still much to be learnt regarding the distribution of British lichens, and this is an aspect of lichenology where the amateur can be of considerable assistance. It should be noted that the maps are based on data supplied to the mapping scheme by

members of the Society and from several other sources and that some records may need verification. A further problem is caused by the changes that have occurred in the concept of certain species. It is often difficult to know to which of the newly recognised names some older records relate. It is hoped that readers of this book will aid the Society's mapping scheme by submitting records. Further information may be obtained from the Society's Mapping Recorder: Prof. M.R.D. Seaward, The Department of Environmental Science, University of Bradford, Bradford, West Yorkshire BD7 1DP.

The British Lichen Society is now recording more detailed mapping information using Recorder 6. This data is being placed on the NBN Gateway. The results of this new scheme should give us a better understanding of the factors that effect the distribution of lichens.

References

Benfield B. (2001) *The Lichen Flora of Devon*. Barbara Benfield.

Broad K. (1989) Lichens in southern woodlands. *Forestry Commission, Handbook 4.* Her Majesty's Stationery Office.

Coppins A.M. (2001) Wayside trees, hedges and shrubs. *Lichen Habitat Management* (A. Fletcher ed.)*:* 07-2. The British Lichen Society.

Coppins A.M. & Coppins B.J. (2002) *Indices of Ecological Continuity for Woodland Epiphytic Lichen Habitats in the British Isles.* The British Lichen Society

Coppins B.J. & Coppins A.M. (2006) The lichens of the Scottish native pinewoods. *Forestry* **79:** 249-259 The Institute of Chartered Foresters.

Dobson F.S. (2011) *Lichens – An illustrated guide to the British and Irish species*. The Richmond Publishing Co Ltd.

Gilbert O. (1976) An alkaline dust effect on epiphytic lichens. *The Lichenologist* **8**: 173-178. Academic Press.

Gilbert O. (2000) *Lichens*. New Naturalist series. HarperCollins.

Hale M. E. (1983) *The Biology of Lichens* 88–89 Arnold.

Hawksworth D.L. & Hill (1984) *The Lichen-forming fungi*. 48-52 Blackie.

Hawksworth D.L. & Rose F. (1970) Qualitative scale for estimating sulphur dioxide ai pollution in England and Wales using epiphytic lichens. *Nature (London)* 227: 145–148.

Hill D. J. (1981) The growth of lichens with special reference to modelling of circular thalli. *The Lichenologist* **13**: 265-287. Academic Press.

James P.W., Hawksworth D.L. & Rose F. (1977) Lichen communities in the British Isles: a preliminary conspectus. In: Seaward, M.R.D (ed.) *Lichenoloy Progess and Problems* 278–307. Academic Press.

Leppik E., Juriado I. & Liira J. (2011) Changes in stand structure due to the cessation of traditional land use in woded meadows impoverish epiphitic lichen communities. *The Lichenologist* **43**: 257–272. Cambridge University Press.

Marmor et al) (2013) Lichens on *Picea abies* and *Pinus silvestris* – from tree bottom to the top. *The Lichenologist* **45**: 257–272. Cambridge University Press

Orange A (1994) Lichens on trees. *British Plant Life Number 3* National Museum of Wales

Rose F. (1976) Lichenological indicators of age and environmental continuity in woodlands. In: Brown D.H., Hawksworth, D.L. Bailey, R.H. (eds.) *Lichen Ecology* 384-387. Academic Press.

Sanderson N. & Wolseley P. (2001) Management of pasture woodland for lichens. In *Lichen Habitat Management* (A. Fletcher ed.): 05-02 The British Lichen Society.

Smith C.W. et al (eds). (2009) *The lichens of Great Britain and Ireland*. The British Lichen Society

Seward M,R.D. (1976) Performance of *Lecanora muralis* in a polluted environment. In: Brown D.H., Hawksworth, D.L. Bailey, R.H. (eds.) *Lichen Ecology* 323-327. Academic Press.

Topham P.B. (1977) Colonisation, growth, succession and competition. In: Seaward, M.R.D (ed.) *Lichen Ecology* 31–68. Academic Press.

Winchester V. (1984) A proposal for a new approach to lichenometry. *British Geomorphological Research Group Technical Bulletin*. **33**: 3–20.

Identification using method 2 (see page 28)

Under 'Notes' in this table: 'margin' refers to the edge of the lichen. 'Nutrient enriched' is caused by bird droppings etc. For abbreviation see page 31.

	Name	Colour	Habitat	Soredia /Isidia	Fruits and Colour	Notes
FRUTICOSE	*Usnea articulata*	Grey-green to grey	Twig, light.	None in Britain	None.	Inflated segments like sausages, lobes . Mainly SW.**Ph. 1.**
	Usnea ceratina	Grey-green	Old trees Trunk and branches	None or granular soredia	Lecan. Rare	Up to 50 cm long, side branches at right angles. Develops white nodules, coarse soredia. **Ph. 2.**
	Usnea florida	Grey to yellow-grey	Upp. Light.	None	Lecan. Abundant	Apothecia to 1 cm diam. with marginal extensions. **Ph. 3**.
	Usnea subfloridana	yellow- green to green- grey	Trees and fences	Soredia and isidia	Lecan. common	Blackened base to holdfast. Mixed soredia and isidia. **Ph. 4**.
	Usnea rubicunda	Reddish-brown to green-grey	Tree trunks	Soredia and isidia	Lecan. Rare	Stems warted, clustered isidia becoming sorediate. **Ph. 5.**
	Ramalina calicaris	Grey-green to grey	Twigs and branches	None	Frequent near tips	Channelled edges to lobes. Nutrient-rich trees **Ph. 6**.
	Ramalina farinacea	Grey-green to yellow-green	Trees and posts	powdery soredia	Lecan. Rare	Commonest *Ramalina*, least affected by pollution. **Ph. 7.**
	Ramalina fastigiata	Grey	Trunks and twigs	None	Lecan. Abundant	Apothecia on lobe tips which may obscure thallus. **Ph. 8.**
	Ramalina fraxinea	Grey-green to olive green	Trees. Light. Often windy	None	Lecan. Frequent	Lobes to 4 cm wide. pollution sensitive. Rare. **Ph.9**.
	Evernia prunastri	Grey-green to yellow-grey	Trees	None or sorediate	Lecan. Very rare	Actually foliose, white under-surface. Common **Ph. 12**.
	Bryoria fuscescens	Brown to green green-brown	Trees/posts. Acid-barked	Soredia	Lecan. Rare	Mainly uplands. To 30 cm long. Usually paler base. **Ph. 10**.
	Teloschistes flavicans	Orange	Trees. Light.	Orange soredia	None	Bushy, branches round or flatt-ened. Rare, do not collect. **Ph. 11.**
SQUAMULOSE	*Hypocenomyce scalaris*	Grey-brown to green-brown	Sawn wood. Acid bark	Tips have pale soredia	Lecid. Rare	Squamules to 1.5 mm wide. Overlapping. **Ph.60.**
	Normandina pulchella	Green-grey to Grey	Trees. Shade. On mosses	Soredia	Perithecia. Very rare	Ear-like, lobes to 1.5 mm diam. Raised margins. **Ph. 61.**
	Cladonia digitata	Green-grey to yellow-grey	Rotting wood. Stumps	Sorediate	Red. Rare	Basal squamules to 1 cm diam. Sorediate undersurface. **Ph. 62.**
	Cladonia floerkeana	Grey to green	Rotting wood. Stumps	Granules or soredia	Red Abundant	Basal squamules never sorediate. **Ph. 66.**
	Cladonia macilenta	Grey to blue-grey	Rotting wood. bark	Soredia or granules	Red Abundant	Basal squamules sometimes sorediate. **Ph. 64.**
	Cladonia fimbriata	Grey to green	Rotting wood. On mosses	Powdery soredia	Brown Rare	Basal squamules small,abundant Podetia 'golf-tee' shaped. **Ph. 63.**
	Cladonia pyxidata	Grey to green	Trunks. On mosses	Soredia to granules	Brown	Cup-shaped podetia. Common-est of the *C. pyxidata* group. **Ph. 68.**
	Cladonia coniocraea	Grey to green	Acid bark. On mosses	Powdery soredia	Brown Rare	Pointed, unbranched podetia. Common and abundant. **Ph. 65.**
	Cladonia squamosa	Grey to green Brownish	Trunks and rotting wood	None but squamulose	Brown Rare	Podetia often with bare patches, branched towards tip. **Ph. 69.**
	Cladonia parasitica	Brownish grey to green-grey	Trunks, and wood	Sorediate squamules	Brown Rare	Squamules form dense mat Sorediate lower surface. **Ph. 67.**
FOLIOSE	*Candelaria concolor*	Yellow to greenish-yellow	Trees and fences	Soredia	Lecan Yellow	Minute lobes to 1mm long sorediate tips **Ph. 14.**
	Xanthoria parietina	Yellow to orange Greyer in shade	Trees, fences, wood.	None	Lecan. Orange	Usually very fertile. Mainly where nutrient enriched. **Ph. 57.**
	Xanthoria polycarpa	Yellow to greenish grey	Twigs, fences, wood.	None	Lecan. Yellow	Short, finger-like lobes. Often in axils of twigs. **Ph. 58.**
	Xanthoria ucrainica	Yellow to orange	Bark, wood, fences.	Soredia on lobe edges	Lecan. Orange	Lobes about 1mm wide, erect at tips. Rarely fertile. **Ph. 59.**

FOLIOSE

Name	Colour	Habitat	Soredia /Isidia	Fruits and Colour	Notes
Cetraria sepincola	Grey-green to chestnut	Twigs, Fences	None	Lecan. Abundant	Apothecia to 4mm diam. Occurs in N. and W.**Ph. 15.**
Melanohalea elegantula	Brown to olive-green	Twigs. Branches	None Isidia	Lecan. Rare	Lobes to 2 mm wide, overlapping Isidia often branched **Ph. 32.**
Melanohalea exasperata	Brown to olive-green	Twigs. Branches	None low warts	Lecan. Abundant	Apothecia with warted margins Acid barked trees. **Ph. 35.**
Melanelixia glabratula	to green-brown	Fences		Brown	Isidia, neat, spaced out. **Ph. 33**
Melenelixia subaurifera	Grey to green-brown	Trees. Sm. Fences	Isidia	Lecan. Brown	Common. Isidia in clumps, almost granular. **Ph. 34.**
Nephroma laevigatum	Brown-grey to red-brown	Bark. Moss.	None	Lecan. Brown	Apothecia on lower surface of lobe tips. **Ph.37.**
Sticta fuliginosa	Brown-grey to dark brown	Bark. Moss.	Isidia	Lecan. Rare	Lobes to 3mm wide with fishy smell when wet. **Ph. 55.**
Sticta limbata	Grey to brown-grey	Bark. Moss	Soredia, Blue-grey	Lecan. Rare	Lobe tips fringed with fine soredia **Ph.56**.
Physconia distorta	Brown to grey	Trees, Light Nutrient-enriched	None Pruinose	Lecan. Common	Very pruinose including the apothecia. **Ph. 51**.
Collema furfuraceum	Dark olive-green to black	Bark. Moss	Isidia	Lecan. Rare	Membrane-like with radiating ridges, adpressed **Ph. 17**.
Leptogium gelatinosum	Brown-black to dark brown	Bark. Moss	None	Lecan. Abundant	Rather erect lobes, often with deeply incised tips. **Ph. 27**.
Peltigera praetextata	Grey-brown to almost black	Mossy trees rotting wood	scale-like lobules	Lecan. Rare	Flattened isidia on margins and on cracks in thallus **Ph. 47**.
Flavoparmelia caperata	Yellow-green to grey-green	Trees. Light. Fences	Coarse soredia	Lecan. Brown	Large. Apple green when wet. Lobes finely corrugated. **Ph. 19.**
Flavoparmelia soredians	Yellow-green to grey-green	Trees. Light. Fences	Fine soredia	Lecan. Brown	Neat rosettes to c. 5 cm diam Soredia in patches.**Ph. 20.**
Parmeliopsis ambigua	Yellowish green to green-grey	Trees. Fences	Yellowish soredia	Lecan. Rare	Lobes to 1 mm wide. lower surface brown. **Ph. 44.**
Lobaria pulmonaria	Green-grey to khaki	Trees Heather	Soredia, isidia	Lecan Red-brown	'Old-forest' species. Soredia or isidia on ridges on lobes. **Ph. 29**.
Lobaria virens	Green-grey to grey-brown	Trees Shade	None	Lecan. Brown	'Old-forest' species. Lower surface pale. **Ph. 31**.
Hyperphyscia adglutinata	Green-grey to brown-grey	Trees Nutrient-enriched	Soralia	Lecan. Rare	On shaded tree trunks. Flattened thallus **Ph. 21**.
Platismatia glauca	Brownish green to dull grey	Trees. Upper side of branches	Isidia Soredia	Lecan. Rare	Lower surface white, brown towards centre. **Ph. 52.**
Lobaria amplissima	Grey-white to to green-grey	Trees and branches	Dark cephalodia	Lecan. Red-brown	Large thallus with bush-like-. brown cephalodia **Ph. 28.**
Anaptychia ciliaris	White to pale grey	Trees. Light. Nutrient-enriched	None	Stalked. Brown-black	Strap-like, tomentose. Long cilia on lobe margins. **Ph. 13.**
Physia leptalea	Pale grey	Shrubs, branches	None	Lecan. Black	Strap-like, long cilia on lobes. Apothecia pruinose. **Ph. 49.**
Pseudevernia furfuracea	Pale grey	Acid-barked trees fences	Isidia	Lecan. Rare	Undersurface black or at least partially black. **Ph. 53.**
Physcia tenella	Grey	Light. Trees, Nutrient-enriched	Soredia	Lecan. Black	Soredia on lower surface of lobe tips. Pollution resistant **Ph. 50.**
Cetrelia olivetorum	Grey, brownish or green-grey	Trees Light, humid	Soredia on lobe tips	Lecan. V. rare	Loosely attached. Pale pseudo-cyphellae on lobes **Ph. 16.**
Punctelia subrudecta	Grey to green-grey	Trees, Light Wood	Soredia, dot-like	Lecan. red-brown	Undersurface pale brown. Sor-edia in pseudocyphellae. **Ph. 54.**
Parmelia saxatilis	Grey	Acid-barked trees, wood	Isidia	Lecan. Brown	Lobes with faint white marks. Minute finger-like isidia. **Ph. 40.**
Parmelia sulcata	Grey grey-green	Trees, shrubs Wood.	Soredia	Lecan. Brown	Lobes with faint white marks. Very common. **Ph. 41.**

	Name	Colour	Habitat	Soredia /Isidia	Fruits and Colour	Notes
FOLIOSE	*Parmotrema perlatum*	Grey	Trees. Light.	Soredia on lobe margin	Lecan. Brown	Loosely attached. Lower surface black with rhizines. **Ph. 45.**
	Parmelina pastillifera	Bluish grey	Trees. Light. Nutrient-enriched	Bun-like isidia	Lecan. Black	Distictive black domed isidia on lobes. **Ph. 79.**
	Parmelina tiliacea	Grey grey	Trees. Nutrient-enriched	Pin-like isidia	Lecan. Black	Isidia brown, fine, finger-like or branched. **Ph. 43.**
	Hypotrachyna revoluta	Grey to green-grey	Trees Shrubs	Soredia on lobe tips	Lecan. Brown	Lower surface black, rhizines to edge. **Ph. 25.**
	Hypotrachyna laevigata	Bluish grey to green-grey	Trees Shrubs	Soredia on lobe tips	Lecan. Brown	As *H. revoluta* but square-cut tips to lobes. **Ph. 25.**
	Lobaria scrobiculata	Yellowish green to grey	Trees Shrubs	Soredia on lobe edges	Lecan. Rare	Rare. Blue-grey soredia also on ridges on lobes. **Ph. 30**
	Hypogymnia physodes	Grey	Trees. Fences	Soredia	Lecan. Brown	Lobes hollow, rather erect. Soredia on back of tips. **Ph. 22.**
	Hypogymnia tubulosa	Grey	Trees. Fences	Soredia	Lecan. Brown	Lobes hollow, finger-like. Soredia cover tips. **Ph. 23.**
	Imshaugia aleurites	Pale grey	Acid-bark Wood, fences	Isidia	Lecan. Rare	Up to 5cm diam. adpressed-Thickly isidiate. **Ph. 26.**
	Pannaria conoplea	Blue- grey to yellowish grey	Trees Moss	Lobular isidia	Lecan. Rare	Coarse isidia-like lobules may cover the thallus centre. **Ph. 38.**
	Degelia plumbea	Bluish grey to grey darker when, wet	Trees mosses	None Lobules	Lecan. Brown	Blue-black furry margin to thallus. Very fertile. **Ph. 18.**
	Pannaria rubiginosa	Lead-grey to green-grey	Trees mosses	None	Lecid. Red-brown	Blue-black furry margin to thallus. Usually fertile. **Ph. 39.**
	Physcia aipolia	Grey to bluish green	Light. Trees. Twigs, fences	None	Lecan. Black	Common on nutrient-rich hedges. Neat rosettes. **Ph. 48.**
	Peltigera membranacea	Grey, Pruinose	Trees. Moss	None	Lecan. Red-brown	White rhizines. Apothecia on . extended lobe tips. **Ph. 46.**
CRUSTOSE–LIRELLATE	*Graphina anguina*	Pale grey cracked	Trees. Smooth	None	Lirell. Black	Lirellae, slit-like, often branched, pruinose. **Ph. 90.**
	Graphis elegans	Grey sometimes yellowish	Trees. Smooth	None	Lirell. Black	Lirellae with furrowed margins. **Ph. 91.**
	Graphis scripta	Grey to grey-green	Trees. Smooth	None	Lirell. Black	Lirellae narow, margins un-furrowed, often pruinose. **Ph. 92.**
	Opegrapha atra	White to cream	Trees. Sm. Wood	None	Lirell. Black	Forms neat patches, usually abundant lirellae. **Ph. 105.**
	Opegrapha vulgata	Grey to brown	Trees. Smooth	None	Lirell. Black	Black dot-like pycnidia abundant over thallus. **Ph. 106.**
	Phaeographis dendritica	Pale grey to greenish Calc.	Trees. Smooth	None	Lirell. Black.	Lirellae usually with wide slit which is pruinose. **Ph. 111.**
	Lecanographa lyncea	Chalky white	Trees. Lit. wood	None	Lirell. Black	Under branches of ancient trees Lirellae very pruinose. **Ph. 94.**
Placodioid	*Diploicia canescens*	White to grey	Trees. Nutrient-enriched	Soredia	Lecid. Rare	Placodioid. Soredia yellowish or grey. Common, less in N. **Ph. 87.**
Pin-like fruits	*Chaenotheca ferruginea*	Grey with orange patches	Acid bark, wood	None	Stalked. Brown	Stalks often very short. Pollution resistant. Common. **Ph. 84.**
	Chaenotheca furfuracea	Yellow to yellow-green	Roots, Stumps	Thallus granular	Stalked. Brown	Stalks to 3 mm high. Often infertile. **Ph. 121.**
	Calicium salicinum	Pale grey	Acid bark, wood	None	Stalked Black	Stalks and cups brown pruinose. Stalk 0.4–1.2 mm tall. **Ph. 120.**
	Calicium viride	Green to yellow-green	Trees, rough-bark	None	Stalked Black	Often in deep bark cracks Stalks 1–2 mm tall. **Ph. 81.**
CRUSTOSE	*Pyrrhospora quernea*	Ochre to yellow-grey	Trees, rough-bark	Granular sorediate	Lecid. Orange	Usually infertile. Mainly well-lit slightly nutrient-enriched. **Ph. 115.**
	Arthonia cinnabarina	Grey to orange	Shd. Smooth young trees	None	Arthonioid Orange	Usually fertile. Fruits pruinose with a white margin. **Ph. 72.**
	Bacidia rubella	Yellow-green to grey	Basic-bark trees	Thallus granular	Lecid. Orange	On nutrient-rich bark of mature trees. **Ph. 78.**

CRUSTOSE

Name	Colour	Habitat	Soredia /Isidia	Fruits and Colour	Notes
Enterographa crassa	Grey, brown olive-green	Old trees. Shade	None	Lecid. Brown	Numerous, almost lirellate dark brown, immersed fruits. **Ph. 88.**
Candelariella reflexa	Yellow-green black	Trees. Nutrient-enriched.	Yellow soredia	Lecan. Yellow	Tree branches and bases often on willow. **Ph. 83.**
Caloplaca cerina	Grey Terr.	Trees, twigs, wood	None	Lecan. Orange	On basic bark, especially elder, in unpolluted areas. **Ph. 82.**
Dimerella pineti	Grey-green to black	Acid-bark, tree-bases	None	Lecan. white	Pollution resistant, often with, minute white pycnidia **Ph. 123.**
Micarea denigrata	Pale green to black	Wood, stumps	None	Lecid. Brown, black	Common, Usually with minute white tipped pycnidia **Ph. 127.**
Fuscidea lightfootii	Grey to green-grey	Twigs, branches Damp areas	Soredia	Lecid. Brown, black	Forms neat patches to 2cm diam, becomes sorediate. **Ph. 89.**
Lecanora confusa	Green-grey to yellow-grey	Trees, twigs. Wood	None	Lecan. grey-green	Fruits have pale margins, Mainly coastal. **Ph. 97.**
Lecanora symmicta	Yellow-green to grey	Wood, fences, acid-bark trees	None	Lecan. yellow-green	Fruit margins excluded early. Often on fences, seats . **Ph. 99.**
Lecidella elaeochroma	Yellow-green to grey	Lit. Sm. Twigs wood	None or sorediate	Lecid. Black	Common, Rarely sorediate. Mosaics on young trees. **Ph. 100.**
Pertusaria hymenea	Green-grey to grey	Shade. Sm. Trees	None	Lecan. Pinkish	Single fruits, more exposed disc than *P. pertusa*. **Ph. 108.**
Pertusaria leioplaca	Green-grey to grey	Terr. Trees	None	Lecid. Brownish	Fruits in oval warts. On young trees. **Ph. 109.**
Lecanora conizaeoides	Grey-green to grey	Acid-bark Wood, fences	None	Lecan. Green-brown	Granular thallus. Was common now rather rare. **Ph. 125.**
Trapeliopsis flexuosa	Bluish green	Wood Acid-bark	Soredia Green-grey	Lecid. Rare	Frequent on old fences/seats, and tree stumps. **Ph. 128.**
Pertusaria pertusa	Green-grey to grey	Shade. Trees	None	Lecan. Pinkish	Multiple fruits in a wart, disc almost closed. **Ph. 110.**
Lecanora expallens	Grey, yellow-green when sorediate	Trees,wood, fences	Soredia yellow green	Lecan. Pinkish	Common, often completely covered in soredia **Ph. 98.**
Bacidia laurocerasi	Grey-green to grey	Basic-bark, branches, shrubs	None	Lecid. Black	Nutrient-rich, open situations. Rare in the North. **Ph. 77.**
Amandinea punctata	Green-grey to grey	Trees, wood, fences	None	Lecid. black	Common, pollution resistant. Nutrient-enriched sites. **Ph. 70.**
Buellia griseovirens	Grey, grey-green when sorediate	Smooth bark wood	Soredia green-grey	Lecid. Rare	Common. Soredia scratch to a yellow colour. **Ph.80.**
Lecanora chlarotera	Pale grey to creamy grey	Trees, wood	None	Lecan Red-brown	Common, fruits abundant often piebald. **Ph. 96.**
Lecanora albella	White to yellow-white	Twigs, trees, wood	None	Lecan. Pruinose	Mainly smooth barked trees. Very pale, pruinose fruits. **Ph 95.**
Lecanora saligna	Grey to yellow-grey	Wood. Lit.	None	Lecan. Red-brown	Fruits very abundant. Most common on coastal fences. **Ph. 126**
Lecanora pulicaris	Grey to yellowish	Twigs, branches, wood	Soredia very rare	Lecan. Red-brown	Common on acid-barked trees and worked wood. **Ph. 124.**
Ochrolechia androgyna	Grey to yellowish	Acid bark on mosses	Soredia yellow-green	Lecan. Tan	Common. Thick thallus. Very frequently infertile. **Ph. 104.**
Phlyctis argena	White to greenish grey	Lit. Trees, shrubs	Soredia white	Lecan Very rare	Soredia arise in pustules often along cracks in thallus. **Ph. 112**.
Pertusaria amara	Grey to greenish grey	Shade. Trees	Soredia white	Lecan. Very Rare	Soredia tastes bitter, if no taste it is *P. albescens* **Ph. 107**.
Thelotrema lepadinum	Creamy-white to grey	Smooth-bark, wood. Shade	None	Lecan. in warts	Fruits in warts showing thin margin. 'Barnacle-like'. **Ph. 118.**
Rinodina roboris	Greenish grey to grey	Rough-bark. Light.	None	Lecan. Black	Less common in the North. Fruits usually abundant **Ph. 116.**
Arthonia radiata	Pale grey to brownish	Smooth-barked trees and shrubs	None	Lecid. Black	Fruits almost lirellate. Forms mosaics on trees. **Ph. 73.**

	Name	Colour	Habitat	Soredia /Isidia	Fruits and Colour	Notes
CRUSTOSE	*Arthonia spadicea*	Greenish grey or immersed	Rough-bark trees, shade	None	Lecid. Black	Fruits look like spots of tar. Often near tree base. **Ph. 75**.
	Buellia disciformis	Whitish to yellow-grey	Smooth bark. Shade	None	Lecid. Black	Frequent, mainly in the North and West. **Ph. 79**.
	Cliostomum griffithii	White to pale grey	Trees, wood	Black pycnidia	Lecid. Brown	Frequently infertile but with abundant minute pycnidia **Ph. 85.**
	Lecanactis abietina	Mauve-grey to grey	Shade Acid-bark	White pycnidia	Lecid. pruinose	On dry, usually mature trees. frequently only with pycnidia **Ph.93.**
	Mycoblastus sanguinarius	Grey	Trees, wood	None	Lecid. Black	Thick thallus. Red patches under fruits. **Ph.103.**
	Cyphelium inquinans	Grey	Wood, rarely trees	None	Lecid. Black	Common on fences. Black spores rub off on finger. **Ph.122.**
	Arthonia pruinata	Grey to pale brown	Old trees, Shade	None	Lecid. Pruinose	Common, mainly in South Fruits very pruinose. **Ph.74.**
	Anisiomeridium biforme	White to pale grey	Mainly on smooth bark	None	Perith. Black	Perithecia to about 0.5 mm diam White tipped pycnidia. **Ph. 71.**
	Arthopyrenia analepta	Immersed	Smooth bark, twigs	None	Perith. Black	Perithecia oval, <0.5 mm diam. Early coloniser of twigs. **Ph. 76**.
	Porina aenea	Brown to green-brown	Shade, young smooth-bark	None	Perith. Black	Perithecia <0.3 mm diam. Often in urban areas. **Ph. 113.**
	Pyrenula chlorospila	Fawn to olive green	Shade. Smooth bark		Perith. Black	Perithecia < 0.4 mm. diam, if < 1 mm diam *P. macrospora*. **Ph. 114**.
	Tomasellia gelatinosa	Buff-grey or immersed	Smooth-bark trees, twigs	None	Multi celled Black	Fruits like flat blackberries. Often on hazel. **Ph. 119**.
Leprose or appears to be leprose	*Chrysothrix candelaris*	Golden-yellow	Cracks in rough-bark	Leprose	None in Britain	Powdery granules in dry shade on trees. **Ph. 86**.
	Lepraria incana	Blue-grey to grey-green	Shade, trees	Leprose	None	Pollution tolerant. Very common and widespread. **Ph. 101**.
	Lepraria lobificans	Apple-green to grey	Shade, trees	Leprose	None	Granular appearance, indistinct lobes, white medulla. **Ph. 102.**
	Schismatomma decolorans	mauve-grey to brown-grey	Shade, rough-bark	Leprose	Lecan. Very rare	Soredia soon cover thallus. Nitrogen pollution resistant. **Ph 117**.
	Buellia griseovirens	Grey, grey-green when sorediate	Smooth bark wood	Soredia green-grey	Lecid. Rare	Common. Soredia scratch to a yellow colour. **Ph.80.**
	Lecanora expallens	Grey, yellow-green when sorediate	Trees,wood, fences	Soredia yellow green	Lecan. Pinkish	Common, often completely covered in soredia **Ph. 98.**
	Lecanora conizaeoides	Grey-green to grey	Acid-bark Wood, fences	None	Lecan. Green-brown	Granular thallus. Was common now rather rare. **Ph. 125.**
	Trapeliopsis flexuosa	Bluish green	Wood Acid-bark	Soredia Green-grey	Lecid. Rare	Frequent on old fences/seats, and tree stumps. **Ph.128.**

The main keys include all the species in this book, except those very rare ones for which notes are provided. The fruticose section of the key includes those *Cladonia* species where the podetia are predominant. Finally there is key E (page 89) to species growing directly on sawn wood such as fences, benches or posts. If these keys do not produces a result, refer to the notes on rare species on page 99. Many of these rare species occur on the Channel Islands, Isles of Scilly, the South Coast and in the West, especially N.W. Scotland.

A Field Key to Tree Lichens using method 3

The maps should be used as an aid to identification. Be cautious if your specimen is outside the recorded range.

Synopsis

1. On trees, shrubs and on mosses on trees **2**

– On bare wood, on live or dead trees or weathered, sawn wood on fences, gates, benches etc **Key E** (page 89)
(Other species may occur in these habitats and if no result is obtained, use the main key by going to couplet 4 of this synopsis)

2. *Fruticose*: bushy lichens (Fig. 1) or *Cladonia* species (Fig. 2) where the podetia predominate *or*
foliose: leafy lichens (Fig. 3) or squamulose (Fig. 4) **3**

– *Crustose*: firm crust-like lichens (Fig. 6)
or almost without structure and powdery (Fig. 7) **5**

3. *Fruticose*: bushy lichens, erect or pendent from base (Fig. 1) Without rhizines (Fig. 3)
Key A – Fruticose or fruiting *Cladonia* (page 43)

– *Foliose*: leafy lichens easily removable from the substratum. Often with rhizines on underside ***or***
Squamulose: lower surface lacking a cortex and which is white or very pale yellow, matt, never glossy, and usually without rhizines. Squamules 0.3–25 mm long (Fig. 4) **4**

4. **Key B – Foliose** (page 48)

– **Key C – Squamulose** including leaf-like *Cladonias* (page 59)

5. Crustose: crust-like and cannot be easily removed from the substratum (but may have lobe-like margins – Placodioid, Fig. 8) **Key D – Crustose** (page 61)

The crustose key starts on this page but it is possible to shorten the search process by going directly to the first section or subsection that fits your specimen but consider the earlier sections in case your specimen has already been eliminated in one of these.

SECTION 1: With stalked fruiting bodies (Fig 5) (page 61)
SECTION 2: With perithecia or lirellate apothecia (page 62)
SECTION 2a: Lirellate apothecia (page 65)
SECTION 3: With disc-like non lirellate apothecia or sterile (page 68)
3(a) Placodioid (Fig 8} (page 68)

Fig. 1. Fruticose lichens (*Ramalina, Usnea* sp.) x1

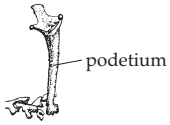


Fig. 2. *Cladonia* showing fruticose podetium x2

Fig. 3. Foliose lichen (*Parmelia* sp.) x2

Fig. 4. Squamules x4 (top).
Section through squamule showing lack of lower cortex x25 (centre)
Squamules of *Agonimia tristicula* x10 (bottom)

3(b) Thallus yellow, yellow-green or orange (page 68)
3(c) Leprose, sorediate, isidiate or granular crust (page 71)
3(c/i) Leprose, sorediate or finely granular (Pg. 73)
3(d) Not sorediate isidiate or a granular crust but may be absent or consist of scattered granules (page 78)
3(d/i) Cortex, medulla, soredia or fruits K+ yellow, orange, red crimson or violet (page 79)
3(d/ii) Any part C+ orange, red or yellow (page 81)
3(d/iii) All parts K–, C– (page 84)

Key E – Lichens growing directly on bare or sawn wood (page 89)

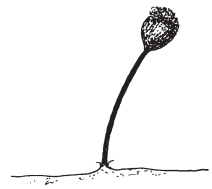


Fig. 5. Stalked fruiting body to 5 mm tall x4.

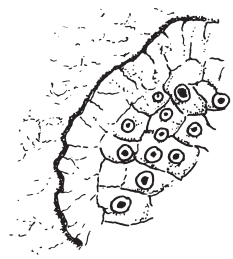


Fig. 6. Crustose species x2. These lichens may, or may not, have a coloured margin.

Fig. 7. Leprose lichen (*Lepraria* sp.) x12

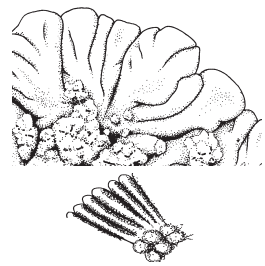
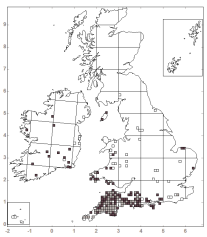
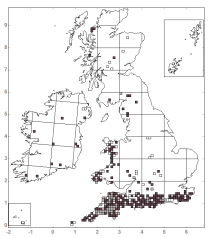


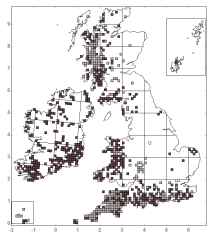
Fig. 8. Placodioid lichens
Above: Edge of wide-lobed placodioid lichen (*Diploicia canescens* x4)
Below: Part of the edge of a crustose, placodioid lichen (*Caloplaca* sp.) x4



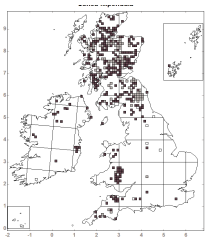
Usnea articulata



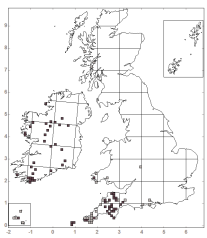
Usnea ceratina



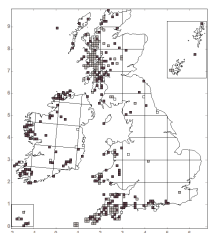
Usnea cornuta



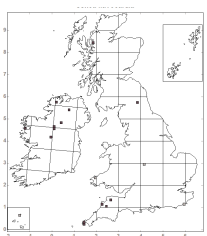
Usnea dasypoga



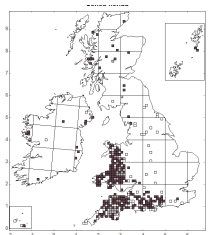
Usnea esperantiana



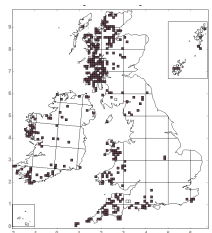
Usnea flammea



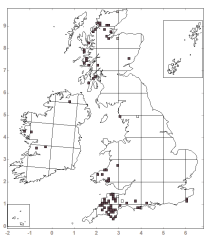
Usnea flavocardia



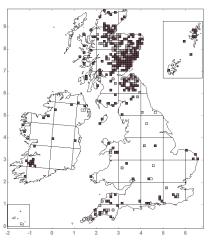
Usnea florida



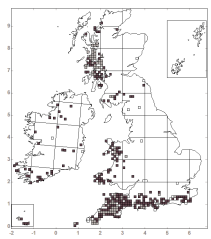
Usnea fragilescens



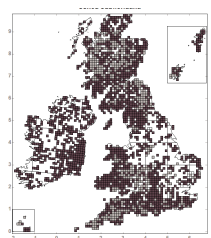
Usnea glabrescens



Usnea hirta



Usnea rubicunda



Usnea subfloridana

Distribution of Usnea species in the British Isles and Ireland

Key A – Fruticose

1. Contains a central core if main stem or branch is pulled (*Usnea*) (Fig. 9) **2**
– No central core **15**

2. Thallus of very swollen 'sausages' between a visible core, often unattached to substratum. **Usnea articulata** (Figs.9, Ph. 1)
– Thallus not very swollen, no visible core. Attached at base **3**

3. Black on and just above holdfast (Fig.11) **4**
– Not black at base **9**

4. Branches constricted where they join the main stem (Fig.12) **Usnea fragilescens**
– Branches not constricted at junction with main stem **5**

5. Blackened base has vertical and horizontal cracking. Oval soralia (see *U. subfloridana*) **Usnea wasmuthii**
– Blackened base has no or only horizontal cracking **6**

6. No soredia, abundantly fertile **Usnea florida** (Ph. 3)
– Soredia or isidia present, rarely fertile **7**

7. Isidiate only (rarely eroded to form dot-like soralia) **Usnea dasypoga (U. filipendula)**
– Sorediate or with soredia and isidia **8**

8. Soralia round, as wide as branch with soredia and isidia (Fig. 10) **Usnea subfloridana** (Ph. 4)
– Soralia narrower than branches, no isidia **Usnea glabrescens**

9. Thallus suffused with redish brown **Usnea rubicunda** (Ph. 5)
– Thallus not suffused with reddish brown **10**

10. Medulla C+ yellow-orange **11**
– Medulla C– **12**

11. Inner part of medulla pale yellow **Usnea flavocardia**
– Medulla pinkish **Usnea ceratina** (Ph. 2)

12. Main branches angular in section, ridged, pitted and covered in long, thin isidia **Usnea hirta**
– Main branches rounded, not covered in long isidia **13**

13. Isidia break down to soredia (Fig. 10). Thallus yellow-green to green with pale annular rings (Fig.13) **Usnea flammea**
– Soredia or mixed isidia and soredia. No pale annular rings **14**

14. Branches not constricted where they join main stem but with twisted tips, very sorediate **Usnea esperantiana** (Fig.14)
– Branches constricted where they join the main stem (Fig. 12). Branches without twisted and contorted tips **Usnea cornuta**

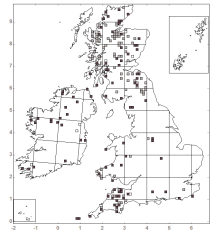
15. Thallus completely orange, brown or black **16**
– Thallus green, yellow-green, grey, white or patchy brown **21**

16. Thallus orange (rare, no collecting) **Teloschistes flavicans** (Ph. 11)
– Thallus brown [branches to 1 mm diam.] **17**

17. Thallus brown to brown-black, compact mat of branches up to 4 x 0.2 mm amongst damp mosses **Polychidium muscicola**
– Main branches wider than 0.3 mm **18**

Fig. 9. *Usnea articulata* showing central core x4

Fig.10. Soredia and isidia on *U. cornuta, U. flammea, U. rubicunda, U. subforidana*



Usnea wasmuthii

Fig. 11. Black holdfast

Fig. 12. Constriction at branch joint

Fig. 13. Annular rings on *U. flammea* x7

Fig. 14. Branch tip of *U. esperantiana*

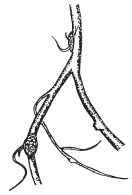


Fig. 15. *Bryoria fuscescens* x3

18. Thallus matt, often smoky brown. Branches rounded, up to 1 mm diam, to 30 cm long. Pale soredia in splits **Bryoria fuscescens** (Fig.15. Ph. 10)
– Thallus ± rounded, pale to dark brown or brown to black with paler tips or grey-green towards tips **19**

19. Thallus smoky brown at base, becoming grey-green above. Sorediate **Bryoria subcana**
– Not sorediate **20**

20. Thallus 4–8 cm, erect, pale to dark brown **Bryoria bicolor** (Fig.16)
– Thallus 10–30 cm, prostrate, brown to black with paler tips **Bryoria capillaris** (Fig.17)

21. Thallus mauvish grey (rare species, do not collect) **22**
– Thallus colours various **23**

22. Thallus strap-like. Soredia C+ red **Roccella fuciformis**
– Thallus finger-like. Soredia C– **Roccella phycopsis** (Fig.18)

23. Main stems brownish with numerous short, round tipped, finger-like, side branches **Sphaerophorus globosus**
– Various colours. Not with finger-like branches. **24**

24. Thallus bluish green to blue grey. Compact mat of strands up to 2 mm x 0.07 mm amongst mosses **Polychidium dendriscum**
– Thallus not bluish or of fine strands **25**

25. Thallus yellow to yellow-green, to 30 cm long **26**
– Thallus squamulose or not or yellow to yellow-green, shorter **27**

26. Thallus of flattened, pitted lobes to 8 mm wide with numerous white pseudocyphellae **Alectoria sarmentosa subsp. vexillifera**
– As above but more pendant and rounded lobes to only 2.5 mm diam **Alectoria sarmentosa subsp. sarmentosa**

27. To 3 mm tall. Tips covered with green soredia so that it forms a green mat from above **Leprocaulon microscopicum** (Fig. 19)
– Taller than 3 mm , sometimes growing with basal squamules. With or without soredia **28**

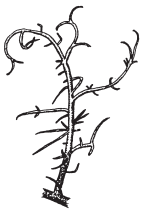


Fig. 16. *Bryoria bicolor* x3

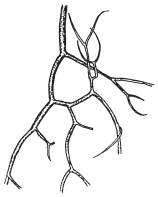


Fig. 17. *Bryoria Capillaris* x2

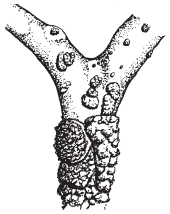
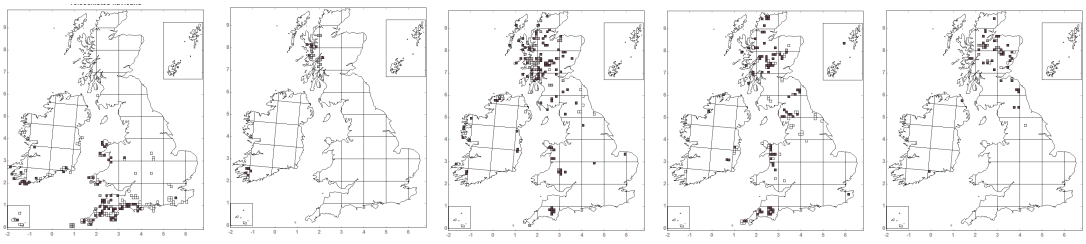
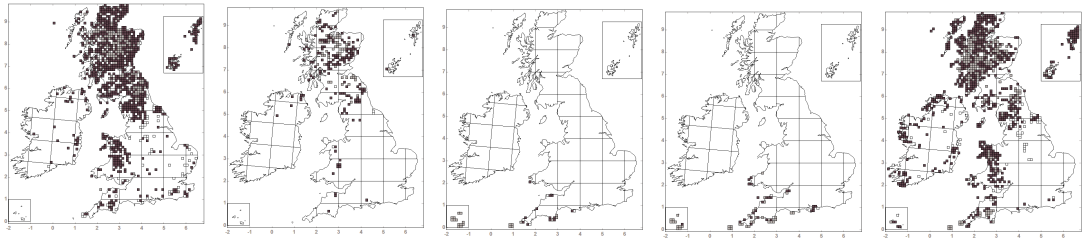


Fig. 18. Soredia on *Roccella phycopsis* x3

Fig. 19. *Leprocaulon microscopicum* x4



Teloschistes flavicans *Polychidium dendriscum* *Polychidium muscicola* *Bryoria bicolor* *Bryoria capillaris*



Bryoria fuscescens *Bryoria subcana* *Roccella fuciformis* *Roccella phycopsis* *Sphaerophorus globosus*

28. Fruiting body stalks hollow, often growing from granules or squamules on the substratum (*Cladonia* group). **29**
– If present, fruiting body stalks solid (may be hollow just near the tip) (*Ramalina* group) **48**

29. Red tipped podetia **30**
– Brown tipped or no coloured tips to podetia **36**

30. Primary squamules dominant, to 1 cm diam, sorediate on lower surface, often orange at base **Cladonia digitata** (Ph. 62)
– Primary squamules not dominant, smaller and not sorediate **31**

31. Podetia cup-shaped **C. diversa** (Fig. 20)
– Podetia not cup-shaped and/or extensions growing from tip **32**

32. Yellow to yellow grey. Basal squamules to 1 cm diam **33**
– Grey to grey-green. Basal squamules much smaller **34**

33. Podetia 2–5 mm tall. Basal squamules dominant, to 4 mm tall **C. incrassata**
– Podetia to 5 cm tall often with split in side **C. sulphurina**

34. Extensions on tip of podetia **C. polydactyla** (Fig. 21)
– No extensions to tips of podetia **35**

35. Podetia squamulose to granular, usually K– **C. floerkeana** (Fig. 22, Ph. 66))
– Podetia partially sorediate, K+ yellow **C. macilenta** (Ph. 64)

36. Podetia if present not dominant to primary thallus **37**
– Podetia large and dominant **38**

37. Podetia with squamules and granules. Primary squamules sorediate. K+yellow **C. parasitica** (Ph. 67)
– Podetia without squamules or granules, almost colourless, no soredia. K– **C. caespiticia**

38. Podetia terminate in a wide cup **39**
– Podetia do not terminate in a definite wide cup **42**

39. Podetia expand widely just below the tip (Fig.23) **40**
– Podetia expand from the base (Fig. 24) **41**

40. Yellow-green, translucent when wet **C. carneola**
– Grey to green, not translucent **C. fimbriata** (Fig.23, Ph. 63)

41. Podetia with medium size soredia **C. chlorophaea** (Fig. 24)
– Podetia with corticate granules to squamules **C. pyxidata** (Ph. 68)

42. Podetia not squamulose except sometimes near the base **43**
– Podetia with numerous squamules **46**

43. Podetia brownish green or grey **C. cornuta**
Podetia grey-green or green **44**

44. Podetia with antler-like tips (resembles fig 21, occurs on rotting wood) **C. subulata**
– Podetia with no or narrow cups, no antler-like tips **45**

45. Podetia to 2.5 mm tall, does not widen near tip **C. coniocrae**a (Fig. 65)
– Podetia to 5 cm tall, slightly wider at the tip **C. ochrochlora**

46 Thallus K+ yellow **C. squamosa** (Ph. 69)
– Thallus K– **47**

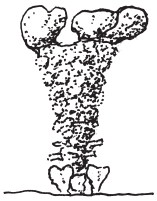


Fig. 20. *Cladonia diversa* x3


Fig. 21. *Cladonia polydactyla* x3


Fig. 22. *Cladonia floerkeana* x3


Fig. 23. *Cladonia fimbriata* x3

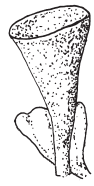


Fig. 24. *Cladonia chlorophaea* x3

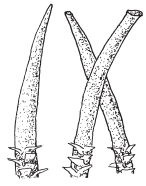


Fig. 25. *Cladonia coniocraea* x3

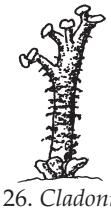


Fig. 26. *Cladonia ramulosa* x3

47. Squamules break off easily when dry. No slit in side **C. ramulosa** (Fig.26)
– Squamules flexible. Podetia usually with slit in the side **C. glauca**

48. Sorediate or isidiate when mature, normally infertile **49**
– Lacking soredia, frequently fertile **54**

49. Soralia marginal or laminal, not in inflated lobe tips **50**
– Lobe tips inflated and split to reveal soredia **Ramalina canariensis** (Fig. 27)

50. Undersurface green **51**
– Undersurface mainly white **Evernia prunastri** (Ph. 12)

51. Soralia irregular, laminal and marginal **52**
– Soralia oval, marginal and ulcer-like **53**

52. Lobes to 1 cm wide with ridges **Ramalina lacera** (Fig.28)
– Lobes to 0.5 cm wide without ridges **Ramalina pollinaria**

53. Grows from a single basal holdfast **Ramalina farinacea** (Fig. 29, Ph. 7). (*If lobes hollow probably* **R. portuensis.** Rare. Occurs in west)
– Grows from a multiple base, forming swards **Ramalina subfarinacea** (Ph. 7)

54. Numerous apothecia on lobe tips **Ramalina fastigiata** (Ph. 8)
– Apothecia mainly lower down on lobes **56**

55. Lobes to 4 cm wide, leaf-like **Ramalina fraxinea** (Ph. 9)
– Lobes to 9 mm, rounded or slightly flattened **57**

56. Lobes channelled by thick margins **Ramalina calicaris** (Ph. 6)
– Lobes not channelled **58**

57. Erect or slightly pendent. Branches flattened, seldom blackened at base and often ridged. Pycnidia tips pale **Ramalina siliquosa**
– Pendent, smooth and not much flattened. Pycnidia tips black **Ramalina cuspidata**

Fig. 27. Lobe tip of *Ramalina canariensis* x5

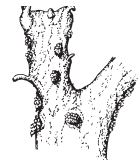
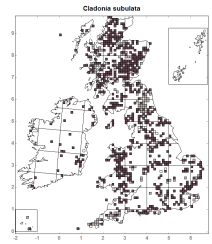
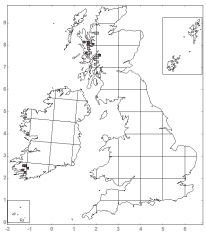


Fig. 28. Lobe tip of *Ramalina lacer*a x5

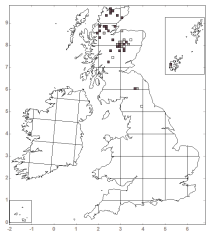
Fig. 29. *Ramalina farinacea* x5



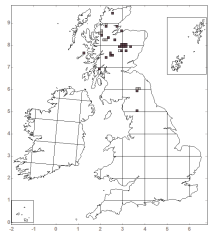
Cladonia subulata



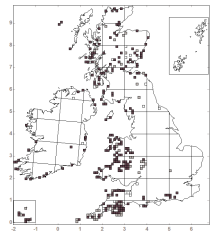
Polychidium dendriscum



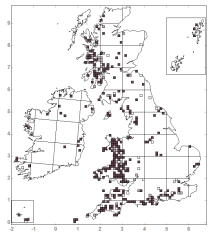
Alectoria sarmentosa subsp. *vexillifera*



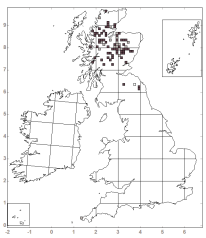
Alectoria sarmentosa subsp. *sarmentosa*



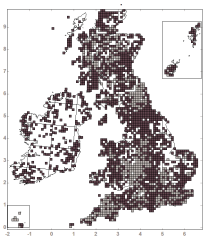
Leprocaulon microscopicum



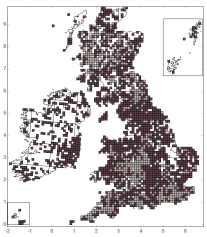
Cladonia caespiticia



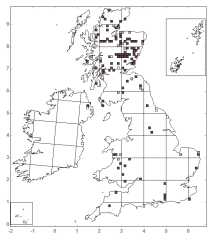
Cladonia carneola



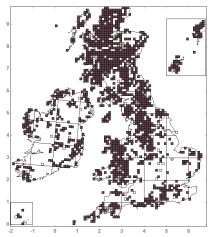
Cladonia chlorophaea



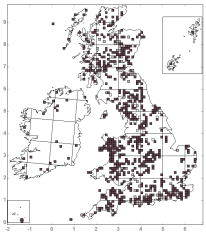
Cladonia coniocraea



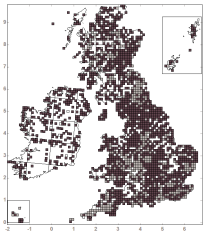
Cladonia cornuta



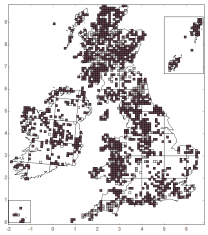
Cladonia diversa



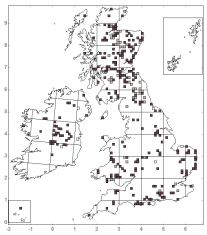
Cladonia digitata



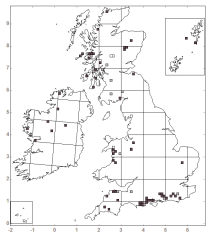
Cladonia fimbriata



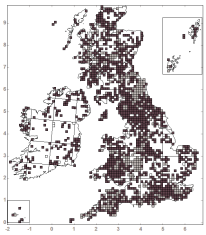
Cladonia floerkeana



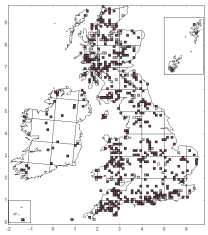
Cladonia glauca



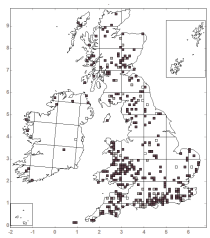
Cladonia incrassata



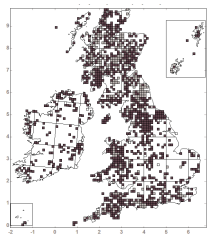
Cladonia macilenta



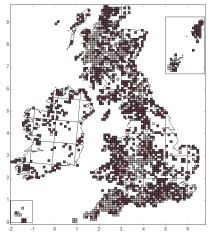
Cladonia ochrochlora



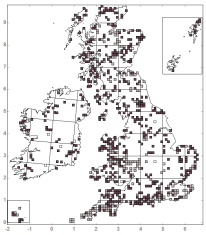
Cladonia parasitica



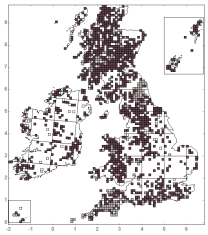
Cladonia polydactyla



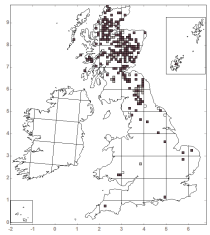
Cladonia pyxidata



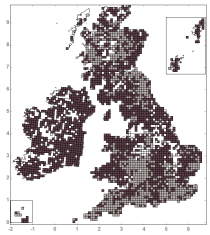
Cladonia ramulosa



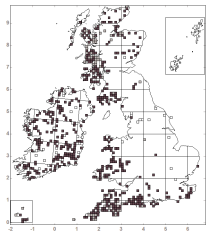
Cladonia squamosa



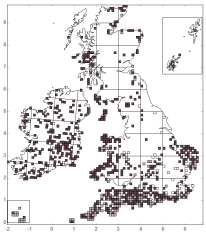
Cladonia sulphurina



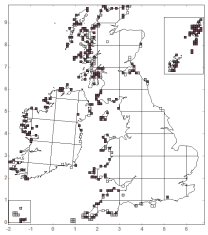
Evernia prunastri



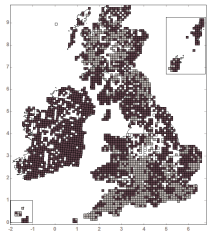
Ramalina calicaris



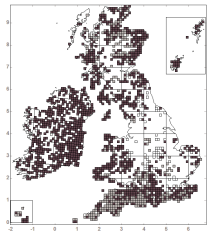
Ramalina canariensis



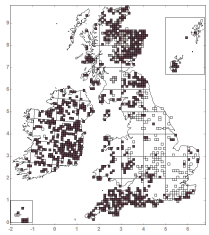
Ramalina cuspidata



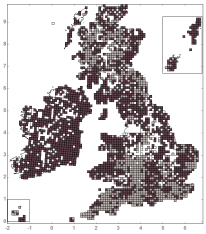
Ramalina farinacea



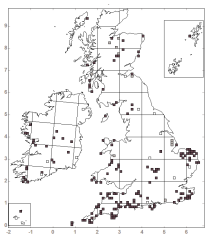
Ramalina fastigiata



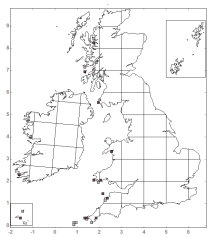
Ramalina fraxinea



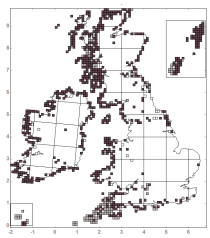
Ramalina lacera



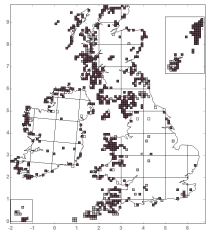
Ramalina pollinaria



Ramalina portuensis



Ramalina siliquosa



Ramalina subfarinacea

Key B – Foliose Lichens

(A few large squamulose lichens, e.g. *Pannaria* can look foliose. If unsuccessful with this key try the Squamulose key)

1. Thallus foliose (Fig. 3). Lower surface firm with a lower cortex which is frequently dark and may have rhizines (Figs. 30, 37) **2**
– Thallus squamulose (Fig. 4). Lower surface matt, no lower cortex. Pale without rhizines. Thallus often fixed firmly to the substratum in the centre Key C page 59

2. Thallus yellow, orange (at least in parts) or greenish orange **3**
– Thallus any other colour including shades of brown or grey, yellow-grey or green-grey **9**

3. Lobe tips up to 7 mm wide. Thallus to 15 cm diam. **4**
– Lobe tips only up to 3 mm wide. Thallus to 6 cm diam. **5**

4. Knobby outgrowths 0.1–0.7 mm diam, near centre. Few or no fruits **Xanthoria calcicola**
– No knobby outgrowths. Usually very fertile with fruits to 4 mm diam. (Fig. 30) **Xanthoria parietina** (Ph. 57)

5. Medulla yellow. Soredia bright yellow **Vulpicida pinastri**
– Medulla white. Soredia if present orange or dull yellow **6**

6. Lobes leaf-like, becoming upright, fan-like with powdery soredia on frilly tips. Not fertile **Xanthoria ucrainica** (Ph.59)
If lobes almost round in section, not fan shaped, probably **X. candelaria**
– Lobes adpressed. Sometimes fertile **7**

7. Lobe tips to 0.5 mm wide. Isidiate or with coarse soredia **Candelaria concolor** (Ph. 14)
– Lobe tips larger than 0.5 mm wide. Not sorediate or isidiate **8**

8. Lobes to 1 mm wide overlapping, yellow-orange to yellow. Fruits almost covering the thallus **Xanthoria polycarpa** (Ph. 58)
– Lobes convex, bright, deep orange. Lobes 0.5–1 mm wide, not overlapping. Sometimes fertile. **Xanthoria elegans**

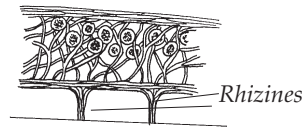


Fig. 30. Section through a foliose lichen x10

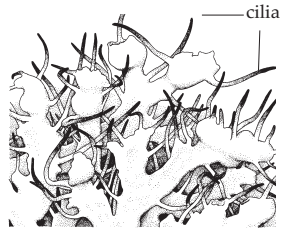
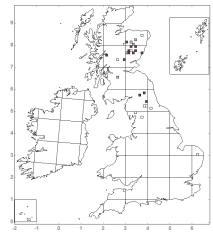
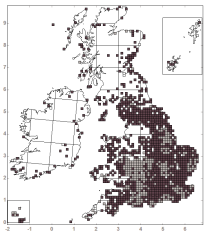


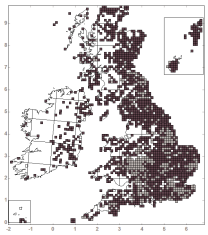
Fig. 31. *Physcia tenella* x1



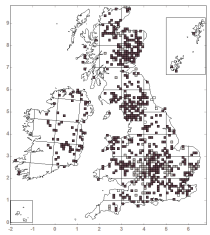
Vulpicida pinastri



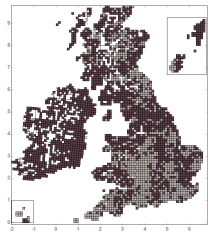
Xanthoria calcicola



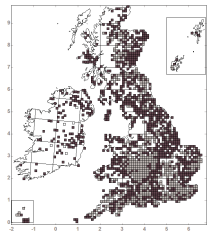
Xanthoria candelaria
(*Xanthoria ucranica* included above)



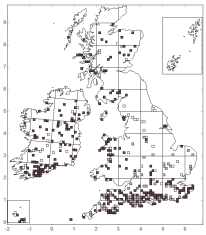
Xanthoria elegans



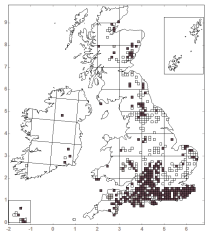
Xanthoria parietina



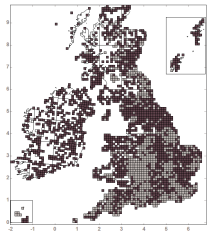
Xanthoria polycarpa



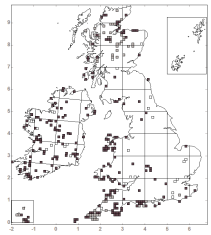
Candelaria concolor



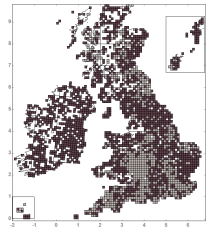
Anaptychia ciliaris



Physcia adscendens



Physcia leptalea



Physcia tenella

9. With marginal black-tipped eyelash-like cilia (Fig. 31). Strap-like. Thallus pale grey to pale brownish grey. (Spores brown 1-septate) **10**

– No long marginal black-tipped (may be all glossy black) eyelash-like cilia. Strap-shaped or not **13**

10. Lobes 1–5 mm wide. Lobe tips not swollen. Not sorediate **11**

– Lobes 0.3–1 mm wide. Swollen, sorediate lobe tips *or* the back of the lobe tips have powdery soredia **12**

11. Lobes to 1 mm wide, not tomentose **Physcia leptalea** (Ph.49)

– Lobes to 5 mm wide, finely tomentose **Anaptychia ciliaris** (Ph. 13)

12. Lobe tips swollen, helmet-shaped, bursting open to reveal powdery soredia (Fig. 32) **Physcia adscendens**

– Lobe tips not swollen, lip-shaped with powdery soredia on back surface of lobe tip (Figs. 31 and 33) **Physcia tenella** (Ph. 50)

13. Thallus papery when dry, swollen, gelatinous when wet, dark brown to green-black (*Collema* and *Leptogium*) **14**

– Thallus not swelling noticeably when wet, colours various **30**

14. Lobes with isidia; wart-like, globose (Fig. 34), flattened (Fig. 35) or finger-like minute outgrowths (Fig. 36), **15**

– Lobes without isidia or wart-like growths **27**

15. Wart-like, nodular outgrowths on lobes **Collema nigrescens**

– Minute, finger-like or flattened or globose isidia on lobes **16**

16. Isidia coralloid **17**

– Isidia globose, flattened or granular **19**

17. Lobes to 1.5 cm wide, grey-black with ridges **Collema furfuraceum** (Ph. 17)

– Lobes to 5 mm wide **18**

18. Thallus lobes 0.2 mm wide to 1 mm long. Dense minute isidia, almost crust-like **Leptogium teretiusculum**

– Thallus lobes to 5 mm wide. Isidia-like extensions to lobes **Leptogium lichenoides**

19. Isidia flattened **20**

– Isidia granular to globose **24**

20. Thallus to 1.5 cm diam. Easily removed when wet and very pulpy **Collema fasciculare**

– Thallus usually larger. Rather firmly fixed **21**

21. Lobes 1 mm long, 0.1 mm wide with flattened projections on the tips. [Usually very fertile] **Leptogium subtile**

– Lobes longer and wider **22**

22. Thallus grey, lower surface paler grey not tomentose. No leaf-like folioles on apothecia **Leptogium cyanescens**

– Thallus olive green or green-black **23**

23. Thallus dark olive-green, lower surface grey, tomentose. Apothecia with folioles on margins **Leptogium burgessii**

– Thallus green-black. [Young isidia may be slightly globular] Rarely fertile. Apothecia without folioles **Collema flaccidum**

24. Isidia granular to minutely globose **25**

– Mature isidia globose, very abundant **Collema subflaccidum**

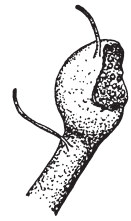


Fig. 32. Lobe tip of *Physcia adscendens* x7

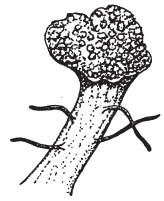


Fig. 33. Lobe tip of *Physcia tenella* x6

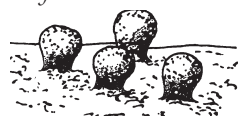
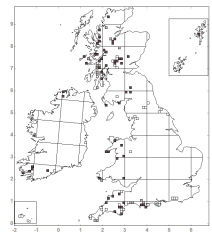


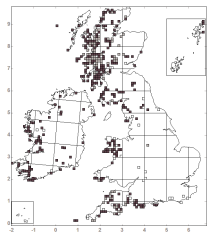
Fig. 34. Globose isidia x15

Fig. 35. Flattened isidia x 15

Fig. 36. Coralloid isidia x10



Collema nigrescens



Collema furfuraceum

25. Lobes have depressions, brownish granular isidia on a blue-grey dry thallus (wet green-black) **Leptogium brebissonii**
– Lobes without holes, no contrasting coloured isidia **26**

26. Lobes ridged, adpressed. Usually fertile **Collema nigrescens**
– Thallus upright tufts to 5 mm high, 1 mm wide, dividing near the base. Often granular isidiate **Leptogium schraderi**

27. Thallus dark grey or brown **28**
– Thallus olive-green (may have a slight brownish tinge) **29**

28. Lobes brown, to 5 mm wide, with ragged tips.
Leptogium gelatinosum (Ph. 27)
– Lobes dark grey, to 1 cm wide with rounded tips
Leptogium cochleatum

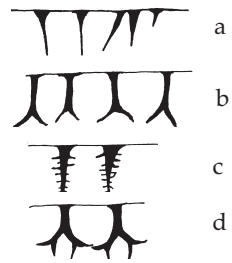
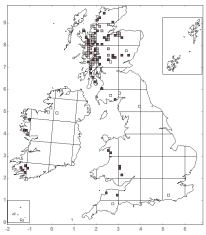
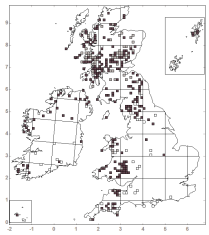
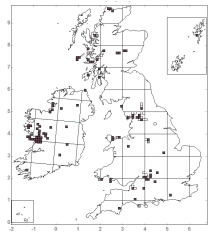
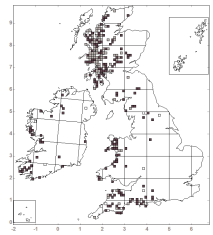


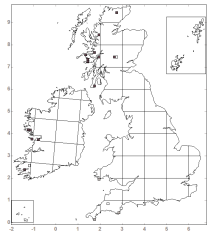
Fig. 37. Some types of rhizines

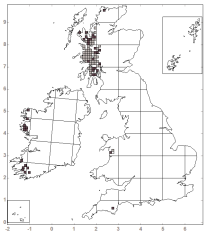

Collema fasciculare

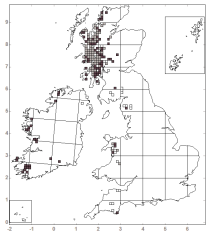

Collema flaccidium

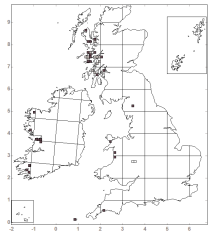

Collema polycarpon

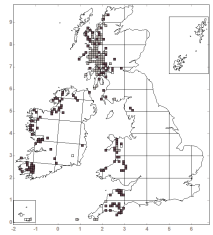

Collema subflaccidum

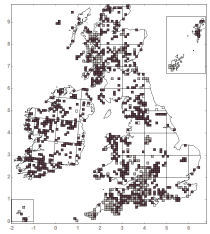

Collema subnigrescens

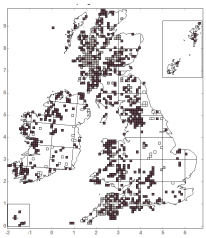

Leptogium brebissonii

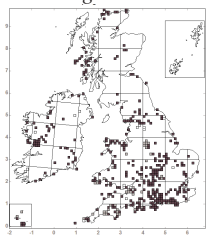

Leptogium burgessii

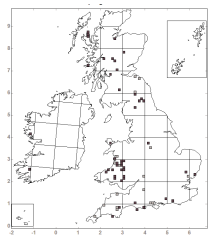

Leptogium cochleatum

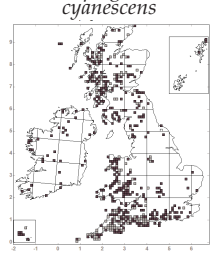

Leptogium cyanescens

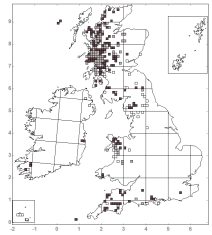

Leptogium gelatinosum


Leptogium lichenoides


Leptogium schraderi


Leptogium subtile


Leptogium teretiusculum


Lobaria amplissima

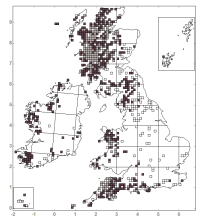
29. Lobes 1–2.5 mm wide with raised margins and fairly thick. Apothecia terminal, on short stalks **Collema polycarpon**
– Lobes 0.5–1.5 cm wide, ridged, papery. Apothecia laminal (often pruinose), not stalked **Collema subnigrescens**

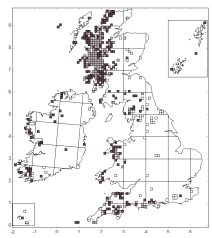
30. Lower surface felt-like, brown tomentose **31**
– Lower surface not felt-like, brown tomentose **46**

31. Medulla K+ yellow, pale yellow or yellow-orange **32**
– Medulla K– or K+ purple **36**

32. Medulla K+ yellow-orange. Thallus with ridges (often sorediate) and depressions **Lobaria pulmonaria** (Ph. 29)
– Medulla K+ yellow. No *prominent* ridges and depressions **33**

33. Thallus lacking soredia, isidia or with black outgrowths **34**
– Thallus sorediate, isidiate or no black coralloid outgrowths **35**


Lobaria pulmonaria


Lobaria virens

34. Thallus silver-grey to pale buff grey-green when wet **Lobaria amplissima** (Ph. 28)
– Thallus green to grey-brown, bright green when wet **Lobaria virens** (Ph. 31)

35. Thallus green-brown, green when wet, strongly ridged, coarse greenish soredia on ridges **Lobaria pulmonaria** (Ph. 29)
– Thallus blue-grey to yellow-grey, lobes slightly ridged, blue-grey soredia on ridges and lobe margins **L. scrobiculata** (Ph. 30)

36. Lower surface brown tomentose or blue-grey and felt-like, without white scattered openings (cyphellae) **37**
– Lower surface brown tomentose with cyphellae **39**

37. Lower surface brown tomentose **38**
– Lower surface dark bluish grey, tomentose (see also *Pannaria* in the squamulose key) **43**

38. Thallus silver-grey to pale buff grey-green when wet **Lobaria amplissima** (Ph. 28)
– Thallus green to grey-brown, bright green when wet **Lobaria virens** (Ph. 31)

39. Thallus bright green when wet (green algal form) **Sticta canariensis**
– Thallus grey-brown to dark brown when wet **40**

40. Lobe margins with dense blue-grey soredia **S. limbata** (Ph. 56)
– Thallus isidiate, not sorediate **41**

41. Lobe margins and surface with lobules and flattened isidia ('blue-green' cyanobacterial form) **S. canariensis**
– Lobes with coralloid isidia **42**

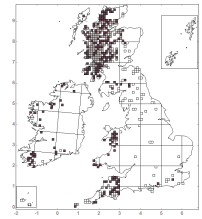
42. Lobes deeply incised so as to appear many lobed, isidia clustered especially on ridges **Sticta sylvatica**
– Lobes little incised, often looks single-lobed,isidia scattered **Sticta fuliginosa** (Ph.55)

43. Thallus with isidia (Fig. 38) **44**
– Thallus lacking isidia (Fig. 39) **45**

44. Globose (Fig. 34) to coralloid isidia (Fig. 36) **Degelia atlantica**
– Flattened (Fig. 35) to spoon shaped isidia **Degelia ligulata**

45. Thallus has concentric ridges and dips. No squamules **Degelia cyanoloma**
– Thallus lacks concentric ridges and may have central squamules **Degelia plumbea** (Ph. 18)

46. Lower surface with a coarse network of brown or white veins and rhizines (Fig. 37). Fruits on upper surface of lobe tips **(*Peltigera*) 47**
– Lower surface not a coarse network of veins. With or without rhizines **54**


Lobaria scrobicularia

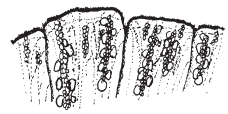


Fig. 38. *Degelia atlantica*/ *D. ligulata*

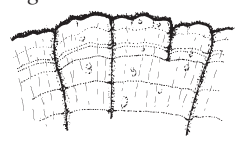
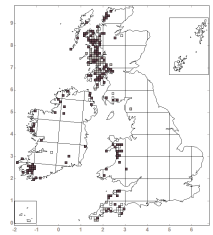
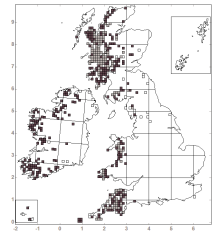
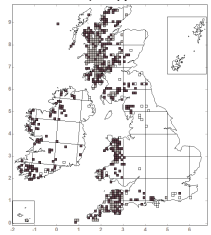
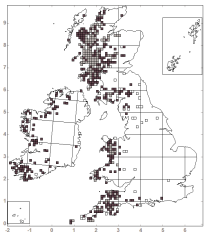


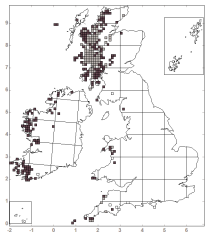
Fig. 39. *Degelia plumbea*/ *D. cyanoloma*


Sticta canariensis


Sticta fuliginosa

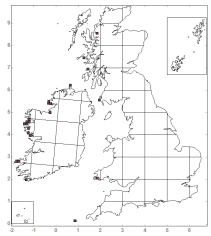

Sticta limbata

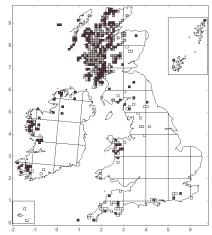

Sticta sylvatica


Degalia atlantica

Map not available for this species

Degalia cyanoloma


Degalia ligulata


Degalia plumbea

47. Thallus with flattened (Fig. 35) or coralloid (Fig.36) isidia on lobe margins or along cracks in the thallus. Rhizines as Fig. 40 **48**
– Thallus with cephalodia, with or without soredia. No isidia **49**

48. Tomentose with flattened isidia on margins and along cracks. Lower surface darker in centre. Veins flattened **Peltigera praetextata** (Ph. 47)
– Not tomentose, marginal isidia or lobules. Lower surface pale cream. Veins narrow, conspicuous **Peltigera degenii**

49. Thallus green when wet, dark button shaped cephalodia on surface which fall out leaving white scars **Peltigera britannica**
– Thallus brown when wet. No dark cephalodia **50**

50. Blue-grey soredia on lobe margins **Peltigera collina**
– No soredia **51**

51. Lower surface dark brown, brown rhizines **P. polydactylon**
– Lower surface white, may be brown in centre. Rhizines white or tan. **52**

52. Veins brown-black, stranded (Fig. 41) **Peltigera horizontalis**
– Veins white or pale tan. Rhizines not of strands **53**

53. Veins white/tan. Rhizines as Fig. 42 **Peltigera hymenina**
– Veins white. Rhizines (Fig. 43) **Peltigera membranacea** (Ph. 46)

54. Medulla yellow to orange, K+ purple **55**
– Medulla white or pale yellow but K– or K+ yellow to red **56**

55. No minute leaf-like outgrowths (folioles) **Nephroma laevigatum** (Ph. 37)
– Abundant folioles on lobes **Nephroma tangeriense**

56. Thallus grey to red-brown with blue-grey to brown marginal soredia. Does not go greener when wet (Photobiont *Nostoc*) **Nephroma parile**
– Thallus colours various, with or without soredia. Goes greener when wet **57**

57. Lobes hollow (visible if lobe is split open) (Fig. 44) **58**
– Lobes solid **60**

58. Holes present in lobes (Fig. 45**)** **Menegazzia terebrata**
– No hole on lobe surfaces **59**

59. Soredia on lower surface of upturned lobe tips (Fig. 46) that have split open **Hypogymnia physodes** (Ph.22)
– Soredia on tips of finger-like lobes (Fig. 47, Ph. 23) **Hypogymnia tubulosa**

60. Attached to substratum only by a single or central holdfast, or along lower edge of erect lobes. No or very few rhizines **61**
– Attached to substratum over much of lower surface with or without rhizines **64**

61. Thallus strap-like, attached at a central holdfast **62**
– Thallus leafy, erect, attached along the lower side in centre **63**

62. Thallus green, white to patchy green under-surface. No isidia but, in mature specimens, granular soredia **Evernia prunastri** (Ph. 12)
– Thallus grey, under-surface white or black. Dense coralloid isidia in mature specimens **Pseudevernia furfuracea** (Ph. 53)

Fig. 40. Rhizines of *Peltigera praetextata* and *P. degenii* x5

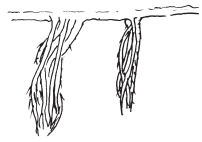


Fig. 41. Rhizine of *Peltigera horizontalis* x5

Fig. 42. Rhizines of *Peltigera hymenina* x5

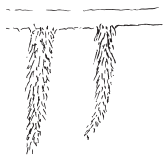


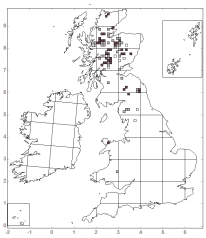
Fig. 43. Rhizines of *Peltigera membranacea* x5

Fig. 44. Hollow lobe of *Hypogymnia* or *Menegazzia*

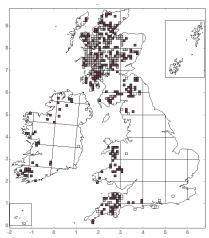
Fig. 45. Holes in *Menegazzia terebrata* x3

Fig. 46. Lobe of *Hypogymnia physodes*

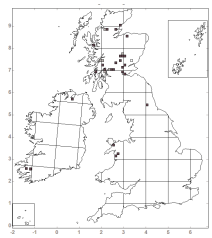
Fig. 47. Lobe of *Hypogymnia tubulosa*



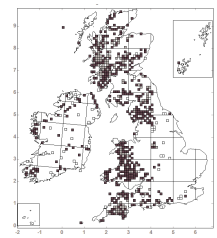
Peltigera britannica



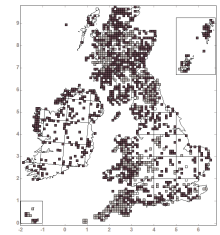
Peltigera collina



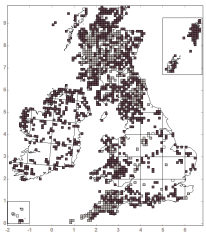
Peltigera degenii



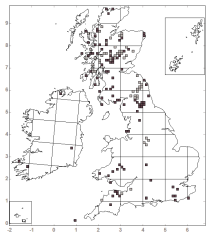
Peltigera horizontalis



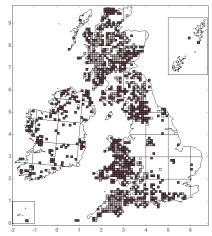
Peltigera hymenina



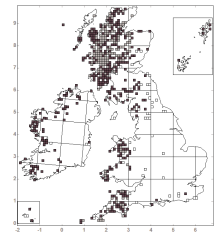
Peltigera membranacea



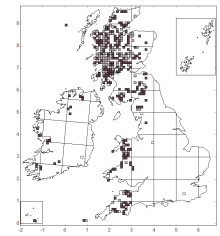
Peltigera polydactylon



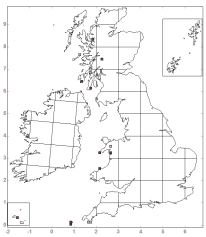
Peltigera praetextata



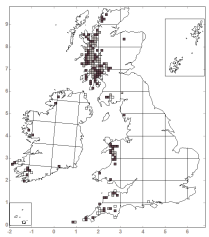
Nephroma laevigatum



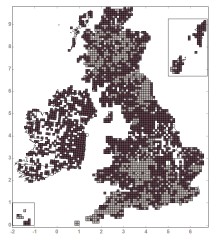
Nephroma parile



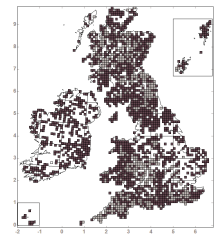
Nephroma tangeriense



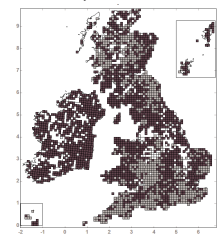
Menegazzia terebrata



Hypogymnia physodes



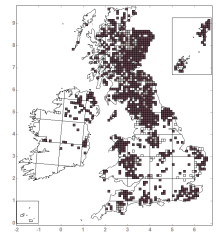
Hypogymnia tubulosa



Evernia prunastri

63. Thallus leafy, wavy, erect, grey-green to brownish, same colour wet. Lower surface whitish becoming darker in centre. K+yellow **Platismatia glauca** (Ph. 52)

– Thallus as above but brown or green-brown on the upper surface, greener when wet, Lower surface brown and becoming white towards the lobe margin. K– **Tuckermanopsis chlorophylla**



Pseudevernia furfuracea

64. Dry thallus grey, green, green-grey, green-brown or yellow-green **65**

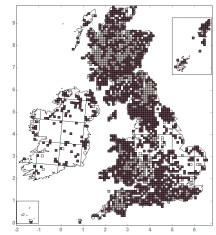
– Dry thallus shades of yellow-brown, brown, green-brown or brown-grey **108**

65. Dry thallus green, greyish green or yellowish green **66**

– Dry thallus grey yellowish grey or green-grey **69**

66. Dry thallus apple-green (almost grey in shade). Lobes to 1 cm wide **67**

– Dry thallus yellow-green or green. Lobes to 1 mm wide **68**



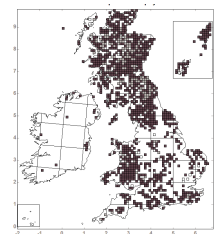
Platismatia glauca

67. Medulla (Fig. 48) K+ yellow turning red **Flavoparmelia soredians** (Ph. 20)

– Medulla K– **Flavoparmelia caperata** (Ph. 19)

68. Thallus yellowish green. Lobes 0.5– 1 mm wide, elongate **Parmeliopsis ambigua** (Ph. 44)

– Thallus green. Lobes 0.2-0.5 mm wide, flattened **Hyperphyscia adglutinata** (Ph. 21)



Tuckermanopsis chlorophylla

69. Thallus with fine or coarse isidia or lobules (Fig. 49) **70**

– Thallus with or without soredia but no isidia or lobules **79**

70. Thallus with minute, black, bun-shaped isidia (Fig. 50) **Parmelina pastillifera** (Ph. 42)
– Isidia or lobules, if present, not black and bun-shaped **71**

71. Lobes with black cilia on surface (not only on lobe margins) *or* pale dots and lines (Fig. 51) **72**
– Lobes lacking black cilia on surface or pale dots and lines **73**

72. Thallus surface with cilia and isidia **Parmotrema crinitum**
– Thallus surface with minute coralloid isidia (Fig. 52) often growing from cracks. No black cilia **Parmelia saxatilis** (Ph.40) (**P. ernstiae** differs in the pruinose lobes and often with lobules)

73. Medulla C+ red or pink-red. Coralloid isidia **74**
– Medulla C–. Isidia various **75**

74. Blue-grey lobes to 10 mm wide **Parmelina tiliacea** (Ph. 43)
– Grey-white lobes to 5 mm wide. **Parmelinopsis minarum**

75. Medulla and cortex K–. Apothecia abundant, with coarse pruina on the margins and thallus which is often lobulate **Physconia distorta**
– Medulla/cortex K+ yellow Apothecia rare, no coarse pruina **76**

76. Under surface black, paler at margin **Parmelinopsis horrescens**
– Undersurface white to pale tan **77**

77. Rosette shaped with branching lobe tips. Isidia coralloid, granular or wart-like **78**
– Spreading, wide lobe tips. Isidia globular or lobular **Physcia tribacia**

78. Lobes to 3 mm wide. Isidia grey, coralloid, soon becoming eroded. **Imshaugia aleurites** (Ph. 26)
– Lobes 0.2–0.8 mm wide. Isidia granular or wart-like, breaking down to soredia **Physcia clementii**

79. No soredia **80**
– Soredia present **84**

80. Medulla C+ red. **81**
– Medulla C–. **82**

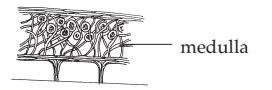


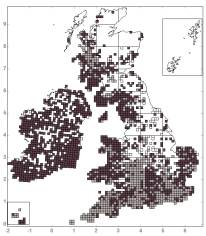
Fig. 48. Position of medulla

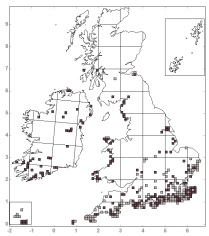

Fig. 49. Lobular isidia x10

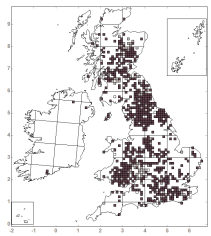

Fig.50. Isidia of *Parmelina pastillifera* x10

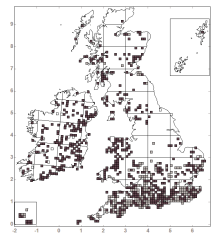

Fig. 51. Lobe tip showing white marks

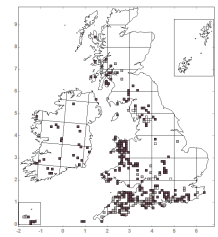

Fig. 52. Coralloid isidia x10

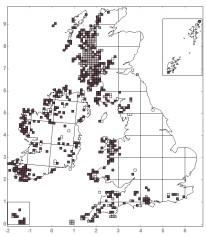

Flavoparmelia caperata

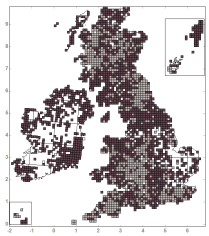

Flavoparmelia soredians

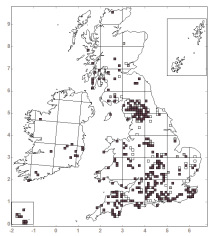

Parmeliopsis ambigua

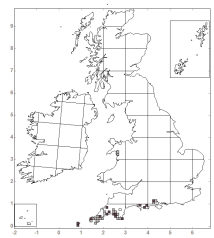

Hyperphyscia adglutinata

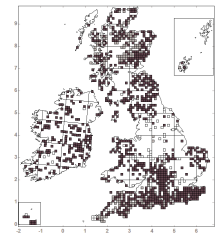

Parmelina pastillifera

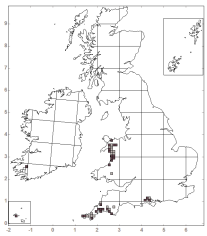

Parmotrema crinitum


Parmelia saxatilis

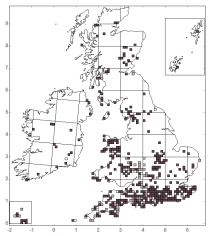

Parmelina tiliacea


Parmeliopsis minarum

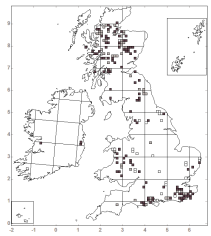

Physconia distorta



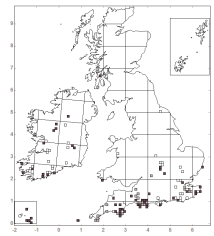
Parmelinopsis horrescens



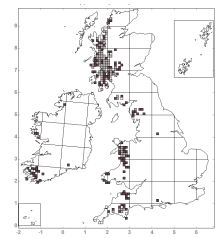
Physcia tribacia



Imshaugia aleurites



Physcia clementii



Hypotrachyna taylorensis

81. Thallus greenish grey with peeling patches showing white medulla. Dichotomous rhizines (Fig. 37b) **Hypotrachyna taylorensis**
– Thallus bluish grey, no peeling patches. Simple rhizines (Fig. 37 a). Rhizines under apothecia **Parmalina carporrhizans**

82. Medulla K+ red. Lobes wrinkled and to 15 mm wide. Undersurface pale brown **Pleurosticta acetabulum**
– Cortex K+ yellow. Medulla K+ y. or K– . Lobes to 2 mm wide **83**

83. Thallus with pale pseudocyphellae. Medulla K+ yellow. **Physcia aipolia** (Ph. 48)
– Thallus without pale pseudocyphellae. Medulla K–. **Physcia stellaris**

84. Medulla C+ orange **85**
– Medulla C+ pink or red or C– **86**

85. Medulla yellowish **Hypotrachyna endochlora**
– Medulla white **Hypotrachyna leavigata** (Ph. 24)

86. Medulla C+ pink or red **87**
– Medulla C– **92**

87. Cortex K– **88**
– Cortex K+ yellow **90**

88. Thallus yellow grey to yellow greenish **Hypotrachyna sinuosa**
– Thallus grey-white to green-grey **89**

89. Soralia ± diffuse **Hypotrachyna revoluta** (Ph. 25)
– Soralia arise in pustules **Hypotrachyna aforerevoluta**

90. Lower surface black. Medulla C+pinkish red **Punctelia borreri**
– Lower surface pale to mid brown. Medulla carmine-red **91**

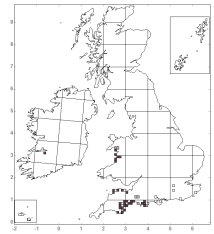
91. Edges and end of lobes pruinose. Soralia mainly marginal **Punctelia jeckeri**
– Edges and end of lobes not pruinose. Soralia mainly laminal **Punctelia rubrudecta** (Ph. 54)

92. Cortex and/or medulla K+ yellow, orange or red **93**
– Medulla and cortex K– **104**

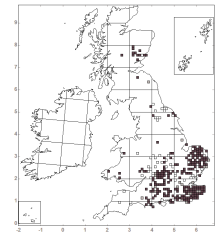
93. Cortex K+ yellow turning orange or red after a few seconds **94**
– Cortex and/ or medulla persistently K+ yellow or orange **96**

94. Very faint white lines (use a hand lens) cover lobes. Soredia and black cilia on lobe margins **Parmotrema reticulatum**
– Lobes with distinct white lines and dots along which soralia form. No black cilia **95**

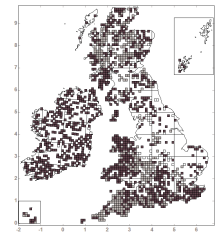
95. Lobes with distinct white lines and dots along which soralia form. Thallus rather flat **Parmelia sulcata** (Ph. 41)
(**P. encryptata** is very similar and appears to be common but can only be separated by DNA analysis)



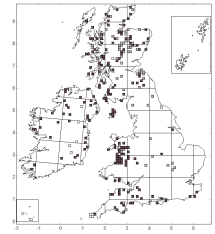
Parmelina carporrhizans



Pleurosticta acetabulum

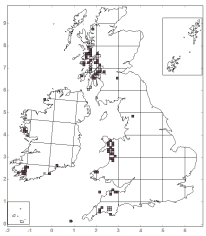


Physcia aipolia

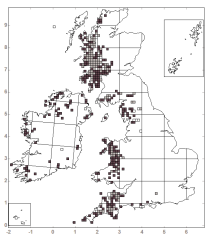


Physcia stellaris

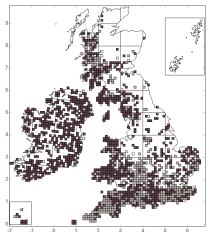
Fig. 53. Bottle-brush rhizines x5



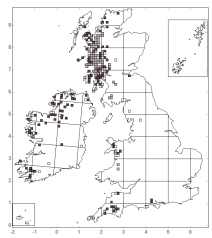
Hypotrachyna endochlora



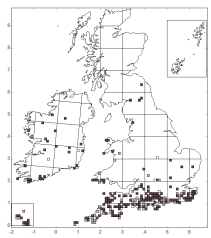
Hypotrachyna laevigata



Hypotrachyna revoluta



Hypotrachyna sinuosa



Punctelia borreri

– Thallus as above but the lobes become strap-shaped and tube-like with almost isidiate soredia. (Rare) **Parmelia submontana**

96. Medulla yellow. Bottle-brush-like (Fig 53) rhizines **Physconia enteroxantha**
– Medulla white. Rhizines not bottle-brush-like **97**

97. Underside of long narrow lobes with dark depressions and no rhizines **Cavernularia hultenii**
– Underside without distinct depression, with rhizines **98**

98. Lobes less than 3 mm wide. Undersurface white to tan **99**
– Lobes up to 15 mm wide. Undersurface very dark brown or black **102**

99. Cortex and medulla K+ yellow **100**
– Cortex only K+ yellow **101**

100. Blue-grey, often blue flecked soredia. Lobes with minute pale dots (more obvious when wet, use a hand-lens) **Physcia caesia**
– Pale grey soredia, never blue flecked. No pale dots. (Very rare. Do not collect) **Physcia tribacioides**

101. Soralia in marginal warts (these two species may be difficult to separate in the field) **Physcia tribacia**
– Soralia mainly lip-shaped **Physcia dubia**

102. Lobes have dot-like pseudocyphellae on which develop coarse soredia that become isidia-like **Punctelia reddenda**
– No pseudocyphellae, soredia powdery on lobe tips/edges **103**

103. Lobes tips incised with inrolled tips **Parmotrema robustum**
– Lobes tips mianly rounded, not inrolled **Parmotrema perlatum** (Ph.45)

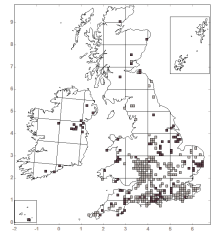
104. Underside of long narrow lobes with dark depressions and no rhizines (map in K+ section of this key) **Cavernularia hultenii**
– Underside without distinct depression, with rhizines **105**

105. Lower surface almost white **Physconia grisea**
– Lower surface pale brown to black, pale towards the edge **106**

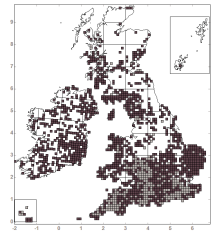
106. Lower surface pale brown. Lobes to 3 mm wide, radiating, covex with yellowish, globose soralia **Arctoparmelia incurva**
– Lower surface black, may be paler towards the tip. Lobes not convex. Soralia grey, yellow-grey to greenish **107**

107. Thallus with small, white pseudocyphellae. Lobes 5–20 mm wide. Frilly margins. Simple rhizines **Cetrelia olivetorum**
– No pseudocyphellae. Lobes 1–5 mm wide, sinuate. raised margins. Dichotomous rhizines **Hypotrachyna sinuosa**

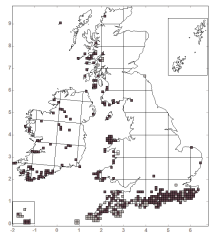
108. Thallus with soredia or isidia **114**
– Thallus without above, may have leaf-like lobules or warts **109**



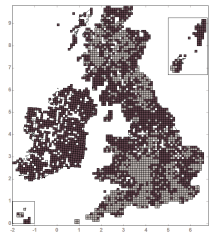
Punctelia jeckii



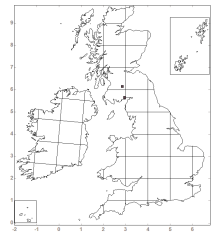
Punctelia subrudecta



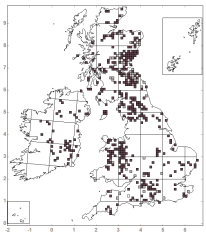
Parmotrema reticulatum



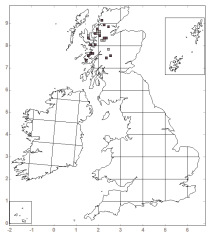
Parmelia sulcata



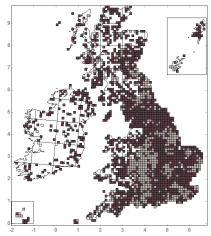
Parmelia submontana



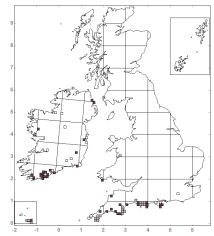
Physconia enteroxantha



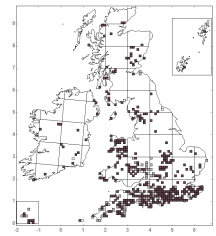
Cavernularia hultenii



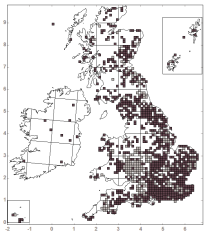
Physcia caesia



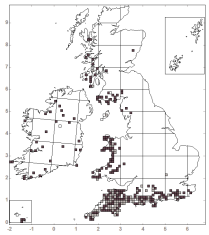
Physcia tribacioides



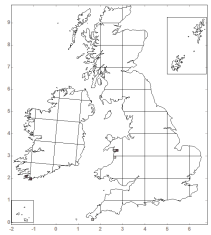
Physcia tribacia



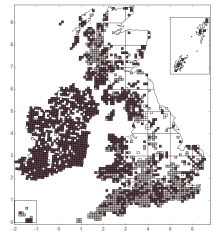
Physcia dubia



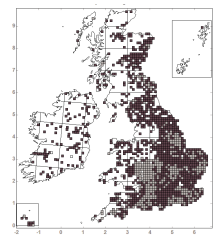
Punctelia reddenda



Parmotrema robustum



Parmotema perlatum



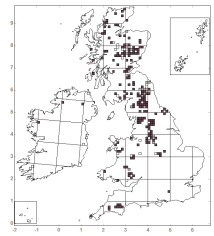
Physconia grisea

109. Thallus lacking leaf-like lobules **110**
– Thallus with small leaf-like lobules **113**

110. Thallus brown to red-brown or olive-brown. [usually with abundant fruits that may cover the thallus] **111**
– Thallus green-brown or grey-brown **112**

111. Lobes to 3 mm wide with white dots (pseudocyphellae) on surface **Melanohalea septentrionalis**
– Lobes incised into lobes up to 8 mm wide. No pseudocyphellae **Cetraria sepincola** (Ph. 15)

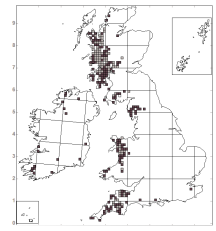
112. Lobes to 2 mm wide, pruinose, adpressed. **Physconia distorta** (Ph. 51)
– Lobes to 2 cm wide, not pruinose, erect margins **Cetrelia olivetorum** (Ph. 16)



Arctoparmelia incurva

113. Lobes pruinose. Thallus to 15 cm diam. Lobules scattered over centre of thallus **Physconia distorta** (Ph. 51. Map page 61)
– Lobes not pruinose, Thallus to 5 cm diam. Marginal lobes flat and wide. Centre covered in leaf-like lobules **Melanohalea laciniatula** (Ph. 36)

114. Thallus with volcano-like warts on surface **Melanohalea exasperata** (Ph. 35)
– No warts but with isidia or soredia **115**



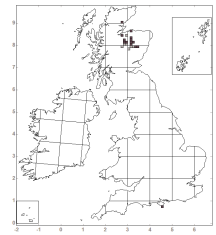
Cetrelia olivetorum

115. Thallus with isidia (which may break down to soredia) **116**
– Thallus with soredia only **120**

116. Medulla C+ red. Thallus yellow-brown to green-brown **117**
– Medulla C–. Thallus red-brown (greyer in shade) **Pseudocyphellaria lacerata**

117. Lower surface of thallus dark brown to black **118**
– Lower surface of thallus white to tan **119**

118. Isidia coralloid, scattered, not breaking down to soredia. Thallus glossy **Melanelixia glabratula** (Ph. 33)
– Isidia coarse in clumps or breaking down to coarse soredia leaving white to pale yellow mark where abraded. Thallus often matt **Melanelixia subaurifera** (Ph. 34)



Melanohalea septentrionalis

119. Isidia simple, scattered, bowl of a spoon shaped
Melanohalea exasperatula
– Isidia often branched, peg-like, evenly spaced
Melanohalea elegantula (Ph. 32)

120. Medulla C+ red**. (**Thallus red-brown, greyer in shade)
Pseudocyphellaria norvegica
– Medulla C –. Thallus colour various **121**

121. Medulla and soralia K+ yellow **122**
– Medulla and soralia K– **123**

122. Yellow pseudocyphellae and soredia
Pseudocyphellaria crocata
– White pseudocyphellae, bluish grey soredia
Pseudocyphellaria intricata

123. Thallus rather erect. Lower surface paler towards the centre
Tuckermanopsis chlorophylla
– Thallus adpressed. Lower surface not paler to the centre **124**

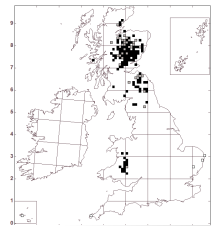
124. Orange-red pigment (K+ purple) in lower medulla
Phaeophyscia endophoenicea
– No orange-red pigment in the lower medulla **125**

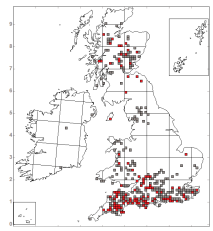
125. Thallus very adpressed with flattened lobes. Difficult to detach from substratum **Hyperphyscia adglutinata** (Ph. 21)
– Thallus. not very adpressed, can be detached from substratum**126**

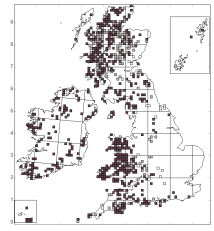
126 Pruinose especially at the lobe tips [simple or bottle-brush rhizines (Figs.37a and 53**)]** **127**
– Lobes not pruinose and with simple rhizines **128**

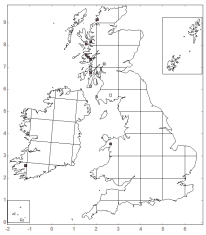
127. Rhizines pale, simple (Fig. 37a) **Physconia grisea**
– Rhizines dark, bottle-brush shaped (Fig. 53)
Physconia perisidiosa

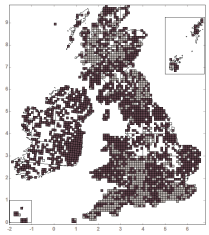
128. Lobes only 0.05 mm to 0.3 mm wide with upturned tips. Underside pale **Phaeophyscia nigricans**
– Lobes 1–2 mm wide, rather flat and spread out. Underside dark **Phaeophyscia orbicularis**

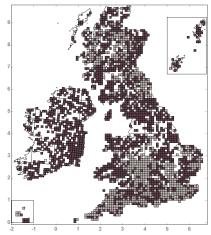

Cetraria sepincola

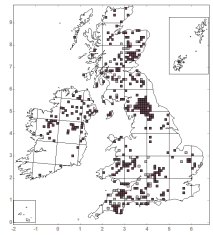

Melanohalea laciniatula

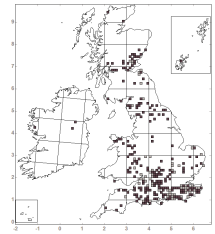

Melanohalea exasperata

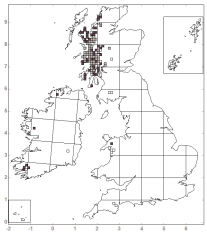

Pseudocyphellaria lacerata

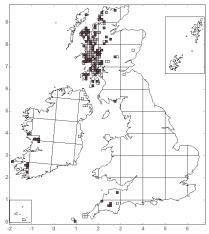

Melanelixia glabratula

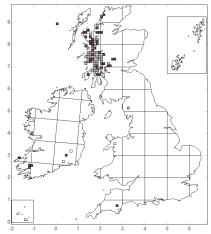

Melanelixia subaurifera

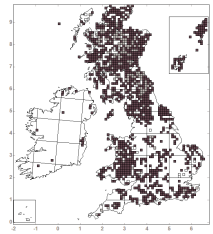

Melanohalea exasperatula

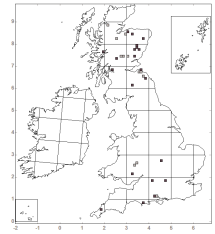

Melanohalea elegantula

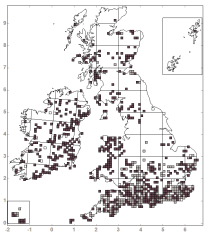

Pseudocyphellaria norvegica


Pseudocyphellaria crocata

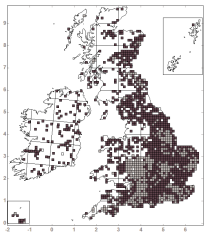

Pseudocyphellaria intricata


Tuckermanopsis chlorophylla

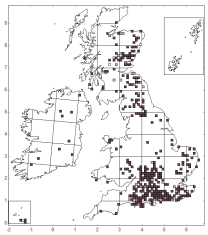

Phaeophyscia endophoenicea



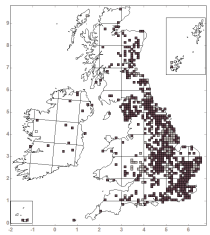
Hyperphyscia adglutinata



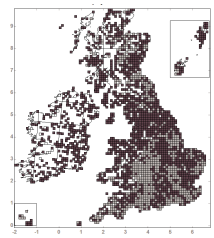
Physconia grisea



Physconia perisidiosa



Phaeophyscia nigricans



Phaeophyscia orbicularis

Key C – Squamulose lichens (Figs. 54 and 55)

(*Cladonia* maps are in the fruticose key)

1. Thallus C+ red or K+ yellow **2**
– Thallus C– and K– **5**

2. Thallus C+ red. Thallus of 1–2 mm diam. squamules often overlapping with sorediate margins. Brown-grey to green-brown **Hypocenomyce scalaris** (Ph. 60, Fig. 56)
– Thallus C– and K+ yellow (*Cladonia*, difficult to separate species from the squamules alone) **3**

3. Squamules large to 1 cm diam. [Undersurface white often orange towards base (K+ purple), Sorediate to margin of squamule] **Cladonia digitata** (Ph. 62)
– Squamules smaller than 1 cm diam **4**

4. Squamules to 5 mm long [very incised, upright, often in a large mat]. Dark pycnidia common **Cladonia parasitica** (Ph. 67)
– Bluish grey-green. Undersurface sometimes orange towards base (K+ purple) **Cladonia macilenta**

5. Squamules to 0.3 mm diam. Fruits perithecia 0.3–0.5 mm **Agonimia tristicula** (Fig. 57)
– Squamules larger. Fruits apothecia, may be on podetia or absent **6**

6. Fruits apothecia or absent. Thallus colour various **7**
– Green-grey to brown-grey. Podetia very squamulose **Cladonia squamosa** (Ph. 67)

7. Thallus of grey to grey-green squamules 1–5 mm diam, raised margins, sorediate. Fruits rare perithecia(Fig. 57, Ph. 61) **Normandina pulchella** (Ph. 61)
– Thallus colour various. Squamules without raised margins **8**

8. Margins of apothecia with squamules or isidia **9**
– Margins of apothecia, if present, not squamulose or isidiate **10**

9. Green-grey to yellow-brown, bright green when wet. Dark cephalodia often present. Pale hairs under apothecia **Psoroma hypnorum**
– Blue-grey to red-brown, blackish when wet. No cephalodia or pale hairs under apothecia **Protopannaria pezizoides**

10. Squamules rather upright. Undersurface mainly white. (*Cladonia* species, difficult to separate from just the squamules) **11**
– Squamules mainly flat. Darker undersurface **15**

11. Squamules to 7 mm long. Grey-green to brownish green. No soredia **Cladonia caespiticia**
– Squamules much smaller. **12**

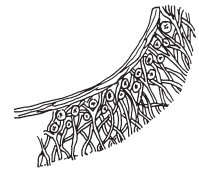


Fig. 54. Cross section of squamule x10

Fig. 55. *Cladonia* squamules x5

Fig. 56. *Hypocenomyce scalaris* squamules x5

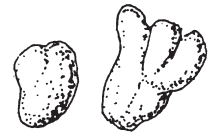


Fig. 57. Squamules of *Agonimia tristicula* x30

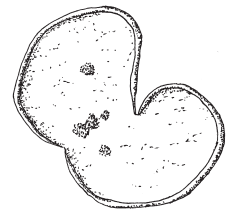


Fig. 58. Squamule of *Normandina pulchella* x15

12. – Yellowish grey-green. To 4 mm tall. Underside sorediate **Cladonia incrassata**

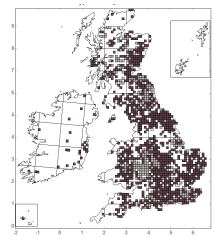
– Squamules smaller. Shades of green or grey **13**

13. Squamules yellowish green-grey (especially when wet). brittle. [Tips turn back]. Often just a crust. **Cladonia ramulosa**

– Green or bluish grey. not brittle. Not just a crust **14**

14. Green when wet. Underside sorediate **Cladonia coniocraea** (Ph. 65)

– Bluish grey. Underside rarely slightly sorediate **Cladonia macilenta** (Ph. 64)



Hypocenomyce scalaris

15. Squamules to 1.5 mm diam. **16**

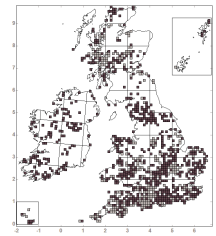
– Squamules larger than 1.5 mm diam. **18**

16. Black hypothallus. Coralloid to lobular isidia **Parmeliella triptophylla**

– No hypothallus. No soredia or isidia **17**

17. Squamules mainly prostrate, shiny **Hypocenomyce friesii**

– Squamules ascending, matt **Hypocenomyce cardocensis**



Agonimia tresticula

18. No soredia or isidia **Pannaria rubiginosa** (Ph. 39)

– Squamules with soredia or isidia **19**

19. Granular soredia on squamules **Fuscopannaia sampaiana**

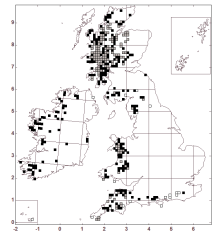
– Isidia (may break down to soredia) present **20**

20. Lobes to 8 mm. Often with lobules **Pannaria conoplea** (Ph. 38)

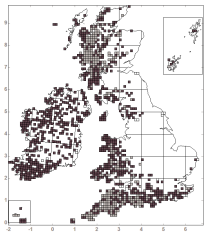
– Lobes 5 mm long or less. Granular or coralloid isidia **21**

21. Marginal lobes to 5 mm long. Wet, crushed specimens smell of antiseptic **Parmeliella testacea**

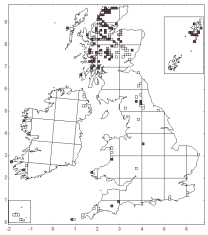
– Marginal and inner lobes to 2 mm. No antiseptic smell **Parmeliella parvula**



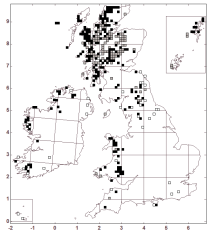
Pannaria cubioplea



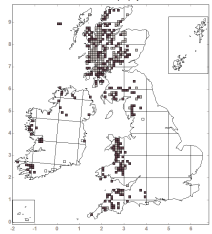
Normandina pulchella



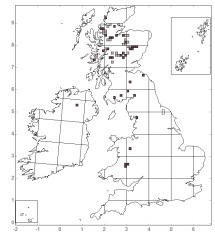
Psoroma hypnorum



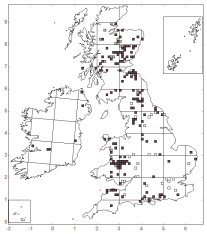
Protopannaria pezizoides



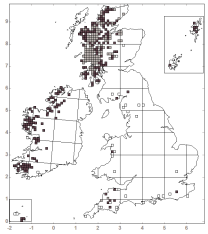
Parmeliella triptophylla



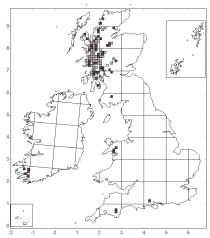
Hypocenomyce friesii



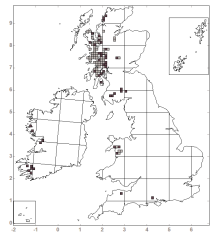
Hypocenomyce cardocensis



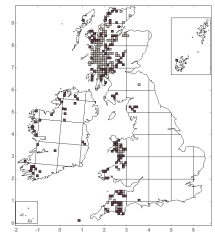
Pannaria rubiginosa



Fuscopannaia sampaiana



Parmeliella testacea



Parmeliella parvula

Key D – Crustose

1. Fruits are pin-like, indian club or golf-tee shaped (Fig. 59–62). **2**
– Fruit types various, not stalked or sterile
Key D – Section 2 (Page 62)

Fig. 59. Apothecium of *Chaenotheca brunneola* x5

Key D – Section 1. With stalked fruits

2. Fruits on a thin stalk with a powdery, brown spore mass on tip of stalk (*Chaenotheca* species Fig 59. *Chaenothecopsis* species have a firm spore mass) **3**
– Fruits indian club or golf tee shaped. Powdery (black) spore mass or not (Figs 60, 61 and 62) **8**

3. Thallus yellow to yellow-grey or yellow-green **4**
– Thallus absent, green or grey to orange **5**

4. Thallus granular to warted, bright yellow. Fruits 0.6–1.3 mm tall **Chaenotheca chrysocephala**
– Thallus powdery, bright yellow-green. Fruits 1.6–2.6 mm tall **Chaenotheca furfuracea** (Ph. 121)

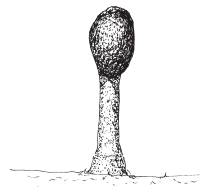


Fig.60. Apothecium of *Stenocybe septata* x10

5. Thallus orange grey with orange patches (K+red) **Chaenotheca ferruginea** (Ph. 84)
– Thallus immersed or green or grey **6**

6. Thallus granular to squamulose, greenish grey. White pruina on upper stalk and apothecial rim **Chaenotheca trichialis**
– Thallus immersed or a few granules. Stalk to 1.4 mm tall **7**

Fig.61. Apothecium of *Calicium viride* x8

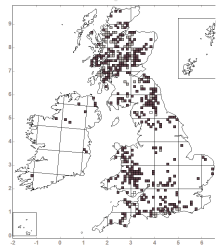
7. Stalk, apothecium and spore mass covered in a greenish yellow pruina **Chaenotheca brachypoda**
– Stalk shiny black, not pruinose **Chaenotheca brunneola** (Fig. 59)

Fig.62. Apothecium of *Calicium salicinum* x8

8. Fruits are indian-club shaped, without a loose spore mass **9**
– Fruits are golf tee shaped with a loose spore mass **10**

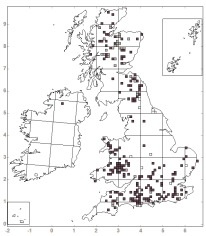
9. Fruits to 2 mm high. Mainly on holly **Stenocybe septata** (Fig.60)
– Fruits to 1 mm high, cup shaped. On alder **Stenocybe pullatula**
(Other similar but rarer genera are difficult to separate in the field. but *Stenocybe* has 3-septate spores and *Phaeocalicium* and *Chaenothecopsis* have simple or 1-septate spores).

10. Thallus bright green, thick, granular. Often occurs in cracks in rough bark **Calicium viride** (Fig 61, Ph. 67))
– Thallus thin or absent, greyish **11**

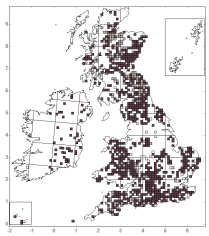


Calicium glaucellum

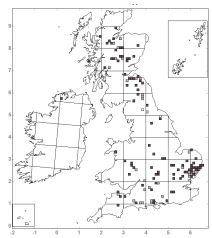
11. Fruits black with pale grey, open **Calicium glaucellum**
(*Calicium glaucellum* spores 9–13 x 5–7 µm *Calicium abietinum* is similar but with spores 11.5–15 x 5–7 µm)
– Fruits light to dark brown, almost globose with brown pruina **Calicium salicinum** (Ph. 120, Fig 62)
(*Microcalicium* species are difficult to identify in the field but have green-black spore masses, *Calicium* has black spore masses)



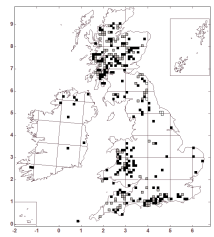
Calicium salicinum



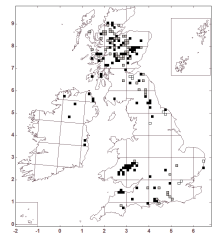
Calicium viride



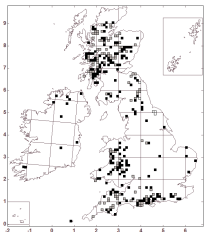
Chaenotheca brachypoda



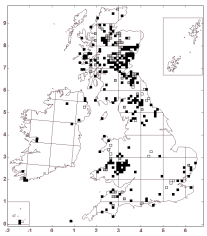
Chaenotheca brunneola



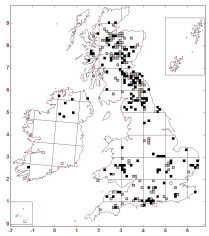
Chaenotheca chrysocephala



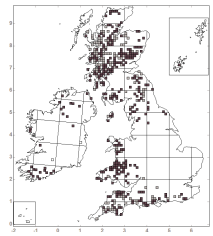
Chaenotheca ferruginea



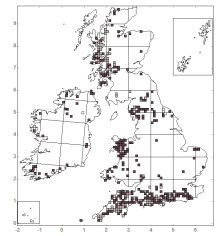
Chaenotheca furfuracea



Chaenotheca trichialis



Stenocybe pullatula



Stenocybe septata

Key D – Section 2 – With perithecia or lirellate apothecia

1. Fruits hard, black, flask-shaped (Fig. 63) and with minute central opening often visible *or* writing-like, longer than wide, (Fig. 65) but may be in rounded heaps or grouped together (a stroma Fig. 67). Frequently very difficult to identify in the field as they are mainly separated by microscopic characters such as spores.It may be necessary to try both halves of a couplet **2**

– Fruits disc- or button-shaped (may be very small) (***apothecia*** Fig. 64), various colours including black. No minute central opening unless in a wart-like swelling of the thallus *if fruits are absent try this split first* **Key D - Section 3.** (page 68)

Fig. 63. Perithecium x6

2. Fruits flask-shaped with small, central opening (use hand-lens) (***perithecia*** Fig. 63). May only be visible as small, dark swellings on the surface of the lichen. **Key D - Section 2a** **3**

– Fruits elongate, often like lines made with a pen, may be piled in heaps (***lirellate***, Fig. 65, 66). **Key D - Section 2b.** (page 65)

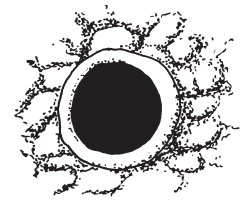


Fig. 64.Apothecium x10

3. Perithecia in a stroma (each perithecium is called a locule) **4**

– Perithecia mostly or all separate **6**

4. Stroma less than 0.3 mm diam, up to 6 locules in each (Fig.67). Stroma irregular in shape. Mainly on hazel twigs. (Spores 4-septate to muriform) **Cyrtidula quercus**

– Stroma larger than 0.3 mm diam, more than 6 locules in each stroma **5**

Fig. 65. *Opegrapha atra* x6

5. 10–55 locules in each stroma. Tissue between locules pale. Mainly on young trees. (Spores 3-septate) **Tomasellia gelatinos**a (Ph.119)

– 4–12 locules in each stroma. Tissue between locules dark. Mainly on alder (spores 1-septate). (Fig.67)**Tomasellia diffusa**

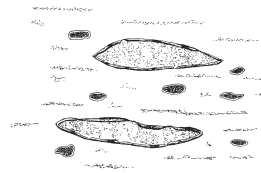


Fig. 66. *Xylographa vitiligo* x6

6. Thallus K+ yellow (spores 3-septate) **7**

– Thallus K– (spores various) **9**

7. Thallus white to cream. No pale pseudocyphellae **Pyrenula laevigata**

– Thallus pale tan to olive green. Flecked with white pseudocyphellae **8**

8. Perithecia up to 0.3 mm diam. **Pyrenula chlorospila** (Ph. 114)

– Perithecia up to 1.0 mm diam. **Pyrenula macrospora** (Ph. 114)

9. Thallus with yellowish green, fine isidia **Porina rosei**

– No isidia **10**

10. Largest perithecia up to about 0.3 mm diam **11**

– Largest perithecia 0.3–1.0 mm diam **23**

11. Reddish brown. Perithecia glossy, indistinct ostiole. Often in urban areas, (3-septate spores)**Porina aenea/P. chlorotica** (Ph. 113)

– Thallus immersed, white or grey-green, fawn or pinkish **13**

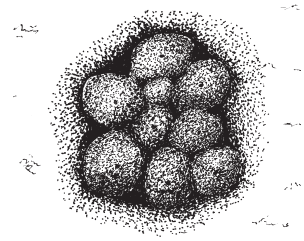


Fig. 67. *Tomasellia diffusa* x8

12. Perithecia 0.1–0.2 (0.3) diam. On smooth bark and twigs. **13**
– Perithecia 0.2–0.35 diam. Rough bark or roughed bark on younger trees. (spores 6–8 septate) **Porina borrerii**

13. Perithecia up to about 0.2 mm diam **14**
– Perithecia to about 0.35 mm diam **20**

14. Thallus grey-green to olive. Often with pinkish brown pycnidia. On trees and conifer bases **Porina leptalea**
– Thallus immersed, pinkish, pale grey, brownish or bright green. Various habitats **15**

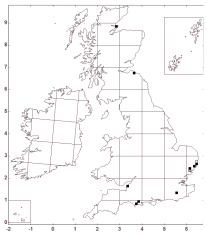
15. Perithecia 0.1-0.2 mm diam. Occurs on smooth bark or elder **16**
– Perithecia larger or it occurs onrough bark or tree roots **19**

16. Perithecia ellipsoid, ostiole depressed. Large pycnidia present. Old woodland (spores 1-3 septate) **Eopyrenula grandicula**
– Perithecia rounded. Not with large pycnidia **17**

17. Thallus whitish, fawn to brown. [Mainly on hazel] **18**
– Thallus immersed or a darker stain. An early coloniser of twigs, common (spores 1-septate) **Arthopyrenia punctiformis**

18. Thallus fawn to brown or pinkish. (Spores 1-septate 14-21 x 3-4.5 µm) **Arthopyrenia carneobrunneola**
– Thallus white to very pale fawn **Arthopyrenia nitescens**

19. Thallus bright green, almost fruticose, becoming covered in soredia. Perithecia pale brown. Mainly on elder. (spores 3- to 5-septate) **Psoroglaena stigonemoides**
If minutely filamentous to granular. Perithecia 0.01–0.12 diam very pale. Possibly **Psoroglaena abscondita** *(spores 1- to 3-septate)*
– Thallus pale grey or immersed. Not sorediate. Occurs on exposed tree roots **Strigula jamesii**


Psoraglaena abscondita

20. Thallus surrounded by purple-black fringe. On shaded, damp smooth bark. No pycnidia. (Spores sole-shaped, 1-septate) **Mycomicrothellia confusa**
– Thallus without a purple-black fringe. usually abundant pycnidia about 0.6-0.1 mmm diam **21**

21. Thallus immersed to pinkish fawn. On smooth areas of rough bark, mainly ash and oak. (spores tadpole-shaped) **Anisomeridium ranunculosporum**
– Thallus white, greenish or pale brown. perithecia smooth to glossy **22**

22 . Circular perithecia. On smooth bark in old woodlands (Spores mainly 1-septate, pointed tips) **Mycoporum antecellens**
– Distictly ellipsoid perithecia. On twigs and smooth bark. (Spores mainly 1-septate, rounded tips constricted septum) **Arthopyrenia analepta** (Ph. 47)

23. Largest perithecia about 1 mm diam. **24**
– Largest perithecia to about 0.6 mm diam **25**

24. Thallus white to pale grey. Perithecia not noticeably in groups, ostiole frequently off centre. Pycnidia circular **Acrocordia gemmata**
– Thallus pale green often with a brown prothallus. Perithecia usually grouped. Ostiole central. Pycnidia comma shaped **Celothelium ischnobellum**

25. Thallus bright green, almost fruticose, becoming covered in soredia. Mainly on elder. (Perithecia pale brown.)
Psoroglaena stigonemoides

– Thallus not bright green. Not sorediate. Perithecia black, brown, red-brown, orange or pink. **26**

26. Thallus immersed or a varnished stain. Perithecia mainly oval and not surrounded by a pale ring but may have a dark fringe **27**

– Thallus thin, white to pale grey or grey green. Perithecia round or oval, with a pale fringe **28**

27. Thallus immersed. Perithecia with a dark fringe. Occurs on birch trees. (curved spores) **Leptorhaphis epidermidis**

– Thallus a varnished stain. No dark ring around the perithecia. Occurs on smooth bark, an early coloniser of twigs
Arthopyrenia analepta (Ph. 47)

28. Perithecia brown or pinkish, about 0.6 mm diam **29**

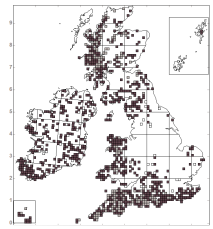
– Perithecia black, 0.2–0.5 mm diam **30**

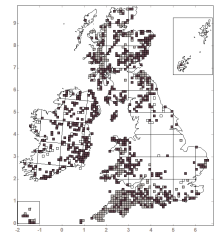
29. Thallus white to pale brown, membranous, often overgrowing mosses (Asci 2-4-spored) **Thelenella muscorum**

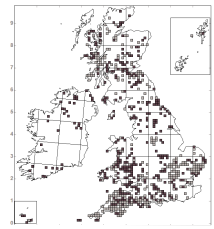
– Thallus grey, grey-green to brown-grey. Perithecia short lived, most common in winter. (Asci 100+ spored) **Thelopsis rubella**

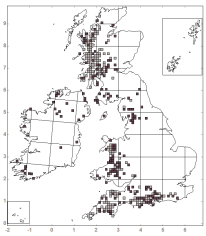
30. Occurs on bog myrtle. Perithecia to 0.6 mm diam, often oval surrounded by a pale ring **Mycoglaena myricae**

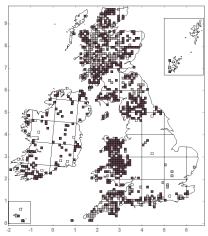
– Not restricted to bog myrtle. Perithecia various **31**

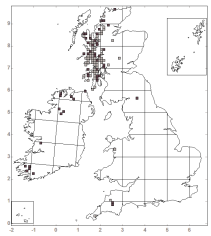

Acrocordia gemmata

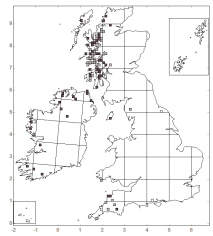

Anisomeridium biforme

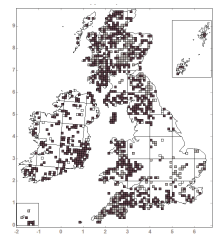

Anisomeridium polypori

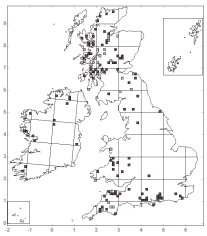

Anisiomeridium ranunculosoporum

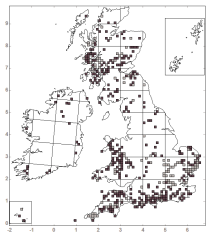

Arthopyrenia analepta

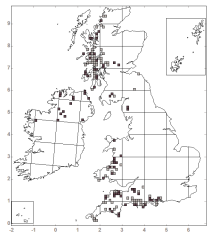

Arthopyrenia carneobrunneola

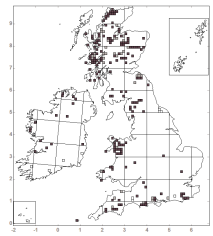

Arthopyrenia nitescens

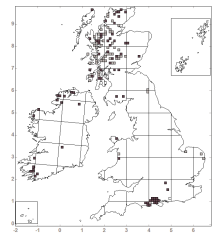

Arthopyrenia punctiformis

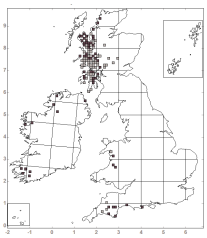

Celothelium ischnobellum

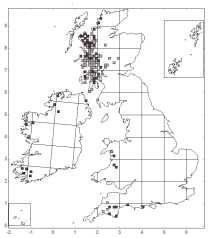

Cytridula quercus

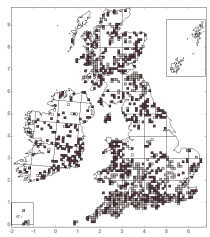

Eopyrenula grandicula

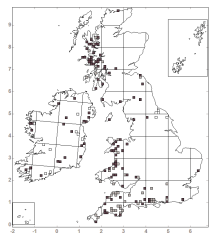

Leptorhaphis epidermidis

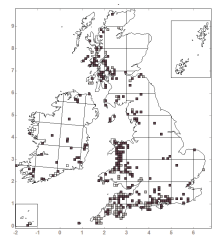

Mycoglaena myricae

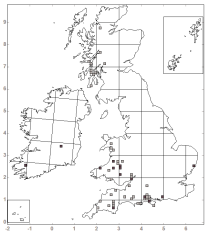

Mycromicrothelelia confusa


Mycoporum antecellens

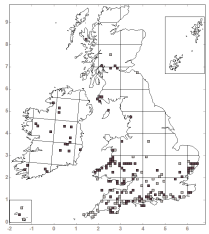

Porina aenea


Porina borreri

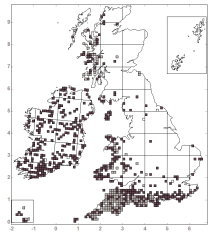

Porina leptaleaa



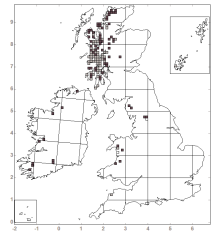
Porina rosei



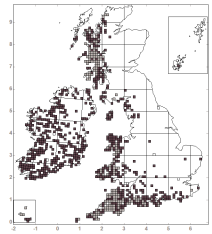
Psoroglaena stigonemoides



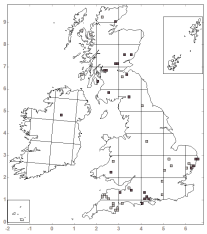
Pyrenula chlorospila



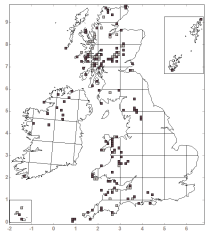
Pyrenula laevigata



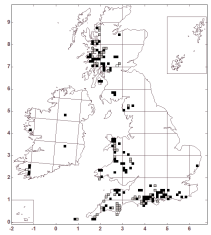
Pyrenula macrospora



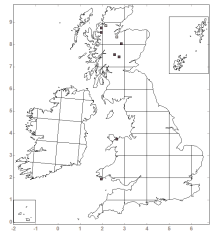
Strigula jamesii



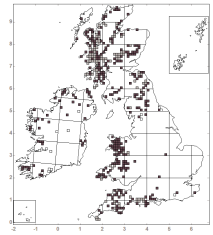
Thelenella muscorum



Thelopsis rubella



Tomasellia diffusa



Tomasellia gelatinosa

31. Perithecia 0.1–0.2 mm diam. Pycnidia to 0.1 mm diam. On bark or sheltered roots **Strigula jamesii**

– Perithecia 0.25–0.5, Numerous prominant conical pycnidia. On shaded bark **32**

32. Thallus with conical pycnidia with peg-like tips (Fig 68) **Anisomeridium polypori**

– Many pycnidia conical, extruding white conidia (Fig.69) **Anisomeridium biforme** (Ph.71)

Fig. 68. Pycnidium of *A. Polypori* x80

Key D - Section 2a. lirellate

1. Thallus sorediate **2**

– Thallus not sorediate **6**

2. Thallus tan to dark brown with yellowish-buff soralia, C+ red. Apothecia in knot-like clumps **Opegrapha gyrocarpa**

– Apothecia long (Fig. 65), spread out C– or C- pink **3**

3. Soralia buff to pale orange, C+ pink-red. Thallus pale to mid brown, thin. Mainly on young trees **Opegrapha sorediifera**

– Soralia pale grey, yellow-buff to dark brown, C– . Thallus dark brown, pale grey or pale brownish grey. Mature trees, wood **4**

4. Lirellae 0.1–0.25 x 0.05–0.1 mm, numerous, immersed. Occurs on dry side of oaks **Enterographa sorediata**

– Lirellae 0.2–1 mm long, prominent, not immersed **5**

5. Thallus chocolate-brown with violet tinge. Soredia dark brown. Rare, on smooth bark **Opegrapha zonata**

– Thallus thin, pale grey. Soralia brown to blue-grey, K+ yellow. On tree stumps and sawn wood **Xylographa vitiligo** (Fig. 70)

6. Thallus or lirellae pruina K+ yellow, yellow to red or purple **7**

– All parts K negative **11**

7. Thallus pale to olive-green. Lirellae 0.5–2.5 mm long containing orange, K+ purple pruina **Opegrapha ochrocheila**

– Thallus K+ pale yellow or yellow turning red **8**

8. Thallus K+ pale yellow. Lirellae to 2 mm long with a pale margin. On smooth bark in W. Scotland **Graphis alboscripta**

– Thallus K+ yellow turning red **9**

Fig. 69. Pycnidium of *A. biforme* x 80

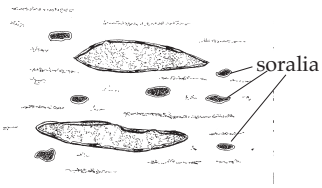


Fig. 70. *Xylographa vitiligo* x 8

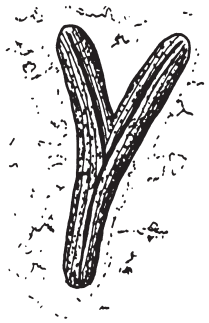


Fig.71. *Graphis elegans* x 10

9. Margins of lirellae multifurrowed **Graphis elegans** (Fig 71)
– Margins of lirellae single **10**

10. Dark carbonaceous margin extends under the hymenium (visible with a hand lens in a cut section**) Phaeographis smithii**
– Dark carbonaceous margin does not extend under the hymenium **Phaeographis dedritica** (Fig. 72)

11. Lirellae thin and dot or thead-like, 0.05–0.2 mm wide (see photo 88) **12**
– Lirellae larger **13**

12. Lirellae brown, unbranched. Mainly shaded trees. Pollution resistant. Common **Enterographa crassa** (Ph. 88)
– Lirellae black, branched, often with a pale margin. On damp tree roots. Rare **Enterographa hutchinsiae**

13. On decaying wood. Thallus immersed or white. Thallus with small, 20–40 μm, brown dots (goniocysts). **14**
– On bark and wood. Thallus immersed or prominent. No goniocysts **15**

14. Lirellae brown becoming black, 2.5 x 0.3 mm **Xylographa parallela**
– Lirellae persistantly brown, 0.2 x 0.1–0.3 mm **Xylographa trunciseda**

15. Thallus immersed. Lirellae follow grain of host, to 2.5 mm long with rounded, glossy lip-like margins. No pycnidia. On nutrient rich old trees **Wadeana dendrographa** (Fig. 73)
– Thallus not immersed. With or without pycnidia **16**

16. Thallus thick, chalk-white. Lirellae 0.3–2 x 0.2–0.5 mm, discs very pruinose on rough, bark or wood of mainly old oaks, often underside of branches **Lecanographa lyncea** (Fig. 74, Ph. 94)
– Thallus not chalk-white, discs not or weakly pruinose **17**

17. Thallus yellow-green, waxy. Lirellae brown-black with a thick white powdery margin, 0.15–0.5 mm wide. On smooth bark in damp woods **Phaeographis lyellii**
(If lacking a powdery margin and stellate, probably **P. inusta**)
– Thallus not yellowish. Lirellae mainly black, not or slightly pruinose. On smooth or rough bark **18**

18. Thallus with numerous small, round pycnidia **19**
– Pycnidia ellipsoid or no pycnidia (rarely, a few) **22**

19. Brown prothallus. Lirellae immersed, surrounded by pale margin. Smooth, shaded, nutrient rich bark **Opegrapha rufescens**
– No prothallus, Lirellae sessile. Various habitats **20**

20. Pycnidia not pruinose. Lirellae 0.3– 0.7 (1) mm long, open slightly. Neutral to basic bark, rarely on wood or conifers **Opegrapha niveoatra**
– Pycnidia white to greenish pruinose. **21**

21. Lirellae 0.5–3.0 mm long and remain a slit. On smooth bark of many trees **Opegrapha vulgata**
– Lirellae 0.7–4.0 mm long, disc open. Neutral to basic rough bark (If with papilla-like, white pruinose pycnidia and lirellae in patches **Opegrapha vermicellifera**) **Opegrapha varia**

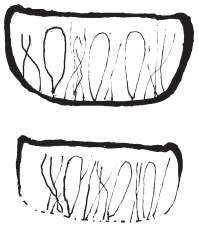


Fig. 72. section through apothecium of *Phaeographis smithii* (above) *P. dendritica* (below)

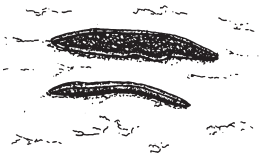


Fig.73. *Wadeana dendrographa* x6

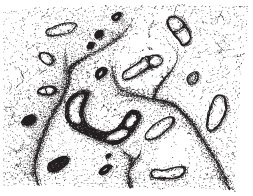


Fig.74. *Lecanographa lyncea* x6

22. Lirellae immersed or very slightly raised **23**
– Lirellae sessile **24**

23. No prothallus. Lirellae often surrounded by pale margin. On smooth bark of many trees **Graphina anguina** (Ph. 90)
– Brown prothallus. No pale margin to lirellae. Smooth bark, young trees **Arthonia radiata**

24. Lirellae gnarled an/or clustered **25**
– Lirellae spread out **26**

25. No prothallus. Numerous ellipsoid pycnidia. On smooth bark in sheltered, damp woodland **Graphina pauciloculata**
– Dark prothallus, often in mosaics with other lichens. Pycnidia rare **Opegrapha atra** (Ph. 105)

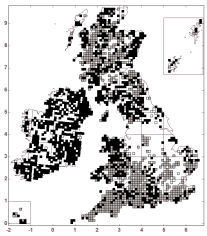
26. Mainly on leached bark of holly in damp valleys. (Disc slit-like, often glossy 0.5–3.20 mm long) **Graphina ruziana** (Fig. 75)
– On various habitats but not restricted to leached bark **27**

27. Lirellae 5–25 mm long, slit-like but open and become white pruinose. Margins unfurrowed (see *Graphis elegans*, fig 69). Common on smooth barked trees**Graphis scripta** (Ph. 92, Fig. 76)
- Lirellae 0.5–3 mm long **28**

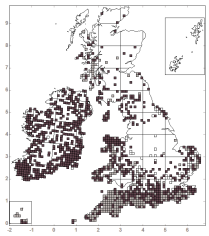
28. Lirellae 0.5–1.0 mm long. Disc becomes exposed and often green pruinose. On smooth bark and wood **Opegrapha herbarum**
– Lirellae 1.0–3.0 mm long. Disc slit-like. On dry, shaded rough bark. Especially churchyard yews **Opegrapha prosodea**

Fig. 75. *Graphina ruiziana* x8

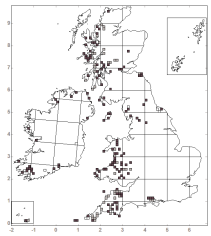
Fig. 76. *Graphis scripta* x6



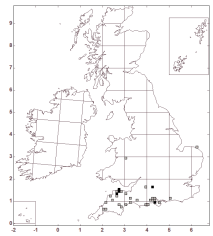
Arthonia radiata



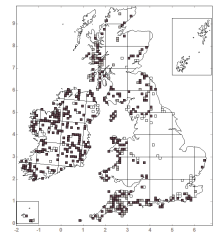
Enterographa crassa



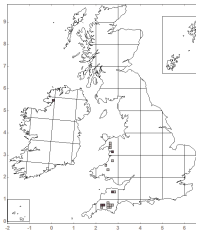
Enterographa hutchinsiae



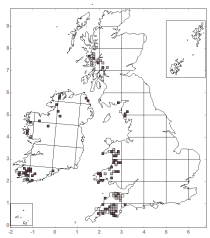
Enterographa sorediata



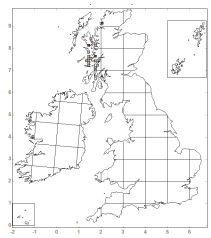
Graphina anguina



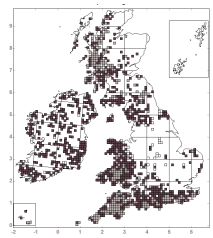
Graphina pauciloculata



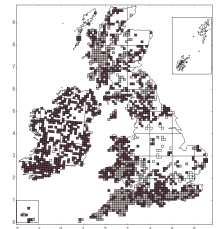
Graphina ruiziana



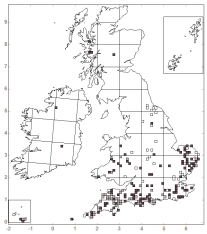
Graphis alboscripta



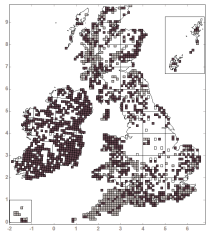
Graphis elegans



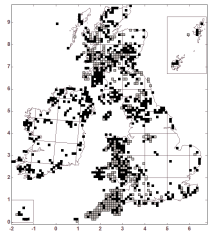
Graphis scripta



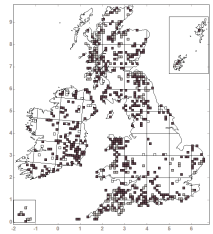
Lecanographa lyncea



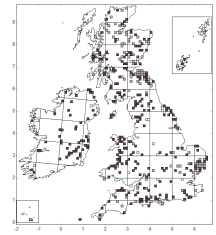
Opegrapha atra



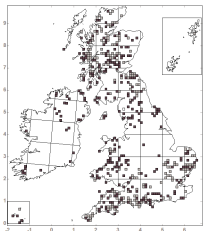
Opegrapha gyrocarpa



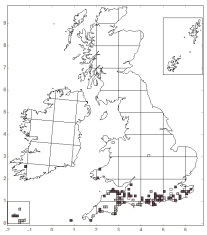
Opegrapha herbarum



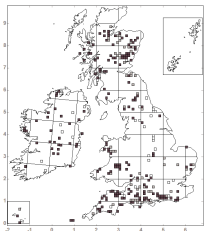
Opegrapha niveoatra



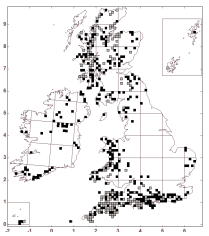
Opegrapha ochrocheila



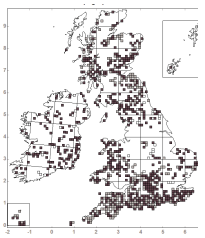
Opegrapha prosodea



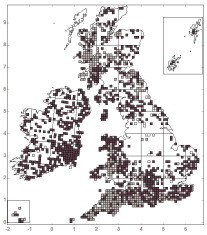
Opegrapha rufescens



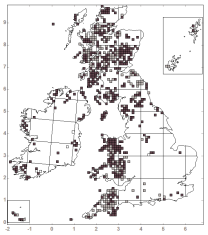
Opegrapha sorediifera



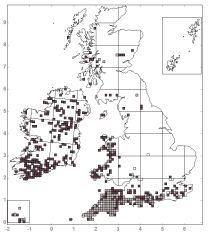
Opegrapha varia



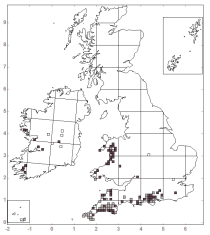
Opegrapha vulgata



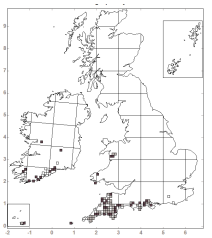
Opegrapha zonata



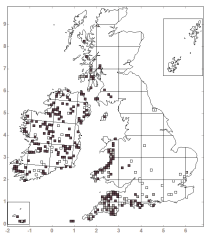
Phaeographis dendritica



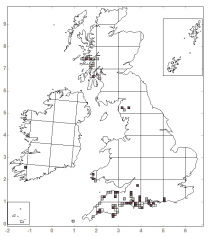
Phaeographis inusta



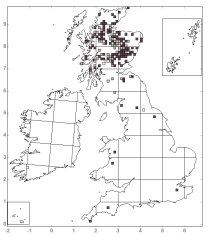
Phaeographis lyellii



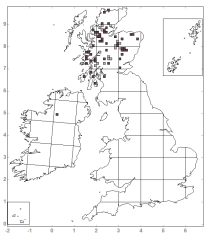
Phaeographis smithii



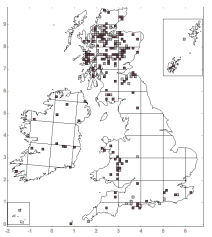
Wadeana dendrographa



Xylographa parallela



Xylographa trunciseda



Xylographa vitiligo

Key D - Section 3. Not lirellate. With apothecia or sterile.

1. **Subsection 3(a) – Thallus placodioid** (flat or rounded marginal lobes, Fig. 77) **2**
– Thallus not placodioid (may be slightly notched at margin) **3**

2. Thallus white to pale grey. Rarely fertile. Usually sorediate. K+ yellow. Common, especially on very nutrient enriched sites **Diploicia canescens** (Ph. 87, Fig. 77)
– Thallus greenish, grey-green or brown-green. Edges of lobes, white. Fruit discs green-buff to brown. Uncommon, on trees and worked wood (very common on stone) **Lecanora muralis**

Subsection 3(b) – Thallus yellow, yellow-green or orange

3. Thallus yellow, yellow-green, grey-yellow or orange **4**
– Thallus other colours including fawn and brown. **Section 3. Subsection 3(c)** (Page 71)

4. Thallus or medulla C+ orange or red **5**
– Thalllus or medulla C– **12**

5. Thallus C+ red **6**
– Thallus C+ orange **7**

6. All parts C+ red. Thallus has orange patches that are K+ purple. Pale green/orange soredia. Soralia to 1.5 mm diam. **Trapeliopsis pseudogranulosa**
– C+ red in a squash. Thallus of fine yellow-brown granules. On rotting or very weathered wood **Placyncnthiella dasaea**

7. Thallus yellow to yellow-grey. Numerous isidia which become sorediate. On well-lit trees **Pertusaria flavida**
– Not isidiate but may be sorediate or not **8**

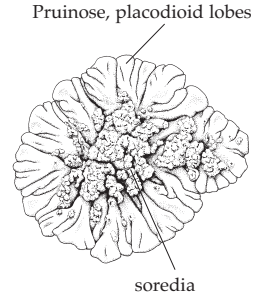
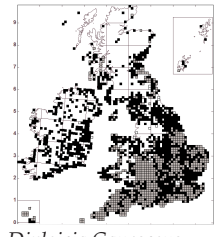
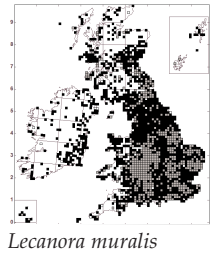


Fig. 77. *Diploicia canescens* x1



Diploicia Canescens



Lecanora muralis

8. Fruits lecideine, black. **Lecidella elaeochroma**(Ph. 100)
(if sorediate **Lecidella eleochroma** form **soralifera**
Fruits lecanorine, greenish or buff, if lecideine, orange. (Fig. 78**) 9**

9. No soredia but may be slightly granular. Very fertile. Fruit disc yellow-green or buff. **10**
– Very sorediate. Any fruits, scattered. Discs reddish brown or flesh coloured **11**

10. Fruit margins excluded early. On trees and wood **Lecanora symmicta** (Ph. 99)
– Thallus somewhat granular to granular-areolate. Fruit margins paler than thallus **Lecanora confusa** (Ph. 97)

11. Soredia yellow buff. Fruit disc reddish brown. Thallus thick, granular. On rough bark **Pyrrhospora quernea**
– Soredia yellow-green. Fruit disc flesh colour. Thallus smooth, cracked thinner. Common on trees and wood, often in light shade **Lecanora expallens** (Ph. 98)

12. Some parts K+ purple **13**
– All parts K– **14**

13. Thallus yellow to pale orange. Yellow, granular soredia. On nutrient enriched wood. Rare, on wood **Caloplaca citrina** agg.
– Thallus pale orange with darker parts. Apothecia orange to brown. Frequent, often in old woodland **Arthonia vinosa**

14. Thallus of fine yellow-brown granules. On rotting or very weathered wood **Placynthiella dasaea**
– Thallus and/or soredia yellow, yellow-grey, orange, yellow-green or bright green. Sorediate or not. **15**

15. Usually very fertile with crowded fruits. Fruits to 1.5 mm diam. Discs yellow-brown to green-brown or yellowish grey **16**
– Fruits scattered 0.2 to 0.8 mm diam or absent **21**

16. Thallus yellow-orange of crowded subsquamulose areoles. Fruit discs greyish yellow. On nutrient enriched trees and wood **Candelariella vitellina**
– Thallus yellowish grey, granular. Fruit discs cream to brownish. On acid barked trees and wood **17**

17. Fruit margin persistent **18**
– Fruit margin excluded very early. On acid barked trees twigs and wood **Lecanora symmicta** (Ph. 99)

18. Fruits sessile, cup-like with a thin double margin (difficult to see, use hand-lens) **Lecanora varia**
– Fruits more immersed, not cup-like. No double margin **19**

19. Fruit discs dark green-brown to emerald **Lecanora intricata**
– Fruit discs pale green to pale brown or grey-brown **20**

20. Fruit discs yellowish to yellow-green or green and jade-like, (spores 5–7μ wide) **Lecanora polytropa** (Ph. 37)
– Fruit discs brownish to grey-brown (spores 3–4μ wide) (*This couplet may be difficult to separate*) **Lecanora stenotropa**

21. Thallus warted. Fruits immersed in thalline warts. On weathered wood especially benches (spores 1-septate to submuriform) **Cyphelium notarisii** (Fig. 79)
– Thallus granular, powdery squamular or a crust. Fruits not immersed in thalline warts **22**

a) Thalline margin: Margin is a similar colour to the thallus

b) Proper margin: Margin is dark and not the same colour as the thallus

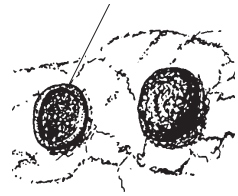
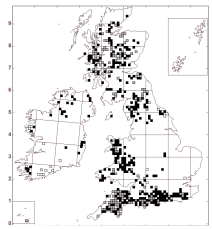


Fig. 78. a and b. Types of fruit margins x5
a: Lecanorine
b: Lecideine



Arthonia vinosa

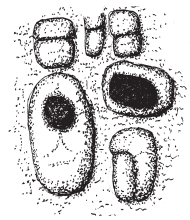


Fig. 79. *Cyphelium notarisii* x8

22. Thallus yellow, yellow-green, powdery, granular or areolate **23**
– Thallus brown-grey, buff-grey granules or thin greyish crust. Soredia if present yellow-green or brown **28**

23. Thallus small dull, greenish yellow, granules or squamulose with bright yellow soredia. Nutrient enriched wood, especially willow**Candelariella reflexa** (Ph. 82, Fig. 80) (if yellow-green granules on a black hypothallus, probably **Candelariella xanthostigma)**
– Thallus yellow, yellow-green, yellow-grey to brown-grey. If present, yellow to yellow-green soredia **24**

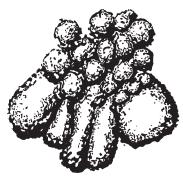


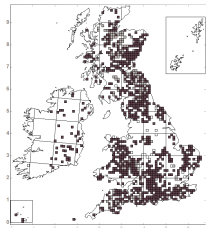
Fig.80. Squamule of *Candelariella reflexa*

24. Thallus yellow-green, squamulose. Yellow-green/green soralia in centre. Soredia initially form in the centre of the areoles. On worked wood **Lecanora soralifera** (Fig.81)
– Thallus not squamulose but areolate, granular or sorediate **25**

Fig. 81.*Lecanora soralifera* x8

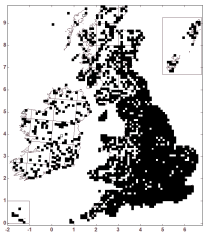
25. Thallus areolate. White prothallus. Soredia arise on margins of areoles. On wood and bark, especially ash **Lecanora orosthea**
– Thallus granular or powdery. Yellow to yellow green. **26**

26. Thallus finely sorediate granules, 0.02–0.025 mm diam, dull yellow-green. On well-lit, not nutrient-enriched trees **Chrysothrix flavovirens**
– Thallus granular or sorediate to 0.3 mm diam. Frequently in cracks in mature trees **27**



Calicium viride

27. Thallus powdery, often a golden tinge.Frequently it occurs in cracks in rough bark **Chrysothrix candelaris** (Ph. 86)
– Thallus granular, yellow to yellow green. Especially common on oaks. Pollution resistant **Calicium viride** (Ph. 81)

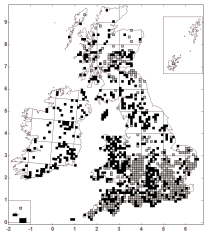


Caloplca citrina

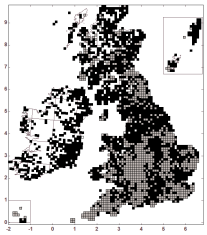
28. Thallus of buff-yellow granules on dark prothallus. Not sorediate. On slightly shaded, not nutrient-enriched trees **Candelariella xanthostigma**
– Thallus pale green,brown-grey to grey. Sorediate **29**

29. Areoles to 0.5 mm diam, Breaking down to bright green soredia in touched with a needle **Halicarnia viridescens**
– Thallus grey and continuous or areoles to 0.5 mm diam **30**

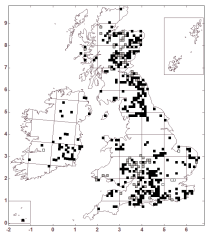
30. Thallus pale brown-grey often greenish of granules to 0.5 mm diam. with greenish-yellow soredia. Damp woodlands often on horizontal branches **Rinodina efflorescens**
– Thallus greyish, almost covered with yellow to yellow-green soredia. On well lit trees **Lecanora compallens**



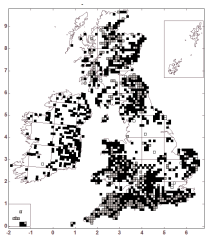
Candelariella reflexa



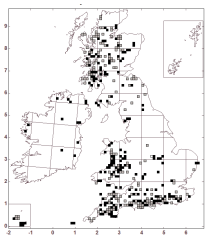
Candelariella vitellina



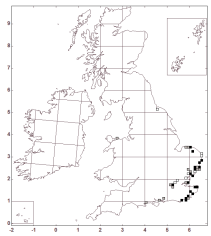
Candelariella xanthostigma



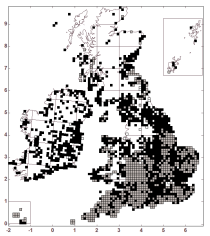
Chrysothrix candelaris



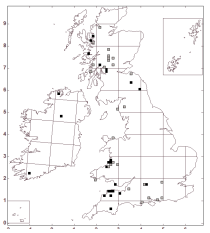
Chrysothrix flavovirens



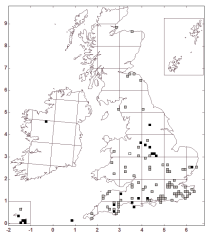
Cyphelium notarisii



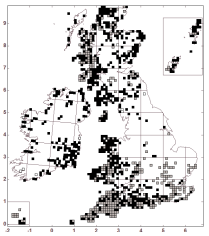
Diploicia canescens



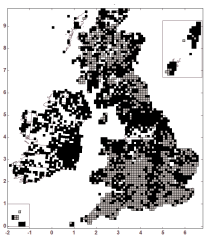
Halecania viridescens



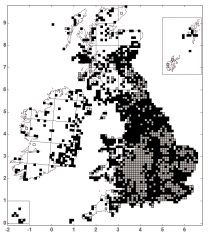
Lecanora compallens



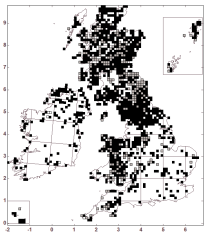
Lecanora confusa



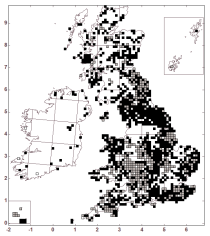
Lecanora expallens



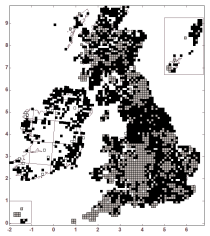
Lecanora muralis



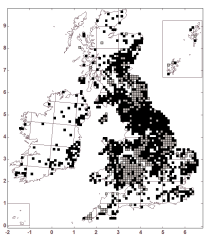
Lecanora intricata



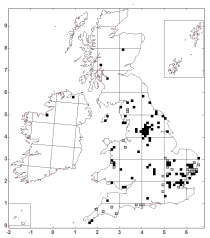
Lecanora orosthea



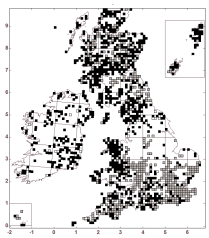
Lecanora polytropa



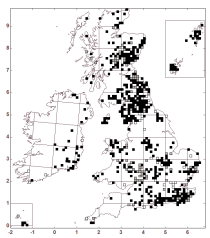
Lecanora soralifera



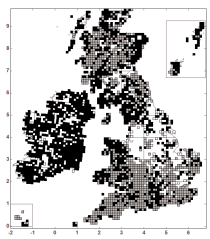
Lecanora stenotropa



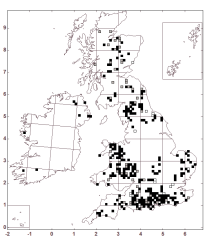
Lecanora symmicta



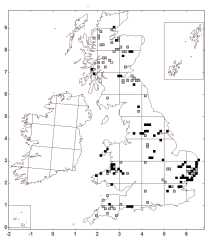
Lecanora varia



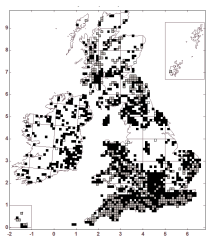
Lecidella elaeochroma



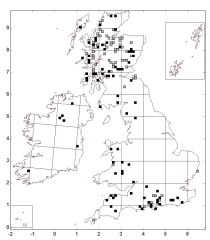
Pertusaria flavida



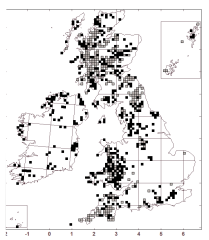
Placynthiella dasaea



Pyrrhospora quernea



Rinodina efflorescens



Trapeliopsis pseudogranulosa

Key D – Section 3
Subsection 3(c) – Thallus sorediate, isidiate or a granular crust

1. Sorediate, isidiate (Fig. 76) or a granular crust **2**
– Not sorediate, isidiate or a granular crust but may consist of scattered granules **Section 3. Subsection 3(d)** (Page 78)**.**

2. Isidiate or coarsely granular. **3**
– Leprose, sorediate or finely granular **Section 3. Subsection 3(c/i)** (Page 73)

3. Isidia and/or thallus C+ red or orange. **4**
– All parts C– **5**

4. Thallus pale grey, granular. Zoned white fringe (Fig. 82). Covered in soft C+ red isidia whch become sorediate and erode to leave white scars. On well-lit trees **Ochrolechia subviridis**
– Thallus yellow to yellow-grey, C+ orange. Numerous isidia which become sorediate. On well-lit trees **Pertusaria flavida**

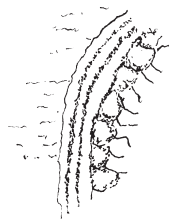


Fig. 82. Zoned margin to thallus x4

5. Thallus K+ yellow, orange or yellow turning red or fruit discs K+ purple **6**
– Thallus K– **9**

6. Fruit disc orange, K+ purple. Thallus grey with blue tinge. On nutrient-enriched tree bases **Caloplaca virescens**
– Thallus K+ yellow, orange or yellow turning red **7**

7. Thallus K+ yellow, consists of corolloid branched isidia. Fruits with crenulate or isidiate margins. **Rinodina isidioides**
– Thallus K+ yellow-orange or yellow turning red **8**

8. Thallus yellow turning red, brownish grey with an unzoned pale prothallus. Numerous erect isidia with grey-green to brownish tips. On well-lit trees **Pertusaria coccodes**
– Thallus K+ yellow-orange. Isidia unoriented. On wayside trees, mainly in C. Scotland **Caloplaca coronata**

9. Thallus grey with blue tinge. On nutrient-enriched tree bases **Caloplaca virescens**
– Thallus green, grey, brownish grey, greenish brown or brown-black. Various habitats **10**

10. Thallus pale grey, granules to 0.2 mm diam. Apothecia 0.3–1.0 mm diam, pale brown to brown-black. On shaded old trees, especially elm and ash **Bilimbia sabuletorum**
– Thallus green, grey, brown-black, brown/green grey **11**

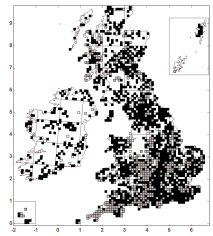
11. Thallus dull dark greenish grey. Granular isidia and fruit margins. On wood and pine trees **Protoparmelia oleagina**
– Thallus green, greenish/black- brown. Squmulose to granular **12**

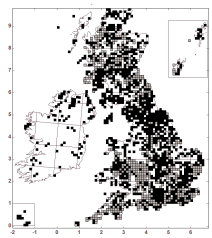
12. Thallus straw, brown to green-brown or brown-black **13**
– Thallus grey-green, brownish, green. Squamulose to granular **14**

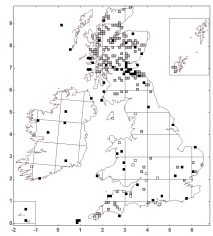
13. Thallus red-brown to brown-black of coralloid granules. Fruits 0.2–0.6 mm diam, paler margin. On wood **Placynthiella icmalea**
– Thallus straw, brown to olive-green of globose granules. Fruit discs pink to dark grey. On trees and wood **Micarea prasina** (if on acid bark and stumps with a greenish thallus. Fruits to 0,2 mmdiam and whitish discs, probably **Micarea micrococca**)

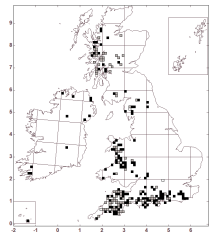
14. Coarsely granular. Soredia grey-green. Declining species, now mainly on sawn wood **Lecanora conizaeoides** (Ph. 125)
– Minutely squamulose or granular isidiate **15**

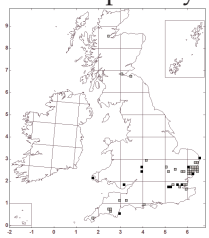
15. Thallus grey-green to olive. Consisting of minutely indented squamules with granular sorediate edges, often covering large areas of shaded somewhat nutrient-enriched trees even in polluted areas. Common but overlooked **Bacidia neosquamulosa**
– Thallus grey-green often brownish or grey towards the tips, of the granular isidia, not squamulose. On mature trees especially oak in open situations. **Bacidia biatorina**

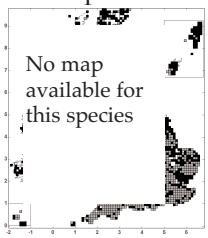

Bilimbia sabuletorum


Placynthiella icmalea

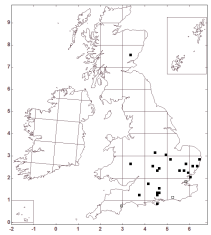

Micarea micrococca

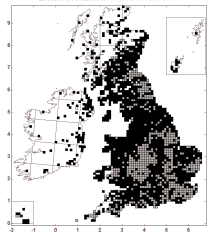

Bacidia biatorina

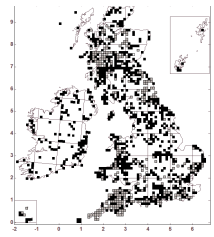

Bacidia neosquamulosa

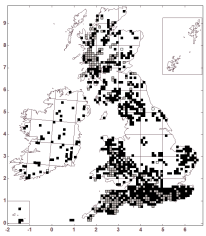


Caloplaca coronata

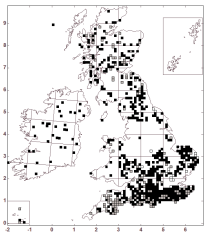

Caloplaca virescens


Lecanora conizaeoides

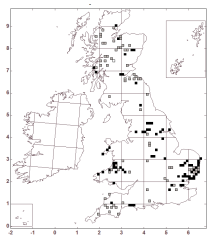

Micarea prasina



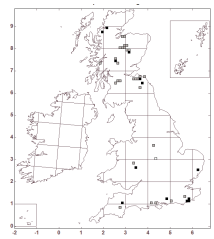
Ochrolechia subviridis



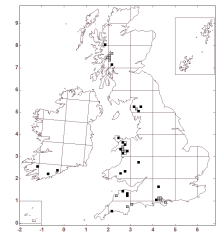
Pertusaria coccodes



Placynthiella dasaea



Protoparmelia oleagina



Rinodina isidioides

Section 3. Subsection 3(c/i). Leprose, sorediate or finely granular

1. Sorediate or a granular crust **2**
– Not sorediate or a granular crust but may consist of scattered granules **Section 3. Subsection 3(d/i)** (Page 78**)**

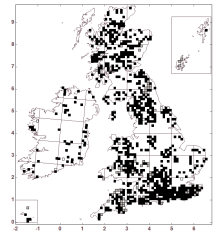
2. Thallus, fruits or soredia C+ yellow, red, pink or orange **3**
– All parts C– **21**

3. C+ yellow or orange **4**
– C+ red or pink **10**

4. C+ yellow **5**
– C+ orange **7**

5. Thallus C+ yellow, membranous with lobed edges, grey often yellowish near margin **Lepraria membranacea**
– Not membranous nor yellow near margin **6**

6. C+ dirty yellow. K+ yellow to orange. Thickly greenish sorediate with weak marginal lobes **Lepraria vouauxii**
– Soralia C+ yellow, bursting from warts on a grey thallus, often forming a powdery crust in centre. On nutrient enriched bark **Ochrolechia turneri**
(soredia very fine, on acid bark **Ochrolechia microstictoides**)

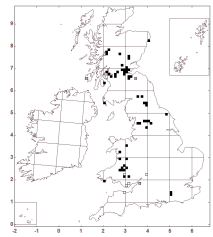


Ochrolechia turneri

7. Green to yellow-brown areoles. K+ weak yellow. Yellow-green soredia. On old acid bark **Lecanora alboflavida**
Thallus granular becoming areolate or smooth. K– **8**

8. Thallus granular to areolate. On dust impregnated bark. Yellow-green soredia scratches to grey-green. **Lecidella scabra**
– Thallus thin or smooth. Smooth bark, wood **9**

9. Thin grey thallus covered in greenish soredia, C+ yellow-orange to red orange. Sheltered trees and wood **Lecanora expallens**
– Thick grey-green thallus. Yellow-green soralia to 1 mm diam. On well-lit smooth bark **Lecidella elaeochroma** forma **soralifera**



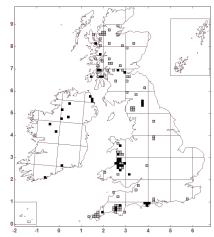
Buellia pulverea

10. Thallus or soredia C+ pink **11**
– Thallus or soredia C+ red **12**

11. Thallus C+ pink, granular, grey-grey to brown-grey. Apothecia 0.5 mm diam, immersed among granules **Buellia pulverea**
– Soralia buff to pale orange, C+ pink-red. Thallus pale to mid brown, thin. Mainly on young trees **Opegrapha sorediifera**

12. Thallus tan to dark brown with yellowish-buff soredia, C+ red. Apothecia in knot-like clumps **Opegrapha gyrocarpa**
– Apothecia long (Fig. 64, 65), thallus colour not as above **13**

13. Thallus to 2 cm diam, immersed or grey-green, soredia green with blue-grey/brownish coating. Acid trees **Micarea coppinsii**
– Thallus larger, green, green-brown or grey **14**



Micarea coppinsii

14. Thallus green to green-brown, scattered areoles. Soralia convex, buff to green-buff. On acid bark **Trapelia corticola**
– Thallus bright green, brown-grey or grey **15**

15. Thallus bright green of fine granules, C+ red. On acid bark, wood mainly in woodlands **Micarea viridileprosa**
– Thallus grey-brown or bluish grey. Not finely granular **16**

16. Thallus of grey to brown-grey areoles, developing a yellowish green crust. Mainly on wood **Micarea leprosula**
– Thallus grey with yellowish soredia or zoned prothallus **17**

17. Thallus pale grey to greenish grey. Granular to areolate. Yellowish soredia. Tree stumps, rotting wood **Trapeliopsis granulosa**
– Thallus grey, greenish or bluish grey. Soredia not yellow **18**

18. Thallus greenish or bluish grey. Becoming covered in concolourous soredia. On old wood **Trapeliopsis flexuosa**
– Thallus grey and/or with K+ crimson orange patches **19**

19. Thallus granular, forming a crust. Greenish soredia. K+ purple orange patches. Damp shaded, decaying wood **Trapeliopsis pseudogranulosa**
– Thallus firm, areolate.Yellow-green or grey soredia. On trees **20**

20. Thallus grey, C+ red. Yellowish soredia to 3 mm diam. Apothecia to 3 mm diam, sessile **Ochrolechia androgyna** (Ph. 104)
– Thallus bluish grey. Zoned prothallus. Medulla/soredia C+ red. Grey soralia. On well-lit trees **Pertusaria hemisphaerica**

21. Thallus grey with a white prothallus, K+ yellow turning red after a few seconds. White soredia **Phlyctis argena** (Ph. 112)
– Thallus K+ yellow, K+ yellow turning red or K– **22**

22. Thallus/soredia/fruits K+ yellow, or K+ yellow turning red **23**
– All parts K– **37**

23. K+ yellow turning red. Thallus grey with blueish green. Grey soredia that scratch yellowish. Black prothallus **Buellia griseovirens**
– K+ yellow not turning red **24**

24. Soredia and apothecia K+ crimson **Caloplaca ulcerosa**
– Soredia and apothecia K+ yellow **25**

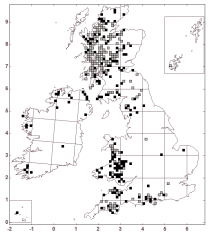
25. Soralia bright, pale lemon. Thallus grey in patches to 3 cm diam. On smooth bark in damp situations **Lecanora jamesii**
– Soralia not lemon yellow. Various habitats **26**

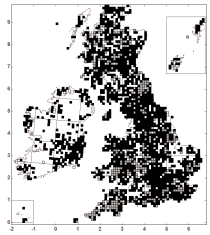
26. Thallus dark grey, K+ brownish yellow. Soralia yellowish to greenish grey. Smooth bark and wood **Mycoblastus fucatus**
– Thallus white to pale grey or a sorediate crust. K+ yellow. **27**

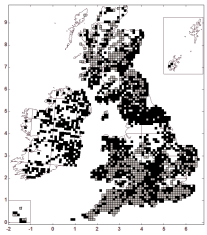
27. Thallus continuous, firm, white to grey-white **28**
– Thallus soft, filmy or a sorediate or granular crust **32**

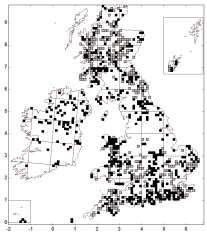
28. Fruits ± visiable within white, sorediate warts. On smooth bark and branches **Pertusaria multipuncta**
– Soredia do not cover fertile warts **29**

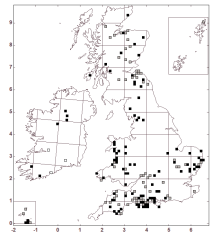
29. Thallus warted. Pale grey prothallus. Soredia pale green-grey. On bases of nutrient enriched trees **Lecanora barkmaniana**
– No prothallus. Not restricted to nutrient enriched sites **30**

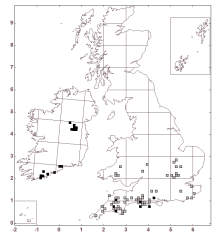

Trapelia corticola


Trapeliopsis granulosa


Phlyctis argena


Buellia griseovirens


Caloplaca ulcerosa


Lecanora barkmaniana

30. Thallus grey to yellowish grey. Yellow to blue-yellow soralia to 2 mm diam. Shaded rough bark trees **Loxospora elatina**
– Smaller grey-green, yellowish green or white soralia **31**

31. Thallus pale grey. Soredia grey-green to yellowish green. On mossy trees in damp woodland **Megalaria pulverea**
– Thallus pale grey to white. Soredia chalk-white. On dry, well-lit trees, slightly nutrient enriched **Schismatomma cretaceum**

32. Thallus filmy or soft yellowish grey to grey-green granules breaking down to soredia. On damp, well-lit trees **Megalospora tuberculosa**
– Thallus of soredia or fine granules. The following *Lepraria* and similar species are difficult to separate without lab. tests **33**

33. Thallus apple green to bluish grey with a white medulla. On bark and wood **Lepraria lobificans** (Ph. 102)
– Thallus not apple green, medulla absent **34**

34. Thallus dull grey to blue-green on shaded acid bark and wood often in high rainfall sites **Lepraria umbricola**
– Thallus grey, bluish white to bluish grey **35**

35. Thallus grey. Granules to 0.2 mm diam. with projecting hyphae to 0.6 mm long **Lepraria rigidula**
– Thallus pale bluish white to bluish grey. Hyphae various **36**

36. Thallus of smaller powdery granules to 0.15 mm diam. On neutral to slightly acidic bark often in oak woods in west. Hyphae below thallus ± purple-red **Lepraria sylvicola**
– Thallus of granules to 0.6 mm diam. On acid bark and conifers especially in secondary woodland **Lepraria jackii**

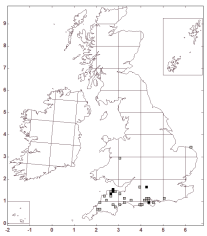
37. Soredia buff to shades of brown or orange **38**
– Soredia other colours than above **41**

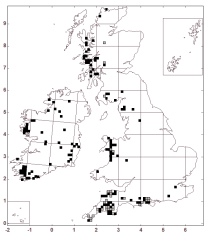
38. Soralia buff to pale orange. Thallus pale to mid brown, thin. Mainly on young trees **Opegrapha sorediifera**
– Soralia pale grey, yellow-buff to orange, C– . Thallus dark brown, pale grey or pale brownish grey. Mature trees, wood **39**

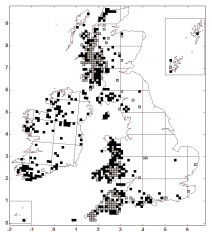
39. Soredia bright orange. On small trees **Opegrapha multipuncta**
– Soredia pale grey-brown. On old trees **40**

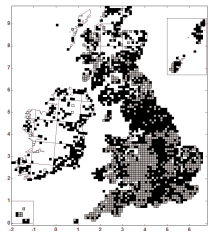
40. Lirellae 0.1–0.25 x 0.05–0.1 mm, numerous, immersed. On dry side of oaks. Soredia grey-white to pale grey-brown, often in lines along cracks **Enterographa sorediata**

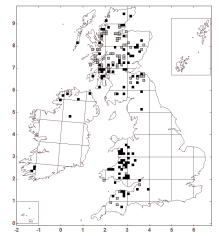
– Apothecia not known. Soredia becoming diffuse, often in small groups, greenish grey to pale fawn. On trees, especially yew, often in shade **Opegrapha corticola**

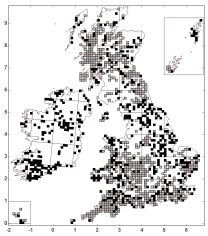

Enterographa soridiata


Lecanora alboflavida

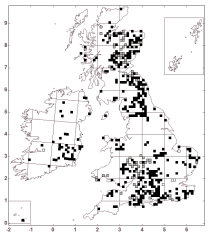

Lecanora jamesii


Lecidella scabra

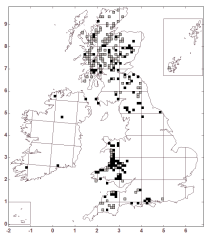

Lepraria jackii



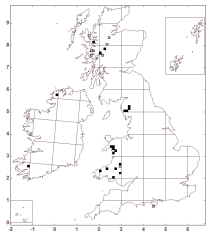
Lepraria lobificans



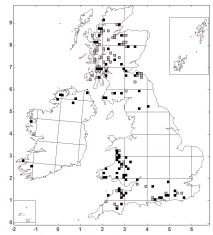
Lepraria membanacea



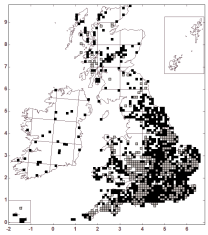
Lepraria rigidula



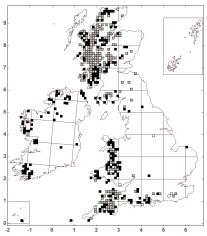
Lepraria sylvicola



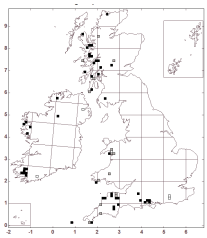
Lepraria umbricola



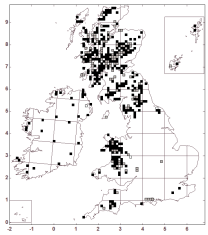
Lepraria vouauxii



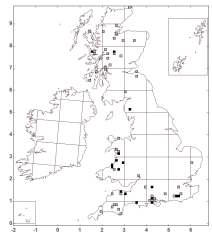
Megalaria pulverea



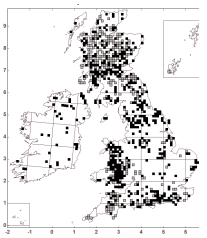
Megalospora tubercolosa



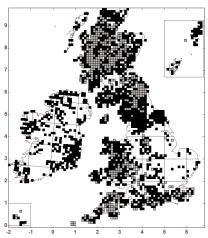
Micarea leprosula



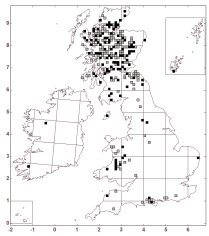
Micarea viridileprosa



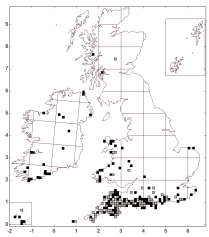
Mycoblastus fucatus



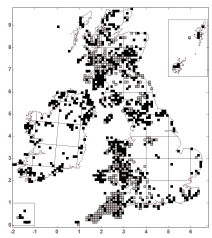
Ochrolechia androgyna



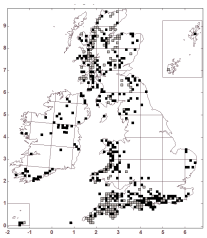
Ochrolechia microstictoides



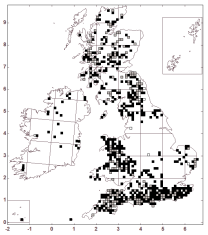
Opegrapha corticola



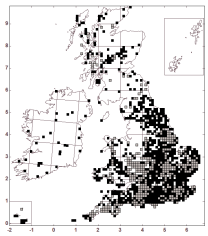
Opegrapha multipuncta



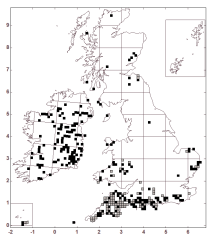
Opegrapha sorediifera



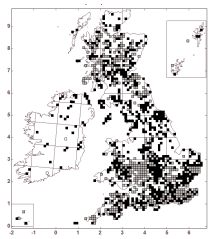
Pertusaria hemisphaerica



Pertusaria multipuncta



Schismatomma cretaceum



Trapeliopsis flexuosa

41. Thallus covered in fine soredia or leprose (up to about 0.3 mm granules). This group is often very difficult to identify in the field and are easily confused with algae. If the crust is yet not fully developed and soralia still discrete, it may still key out here **42**

– Thallus with more scattered soralia **55**

42. White black or dark blue-grey prothallus **43**

– No prothallus (do not confuse with a ring of thallus surrounding a central sorediate crust) **47**

43. Dark blue-grey prothallus. Thin, pale grey thallus. Soredia whitish to pale grey. On smooth and rough bark **Mycoblastus caesius**

– White or black prothallus. **44**

44. Black prothallus. Thallus pale grey, or pinkish mauve-grey. Pale greyish soredia **45**

– White prothallus. Pale grey to green-grey thallus. Green to yellow-green soredia **46**

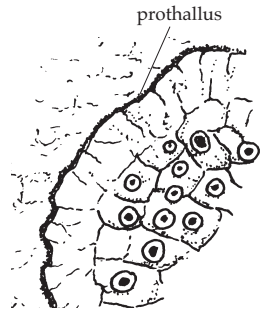


Fig. 83. Position of prothallus on the margin of a lichen

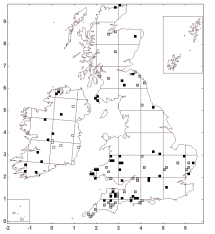
45. Thallus mauve-grey to brown-grey. Paler soredia. Shaded, rough bark **Schismatomma decolorans** (Ph. 117)
– Thallus pinkish to pale grey. Pale grey soredia that form a crust. On dry trees in old wodland **Schismatomma niveum**

46. Greenish grey, areolate thallus. On acid bark in woodland **Ropalospora viridis**
– Pale grey to grey green thallus, immersed often felt-like. Yellowish green soredia. Often with white pycnidia to 0.25 mm diam. Dry bark in shaded woodland**.** **Bacidia viridifarinosa**

47. Leprose or completely granular sometimes over a thallus **48**
– Crustose. Thallus often very thin. Thallus yellow-green to green or grey-green **52**

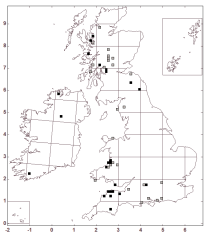
48. Thallus grey-green to black-green scattered, or a crust of granules. Fruits 0.2-0.3 mm diam, dark brown. On damp, shaded trees. Very common **Scoliciosporum chlorococcum**
– Thallus pale grey, blue-grey or grey-green **49**

49. Thallus covered in fine bluish green soredia. Fruits 0.1-0.3 mm diam, pinkish. On leaves and twigs **Fellhanera bouteillei**
– On rough bark or wood. Fruits 0.2–1.1 mm diam **50**


Fellhanera bouteillei

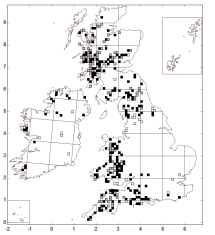
50. Thallus very finely granular, grey-green. Fruits buff to orange, globose. On shaded, humid trees **Mycobilimbia pilularis**
– Not fertile or with pycnidia to 0.3 mm tall, pruinose **51**

51. Thallus blue-grey. On sheltered, dry bark often forming large patches. No pycnidia. Very common**Lepraria incana** (Ph. 101)
Thallus pale grey to grey-green. Numerous pycnidia to 0.3 mm tall, grey-brown, pale pruina. On dry, sheltered rough bark or wood **Micarea doliiformis**


Halecania viridescens

52. Thallus green to green-brown covered in fragile pale green soredia. Fruits 0.2–0.4 mm diam, grey to dark brown. On slightly nutrient enriched branches. **Halecania viridescens**
– Fruit discs orange, pink to blue-black. Mainly on tree trunks **53**

53. Thallus grey-green. Fruits to 1 mm diam., disc orange-pink to buff. On sheltered trees and bases **Mycobilimbia pilularis**
– Thallus yellow-green, buff or bright green **54**


Mycobilimbia pilularis

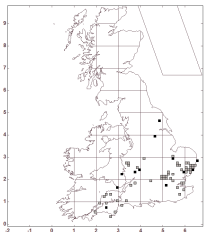
54. Thallus vivid yellow-green forming large patches on nutrient-enriched trees even in polluted areas. Fruits rare, 0.4–0.7 mm diam, pink to blue-black **Bacidia adastra**
– Thallus buff to bright green. Fruits 0.2–0.7 mm diam. white to orange pink. On shaded basic bark **Bacidia delicata**

55 . Thallus pale brown-grey. Pinkish soredia. Soralia usually remain separate. Old woodland **Schismatomma quercicola**
– Thallus grey to grey-green or green. Soredia not pinkish **56**

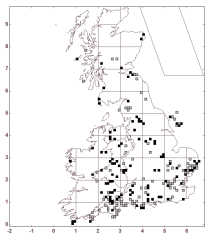
56. Thallus grey, limited by a zoned margin **57**
– Thallus grey-green or green when wet, no zoned magin **58**

57. Soredia taste bitter **Pertusaria amara** (Ph. 107)
– Soredia do not taste bitter **Pertusaria albescens**

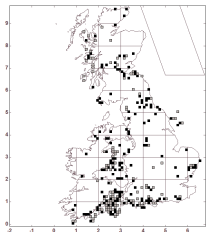
58. Fruits several in a wart under soredia (Ascus 1-spored). On acid bark in humid woodland **Pertusaria ophthalmiza**
– Soredia do not cover fruits **59**



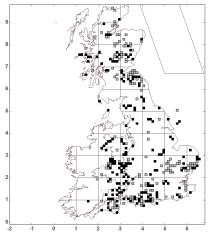
Bacidia adastra



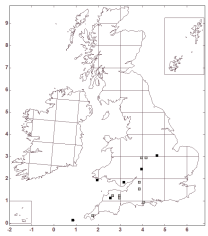
Bacidia delicata



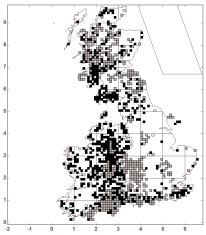
Bacidia viridifarinosa



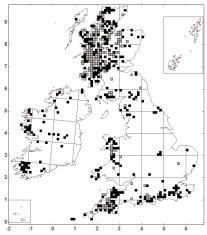
Caloplaca obscurella



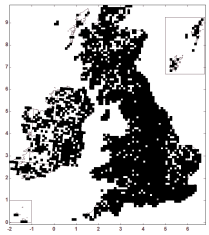
Fellhanera viridisorediata



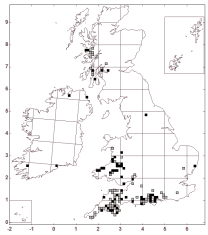
Fuscidea lightfootii



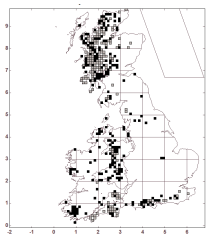
Loxospora elatina



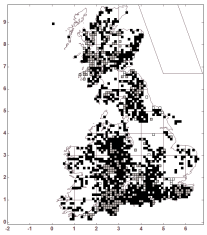
Lepraria incana



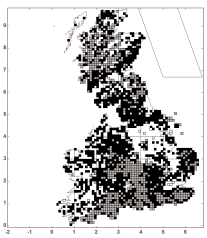
Micarea doliiformis



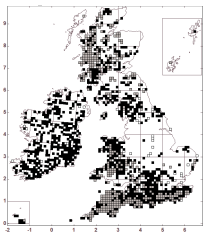
Mycoblastus caesius



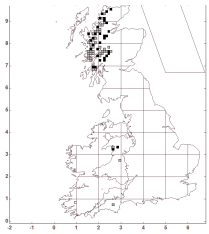
Pertusaria albescens



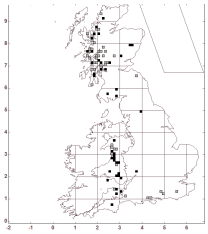
Pertusaria amara



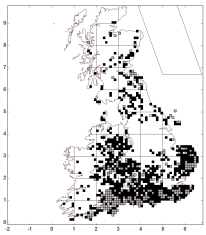
Pertusaria hymenea



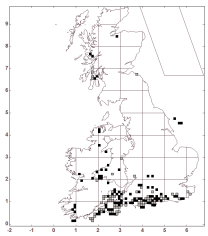
Pertusaria ophthalmiza



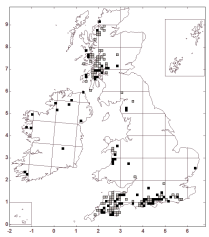
Ropalospora viridis



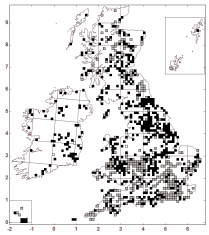
Schismatomma decolorans



Schismatomma niveum



Schismatomma quercicola



Scoliciosporum chlorococcum

59. Soralia 0.1-0.3 mm diam, concave. Soredia grey-green to blue-green. Grey to blue-black prothallus sometimes present (Fig. 83). On nutrient enriched basic bark **Caloplaca obscurella**

– Soralia larger not concave, soredia green. No dark prothallus **60**

60. Finely granular. Mainly on tree bases. Pollution resistant. Fruits rare, discs brown **Fellhanera viridisorediata**

– Warted, large granular. Mainly on twigs and branches. Fruits common, disc dark brown to black **Fuscidea lightfootii** (Ph. 89)

Key D – Section 3 Subsection 3(d). Thallus not sorediate, isidiate or a granular crust but may be absent or consist of scattered granules.

1. Arthonioid. Irregular shaped fruits that erupt from the thallus without any margin (Fig. 84). Usually in sheltered sites **2**

– Fruits lecanorine or lecideine. Fruits with a margin (Fig. 85) or absent **11**

Fig. 84. Arthonioid fruits x20

2. Thallus C+ red. Grey to warm brown. Fruits immersed to 1mm diam, brown but grey pruinose. On dry side of old trees **Arthonia pruinata** (Ph. 74)
– Thallus C– **3**

3. Fruits K+ orange, red or purple. On smooth bark **4**
– Fruits K– or faint yellow. Habitats various **7**

4. Fruits to 1.5 mm diam **5**
– Fruits to 0.6 mm diam **6**

5. Fruits often branched, purple brown, reddish pruina along margins. Smooth bark **Arthonia elegans**
– Fruits unbranched, black, no pruina. Look like tar spots. On very shaded basic bark, often near base **Arthonia spadicea** (Ph. 75)

6. Brown prothallus. Fruits white to red pruinose with orange margins, often in small groups. **Arthonia cinnabarina** (Ph. 72)
– No prothallus. Fruits not pruinose **Arthonia vinosa**

7. Thallus white to pale grey. Fruits to 2 cm long, branched crowded. Forms mosaics with other smooth bark species separated by black prothallus **Arthonia radiata (Ph. 73)**
– Fruits to 0.8 mm diam. No prothallus **8**

8. Thallus green-grey to brown-grey, scurfy to granular. Forms patches to 5 mm diam. Mainly on twigs **Arthonia muscigena**
– Thallus immersed or white to fawn or pinkish. Larger thalli **9**

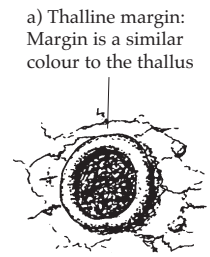
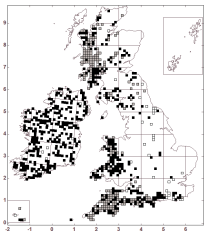
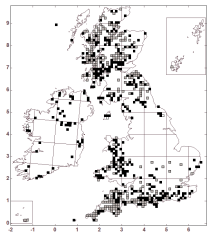
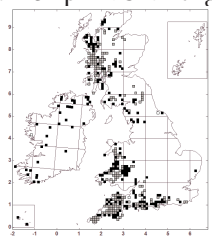
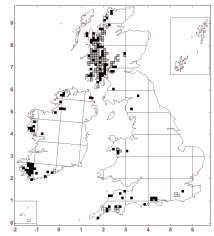


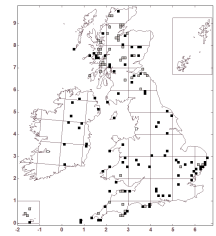
Fig. 85. a and b. Types of fruit margins x5
a: Lecanorine
b: Lecideine

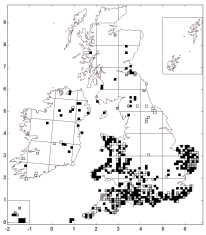

Arthonia cinnabarina

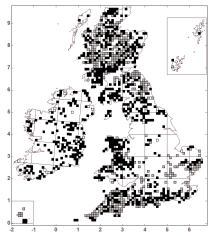

Arthonia didyma

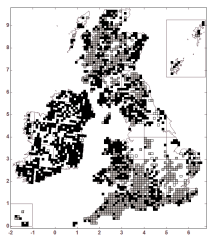

Arthonia elegans

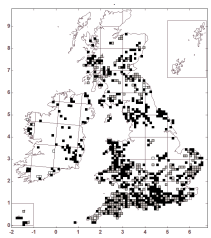

Arthonia ilicina

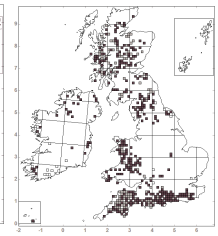

Arthonia muscigena


Arthonia pruinata


Arthonia punctiformis


Arthonia radiata


Arthonia spadicea


Arthonia vinosa

9. Thallus fawn to pinkish. Fruits red-brown to purple-black. Common on smooth bark especially hazel **Arthonia didyma**
– Thallus immersed, white or cream. Fruits dark brown to black **10**

10. Thallus immersed. No prothallus. Fruits black to 0.25 mm diam, often elongate. Common on twigs **Arthonia punctiformis**
– Thallus white to cream, brown prothallus. Fruits dark brown from 0.2 to 2 mm. In old oceanic woodlands **Arthonia ilicina**

11. Thallus, fruits or medulla K+ yellow, orange red or crimson **12**
– Thallus K– **Subsection 3(d/iii) page 84**

12. Any part (mainly fruits) K+ bright crimson **13**
– Thallus, fruits or medulla K+ yellow, yellow-brown or red **16**

13. Thallus greenish fawn, deeply cracked. Fruits K+ up to 0.8 mm diam, yellow darkening with age. Mainly on horizontal wood near the ground, often urban **Caloplaca crenulatella**
– Thallus immersed white or grey **14**

14. Fruits to 0.3 mm diam, in clusters. Basic, nutrient enriched bark. (Ascus 12- to 16-spored) **Caloplaca cerinella**
(If ascus is 8-spored **Caloplaca cerinelloides**)
– Fruits larger 0.3 to 2.0mm diam **15**

15. Fruits abundant, orange, 0.3-0.6 mm diam. Rare, rough bark of *Acer*, often in wound tracks **Caloplaca luteoalba**
– Fruits scattered, to 2 mm diam, orange with a grey margin. On unpolluted basic bark **Caloplaca cerina** (Ph. 82)

16. Thallus K+ yellow turning red after a few seconds **17**
– Thallus K+ persistent yellow or yellow-brown **18**

17. Thallus thin, cracked. Fruits dark red-brown to black, to 1mm diam. On smooth bark **Buellia erubescens**
– Thallus cracked or warted, often with a white prothallus. Fruits 0.2-0.3 mm diam in powdery warts. Disc grey to reddish. On smooth bark **Phlyctis agelaea**

18. Thallus K+ yellow-brown, grey cracked. Fruits usually abundant, to 2.5 mm diam. Black loose spores rub off on fingers) On acid bark, fences etc. **Cyphelium inquinans** (Ph. 122)
– Thallus K+ yellow **19**

19. Thallus K+ yellow. Fruits lecanorine (Fig. 85) **20**
– Thallus K+ yellow. Fruits lecideine **32**

20. Parasitic on *Lecanora varia*. Greenish brown thallus and darkens fruit disc. K reaction weak **Ramboldia insidiosa**
– Not parasitic **21**

21. Fruit disc black **22**
– Fruit disc coloured, not black **24**

22. Fruits to 1.5 mm diam. Rarely with grey prothallus. On well-lit rough barked trees. (Spores brown, 1-septate)
Rinodina roboris (Ph. 116)
– Fruits to 3 mm diam. White or black prothallus. (Spores colourless, simple) **23**

23. Thallus white to pale grey, knobbly. Many fruits have a thin, wavy pale margin (Fig. 86) **Tephromela atra**
Cut through a fruit vertically. Cut edge has a dark purple-red tinge, especially when wet. Base of thallus next to substratum not orange and not K+ purple (Fig. 88)
– Thallus white to greenish grey. Fruits neat, with thick, pale, circular, smooth margin (Fig. 87) **Lecanora gangaleoides**
Cut edge of vertical fruit section has a greenish tinge. Base of thallus next to substratum often orange and K+ purple (Fig. 87a)

24. Fruits in fertile warts bulging from the thallus a with pore like opening **25**
– Fruits disc shaped, open. **26**

25. Fruits several per globose wart (Fig. 88). Smooth or rough bark. (Asci mainly 2 spored) **Pertusaria pertusa** (Ph. 110)
– Fruits single in flat topped warts (often elliptical). On smooth bark. (Asci mainly 4 spored) **Pertusaria leioplaca** (Ph. 109)

Fig. 86. *Tephromela atra* x10

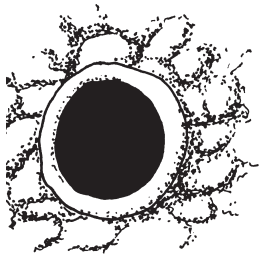


Fig. 87. *Lecanora gangaleoides* x10

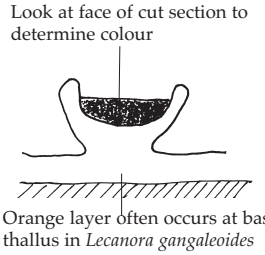


Fig. 87a. Section through *Lecanora gangaleoides*/ *Tephromela atra*

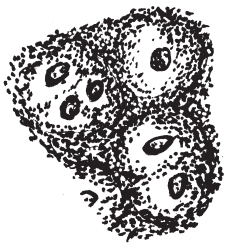


Fig. 88. Warted apothecia in *Petrusaria pertusa* x6

26. Discs very pruinose when mature **27**
– Discs not or slightly pruinose when mature **28**

27. Fruits to 1.5 mm diam, buff to pale mud (C–). On twigs and smooth bark of rather acid trees **Lecanora albella** (Ph. 95)
– Fruits to 1mm diam, brown-grey (C+ yellow). On basic, small trees and branches **Lecanora carpinea**

28. Fruits to 3 mm diam. Wide margin that looks inflated, pruinose when young, orange to reddish brown. On smooth barked trees **Lecanora intumescens**
– Fruits to 1.5 mm. Margins narrow, not 'inflated', not or slightly pruinose, brown to red-brown **29**

29. Thallus grey to yellowish grey. Milk chocolate to almost black disc. Mainly on sawn wood **Lecanora pulicaris** (Ph. 124)
– Thallus white to yellowish grey. Fruits red-brown or piebald **30**

30. White fimbriate margin. Thick, warted thallus. Abundant fruits in centre. On wood, uncommon **Lecanora campestris** (Fig. 89)
– Black or no prothallus.Common on mainly smooth bark **31**

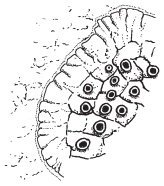
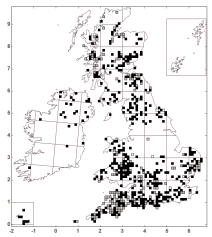


Fig. 89. *Lecanora campestris* x2

31. Black prothallus. Overlooked for *L chlarotera* but beware of a dark prothallus belonging to other species that may form a mosaic with it **Lecanora argentata**
– No prothallus. On bark and wood **Lecanora chlarotera**

32. Knob-like or cylindrical, pruinose pycnidia **33**
– No knob-like or cylindrical, pruinose pycnidia **34**

33. Pycnidia tipped with C+ red, white pruina. Fruits with buff-grey pruina. Shaded acid barked trees **Lecanactis abietina** (Ph. 93)
– Pycnidia tips C–, K+ yellow, white pruina. Fruits unknown. On shaded, old, acid barked trees (mainly oak) and ivy stems **Lecanactis subabietina**
(If pycnidia tips C–, K–. On basic bark**Opegrapha vermicellifera**)



Opegrapha vermicellifera

34. Fruits to 2mm diam **35**
– Fruits to 1 mm diam **37**

35. Fruits globular and leave a carmine spot when removed. On trees especially hazel **Mycoblastus sanguinarius** (Ph. 103)
– Fruits do not leave a carmine spot when removed **36**

36. Fruits to 2 mm diam, matt with glossy margins, flat to convex, often in groups. Basic bark in old woods **Megalaria grossa**
– Fruits to 1.5 mm diam, matt, concave. On acid bark, especially conifers and birch **Mycoblastis affinis**

37. Thallus cracked and glossy. Normally fertile. Fruits to 1 mm diam. No pycnidia. Smooth bark **Buellia disciformis** (Ph. 79)
– Thallus smooth or warted or areolate. Usually infertile but with numerous black pycnidia to 0.5 mm diam. **38**

38. Thallus smooth or warted. Pycnidia to 0.2 mm diam, black. On dry side of trees. Common **Cliostomum griffithii** (Ph. 85)
– Thallus of convex, warted areoles with a greasy shine. Very rarely fertile. Pycnidia to 0.5 mm with a pale tip. On old wooden structures. Rare **Cliostomum corrugatum**

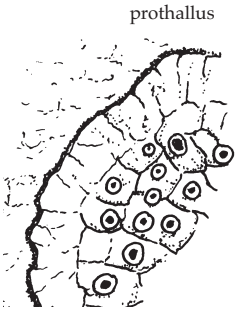


Fig. 90. Position of prothallus on the margin of a lichen

39. Any part C+ yellow, red or orange **Subsection 3(d/ii)** **40**
– All parts C– **Subsection 3(d/iii) page 84**

40. Fruits or disc pruina C+ deep orange-red to red **41**
– Thallus C+ yellow, orange or red or fruits only C+ yellow **42**

41. Disc pruina only C+ red. Fruits to 5 mm diam, pink-brown, pale pruina. white prothallus (Fig. 90). Rare on trees but common on stone **Ochrolechia parella**

– Fruit margin C+red. Thallus pale grey, soft, C+ orange-red. Fruits to 8 mm diam. Brown to orange. Zoned pale prothallus. On leached acid bark **Ochrolechia tartarea**

42. Thallus C+ yellow or orange or fruits only C+ yellow **43**

– Thallus C+ red **48**

43. Fruits C+ yellow, to 2.5 mm diam, scattered. Thallus yellow-grey, thin, smooth, black prothallus. On acid bark in damp woods **Ochrolechia szatalaensis**

– Thallus or fruit disc C+ orange or yellow **44**

44. Fruit disc C+ yellow to orange. Thallus pale grey in neat patches. White prothallus. Fruits brown, white pruina. On smooth bark and twigs **Lecanora carpinea**

– Thallus C+ orange or yellow **45**

45. Thallus grey to pale buff, C+ yellow. Fruits to 5 mm, pink-brown, pale pruinose, white prothallus **Ochrolechia parella**

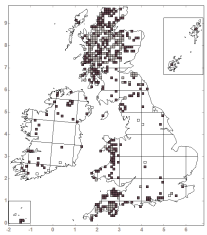
– Thallus C+ orange. Green yellow-grey or green-grey **46**

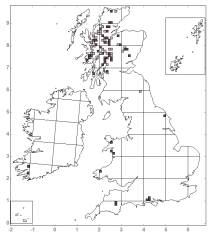
46. Thallus thick with deep cracks. Fruits in warts to 2mm diam. Disc brown to grey black, often pruinose. On trees (often shaded) **Pertusaria hymenea** (Ph. 108)

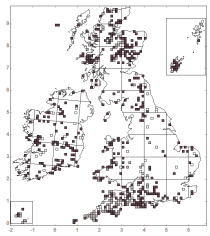
– Thallus fairly thin. Fruits not in warts **47**

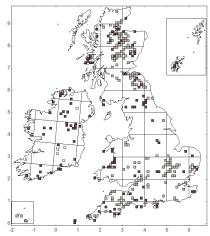
47. Thallus yellow grey. Fruits to 1 mm diam black, black prothallus. On smooth bark **Lecidella elaeochroma** (Ph. 100)

– Thallus green to yellow grey. Fruits to 0.7 mm diam, pale margins. On smooth bark **Lecanora confusa** (Ph. 97)


Buellia disciformis


Buellia erubescens


Caloplaca cerina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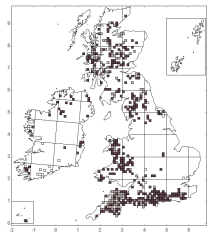
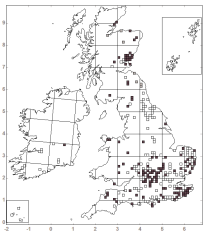
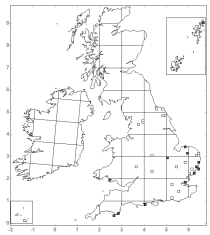
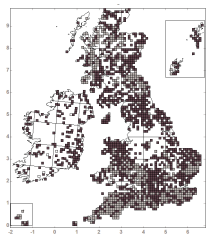
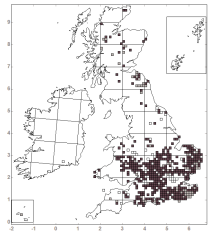
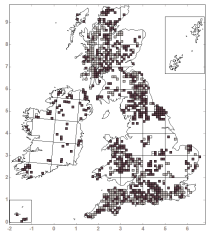

Caloplaca crenulatella

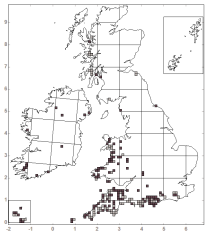

Caloplaca luteoalba

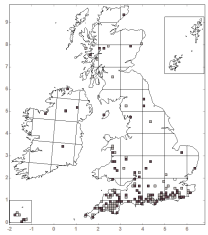

Cliostomum corrugatum

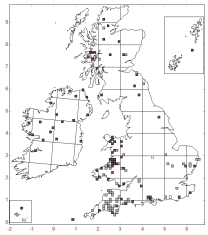

Cliostomum griffithii

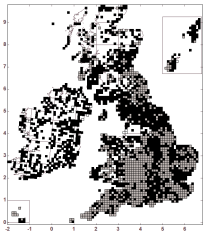

Cyphelium inquinans

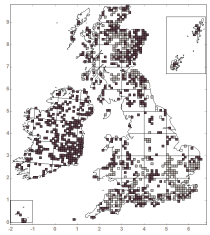

Lecanactis abietina

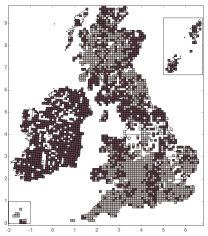

Lecanactis subabietina


Lecanora albella

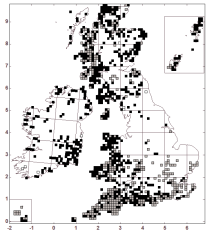

Lecanora argentata


Lecanora campestris

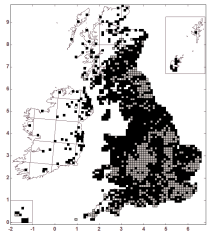

Lecanora carpinea



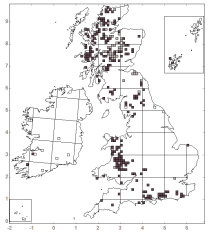
Lecanora chlarotera



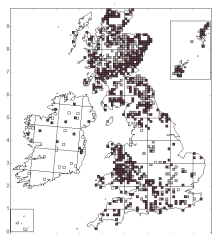
Lecanora confusa



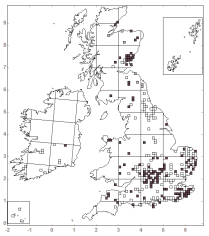
Lecanora gangaleoides



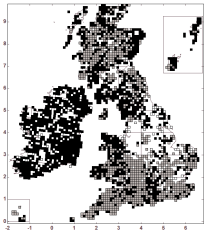
Lecanora intumescens



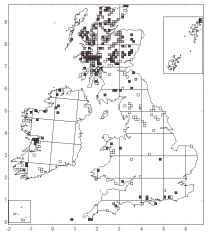
Lecanora pulicaris



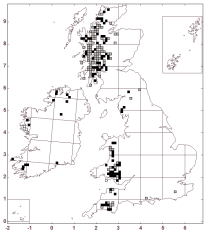
Lecanora varia



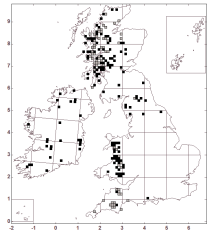
Lecidella elaeochroma



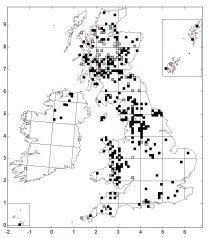
Megalaria grossa



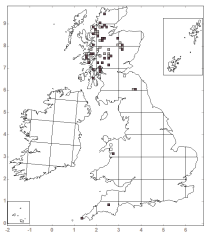
Micarea alabastrites



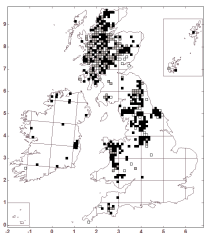
Micarea cinerea



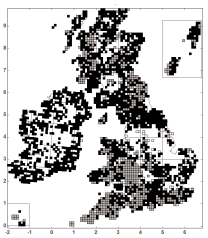
Micarea melaena



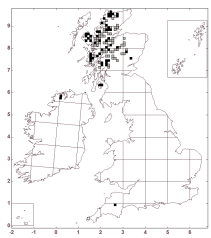
Mycoblastus affinis



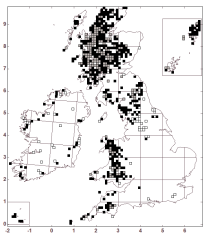
Mycoblastus sanguinarius



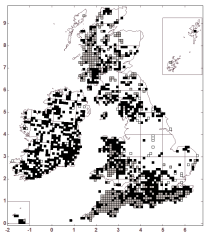
Ochrolechia parella



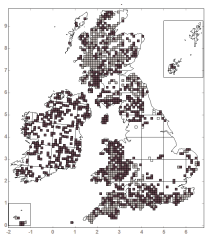
Ochrolechia szatalaensis



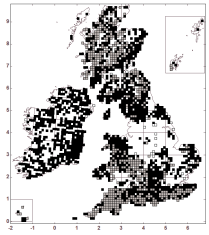
Ochrolechia tartarea



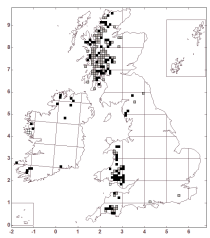
Pertusaria hymenea



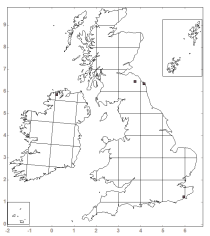
Pertusaria leioplaca



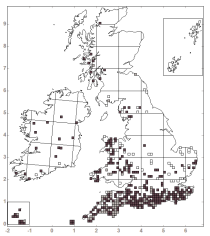
Pertusaria pertusa



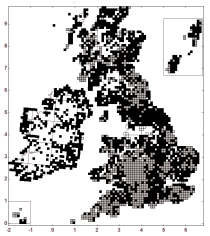
Phlyctis agelaea



Ramboldia insidiosa



Rinodina roboris



Tephromela atra

48. Thallus of granules about 0.1 mm diam, grey-green to pale buff or forming a black crust. Fruits abundant, black, to 0.4 mm diam. On trees, stumps, and sawn wood **Micarea melaena**

– Thallus immersed or areolate, grey-green. Fruits white to grey **49**

49. Thallus scurfy or areolate Fruits white, 0.2–0.7 mm diam. On damp bark or wood **Micarea alabastrites**

– Thallus immersed or areolate. Fruits white to dark grey, 0.2–1.3 mm diam. Pycnidia 0.16–0.3 mm diam**Micarea cinerea**

Subsection 3(d/iii) – Thallus not sorediate, isidiate or granular. All Parts K– and C–

1. Fruits lecanorine (Fig. 89) **2**
– Fruits lecideine **15**

2. Thallus grey to brown on an inconspicuous dark hypothallus. Fruits to 2 mm diam with nodular margins **Protopannaria pezizoides**
– No dark felted hypothallus **3**

3. Fruits in warts with detached proper margin giving a barnacle appearance. On smooth bark **Thelotrema lepadinum** (Ph. 118)
– Fruits not as above **4**

4. Thallus with a dark or light prothallus, at least in parts **5**
– No prothallus. (If no result, try above) **9**

5. Thallus grey to green-brown. Prothallus dark grey. Fruits to 1.6 mm diam, discs dark brown to black. On smooth bark especially ash or twigs **Rinodina sophodes**
– Fruits to 0.6 mm diam. If larger, disc glossy orange-brown **6**

6. Thallus grey, to 2 cm diam, dark prothallus. Fruits to 0.5 mm, orange-brown disc. On twigs and nodes **Lecanora persimilis**
– Thallus white to creamy with white or pale brown prothallus **8**

7. Fruits 0.2–0.6 mm diam, red-brown to black, margins become excluded. On twigs, acid bark and wood **Lecanora aitema**
– Fruits to 2.5 mm diam, in groups, glossy, orange brown, wavy margin. On deciduous trees **Lecanora horiza**

8. Fruits buff to grey-pink. Thallus filmy **9**
– Fruits brown to black or piebald. Thallus immersed to thick **10**

9. Fruits to 0.5 mm, abundant convex margins becoming excluded. Rough nutrient-enriched bark. (Asci 8-spored, spores 3–5 μm wide) **Lecania cyrtella**
– As above but on shaded basic, not nutrient enriched bark. (asci 8-spored, spores 2–4 mm wide) **Lecania cyrtellina**
(If asci 12– to 16–spored. Mainly on aspen in E. Scottish Highlands.) **Lecania sambucina**

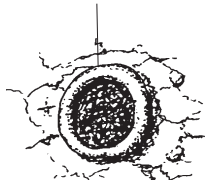
10. Fruits to 3.5 mm diam, concave with wavy margins when old. Disc red-brown to brown-black. On wood and dead thrift. Coastal **Lecanora zosterae**
– Fruits to 1 mm diam. Not strictly coastal **11**

11. Thallus of dispersed granules. Grey to yellowish grey. Fruits abundant to 1.1 mm diam. Discs pale red-brown, abundant, sometimes pruinose. Minute red-brown pycnidia common. On well-lit wood, especially fences **Lecanora saligna** (Ph. 126)
– Thallus continuous or immersed. No abundant pycnidia **12**

12. Thallus smooth yellowish white to green. Small patches amongst other lichens, fruit discs white to brown-black or piebald. Nutrient-enriched bark and twigs **Lecania naegelli**
– Thallus immersed or grey. Fruit discs brown to black **13**

13. Thallus smooth, oily looking grey. Fruits to 0.5 mm diam. Discs red-brown, pruinose or not. On neutral bark **Lecanora hagenii**
– Thallus grey, greenish to brown-grey or grey, thin, not oily. Fruit discs dark brown to black. To 1 mm diam. **14**

a) Thalline margin: Margin is a similar colour to the thallus



b) Proper margin: Margin is dark and not the same colour as the thallus

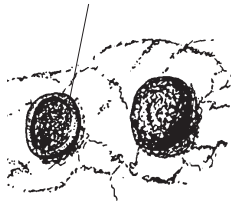
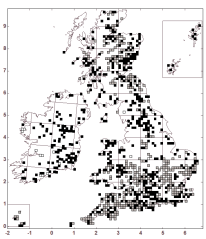
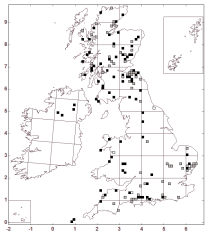
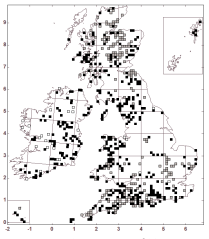
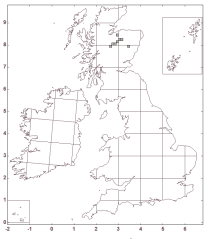


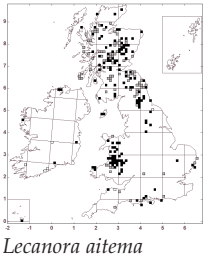
Fig. 91. a and b. Types of fruit margins x5
a: Lecanorine
b: Lecideine

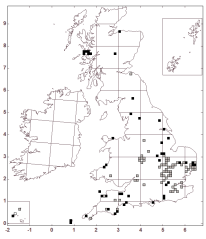

Lecania cyrtella

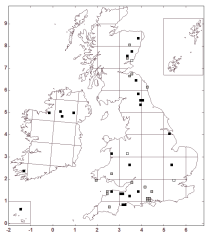

Lecania cyrtellina

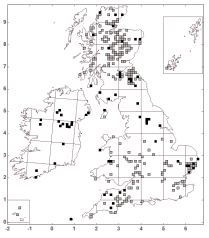

Lecania naegelii

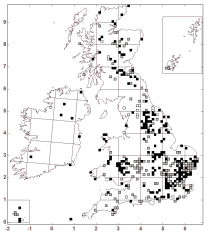

Lecania sambucina

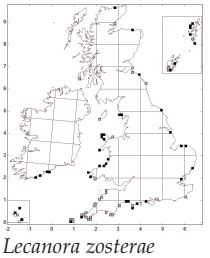

Lecanora aitema

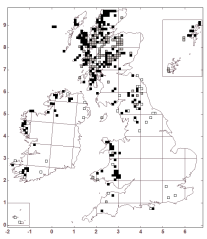

Lecanora hagenii

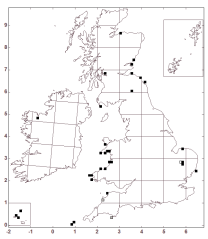

Lecanora horiza

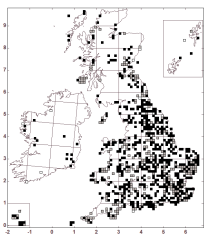

Lecanora persimilis

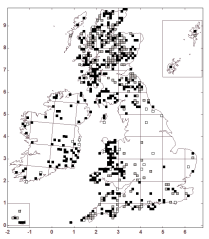

Lecanora saligna

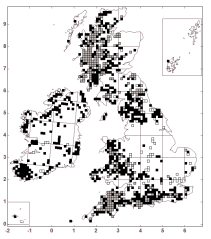

Lecanora zosterae


Protopannaria pezizoides


Rinodina conradii


Rinodina oleae


Rinodina sophodes


Thelotrema lepadinum

14. Thallus grey greenish or brownish, cracked. Fruits to 0.6 mm diam. On bark or wood **Rinodina oleae**

– Thallus pale grey to brownish, flat or slightly warted. Fruits to 1.0 mm. On bark and wood (spores 3-septate**)** **Rinodina conradii** **(**If more than 3-septate, usually in damp crevices or dead horizontal branches. Distribution unclear **Rinodina intermedia**)

15. Fruit discs white, flesh, buff, orange, pink, yellow or pale brown **16**

– Fruit discs brown, red-brown, grey or black **24**

16. Thallus yellow-grey or yellow-green or white or fruit discs yellow pruinose **17**

– Thallus white, immersed, grey to grey-green or green **19**

17. Thallus white. Fruits immersed becoming sessile to 1 mm diam, disc pinkish orange often with a paler margin. Now rare, it occurs on ivy stems, ash and elm **Cryptolechia carneolutea**

– Thallus yellow-grey,yellow-green or discs yellow pruinose **18**

18. Thallus yellowish grey or immersed. Very fertile Fruits to 0.2 mm. Disc yellow-orange, lemon-yellow pruina. On conifers in the Caledonian forest, trees in SW ireland **Chrysothrix chrysophthalma**

– Thallus yellow-green, granular/areolate. Fruits to 0.5 mm. Disc flesh to pink. On basic, rough bark in shade
Thallus yellow-grey or yellow-green **Bacidia rubella** (Ph. 78)

19. Fruits white to pale pink. Numerous pycnidia to 0.3 mm diam **20**

– Fruits orange, buff, flesh or pale brown. Pycnidia or not **21**

20. Fruits 0.2–0.5 mm diam. often missing in summer. Numerous pycnidia to 0.2 diam. On shaded tree bases, in cracks and on wood **Dimerella pineti** (Ph. 123)
– Fruits 0.15–0.4 mm diam., persistent. Pycnidia 0.1–0.3 mm diam.Tree bases, leaves and twigs **Fellhanera subtilis**

21. Fruits to 2 mm diam, apricot orange, paler margins. In shade often growing over mosses. (Spores 1-septate)**Dimerella lutea**
– Fruit to 1 mm diam **22**

22. Fruits buff to orange pink, flat to globose to 0.5 mm diam,. Thallus warted or scurfy. On nutrient-rich, shaded basic trees **Bacidia phacodes**
– Fruits flesh buff or orange, concave, to 0.6 mm diam **23**

23. Thallus immersed, thin or scurfy, Fruits to 0.5 mm diam, buff, flesh or orange. On nutrient-rich well-lit bark (slightly muriform with 6 or more cells) **Gyalecta truncigena**
– As above, often in wound cracks, especially on ash (spores 5- to 13-septate) **Gyalecta derivata**
(If as *G. truncigena* but spores less than 6 cells, 9–17 x 6–11 μm. Probably the rare **G. flotowii**)

24. Fruits red-brown (often very dark) or pinkish/orange brown **25**
– Fruits purple-brown to black or grey **29**

25. Thallus pale grey to green-grey. Fruits abundant, red-brown to orange-brown, to 0.5 mm diam. On sheltered, old forest trees. (Spores 9–15 septate, pointed tips) **Pachyphiale carneola**
(If fruits darker brown and spores 3–7 septate with rounded tips (Fig. 90) on basic bark in Scotland. **Pachyphiale fagicola**)
– Fruits dark red-brown or brown, 0.2–0.8 mm diam, **26**

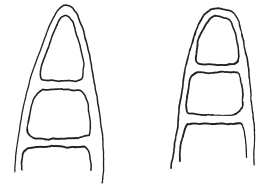
26. Thallus immersed or whitish, black prothallus. Fruits 0.2–0.5 mm diam, pale to dark red-brown. On smooth bark and twigs, especially willow **Japewiella tavaresiana**
– Thallus grey to grey-green or brown-green. No prothallus**.** Fruits 0.2–0.8 mm **27**

27. Thallus dark grey-green to green-brown, scurfy, areolate or flakey. Fruits red-brown to almost black, globose. On trees and wood. (Spores twisted in ascus) **Scoliciosporum umbrinum**
– Thallus pale grey-green or brownish grey **28**

28. Thallus grey to brownish grey, slightly warted. Fruits dark red-brown, translucent when wet, often in small groups. On well-lit trees, especially ash and elder **Strangospora pinicola**
(If on wood and fruits are not translucent when wet and may have a bluish tinge, It is the rare **Strangospora moriformis**)
– Thallus smooth and waxy, pale grey-green. Fruits pale to dark red-brown. On wood, stumps and loose bark **Micarea adnata**

29 . Fruits purple-brown to purple-black **30**
– Fruits grey or black **32**

30. Thallus grey to green-grey, smooth to slightly warted. Fruits to 1.2 mm diam, pinkish brown to black, abundant. On nutrient-rich, well-lit trees (spores 7–16 septate) **Bacidia laurocerasi**
– Thallus granular to warted, grey, grey-green or grey-brown. Fruits purple-brown to purple-black **31**



Pachyphiale carniola *Pachyphiale fagicola*

Fig.90. spore tips of *Pachyphiale* spores

31. Thallus green grey or pale brown, granular to warted. Fruits 1 mm diam, often with a paler margin **Bacidia incompta**
– Thallus grey-brown, immersed or minutely granular. Fruits to 0.8 mm diam, wide margin becoming excluded. On rough bark or over moss; an 'old forest species' **Catinaria atropurpurea**

32. Numerous pycnidia 1 mm tall, white or white tipped **33**
– No white or white tipped pycnidia **34**

33. Thallus greenish white to a black crust. Pycnidia up to 0.15 mm diam with white tips. On wood **Micarea denigrata** (Ph. 127)
– Thallus grey-green, areolate. Pycnidia whitish, stalks simple or branched. On leached bark in damp woods **Micarea stipitata**

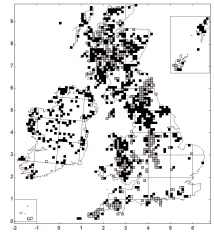
34. Fruits to 2.mm diam **35**
– Fruits to 0.6 mm diam **36**

35. Thallus green-grey to grey or immersed. Fruits to 2 mm diam usually thinly grey-green pruinose. On well-lit bark, especially oak, yew or beech (spores 4–5-septate) **Cresponea premnea**
– Thallus grey, smooth, cracked. Fruits to 1.5 mm diam, white pruinose, thin grey margin. Rare, on nutrient-enriched trees (mature spores submuriform) **Diplotomma alboatrum**

36. Thallus membranous, pale grey to green. Fruits to 0.6 mm diam, short furrowed stalks with up to 6 black fruits on each (Fig. 91) On mosses on trees **Gomphillus calycioides**
– Fruits not on tips of short stalks **37**

Fig. 91. *Gomphillus calycioides* x20

37. Thallus straw to dark green, scurfy granular. Fruits to 0.5 mm diam, convex. On tree bases or stumps **Micarea botryoides**
– Thallus grey, grey-green or buff **38**

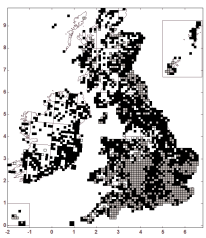


Micarea lignaria

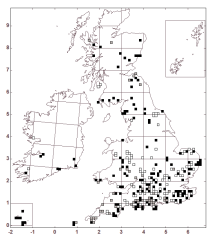
38. Thallus pale green or grey to blue-grey, rounded areoles. Fruits to 1 mm diam whitish to blue-grey or almost black. On acid barked trees **Micarea peliocarpa**
(In sections, fruits are C+ red if C– probably **Micarea lignaria**
– Fruits to 0.5 (rarely 0.8) mm diam, thallus smooth, or scurfy **39**

39. Thallus pale grey, greenish or brownish, smooth or scurfy. Fruits to 0.4 mm diam or rarely wart-like to 0.8 mm, grey-brown to black. On tree roots under overhangs **Micarea lutulata**
– On acid bark or wood. Thallus grey or grey-green **40**

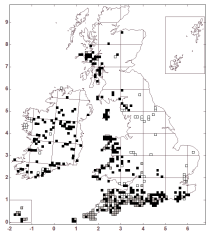
40. Thallus pale grey, smooth or cracked. Fruits 0.2–0.5 mm diam, black. On acid bark especialy oak or wood **Buellia schaereri**
– Thallus grey to grey-green or brownish, cracked or slightly areolate. Fruits to 0.6 mm diam. On nutrient-enriched bark or wood. Difficult to separate from *B schaereri* but it has a darker thallus and different shaped conidia
Amandinea punctata (Ph. 70)



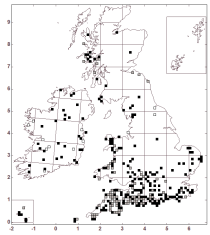
Amandinea punctata



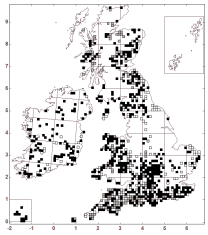
Bacidia incompta



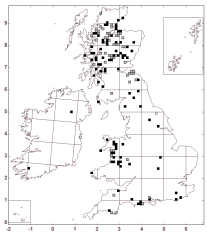
Bacidia laurocerasi



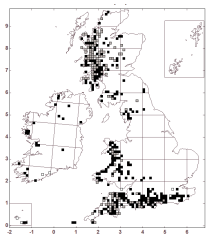
Bacidia phacodes



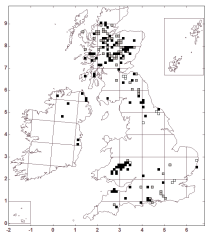
Bacidia rubella



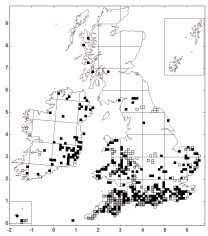
Buellia schaereri



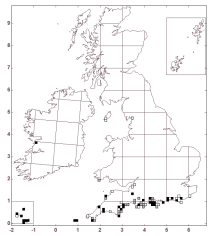
Catinaria atropurpurea



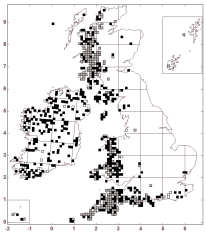
Chrysothrix chrysophthalma



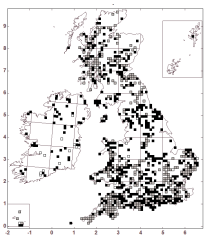
Cresponea premnea



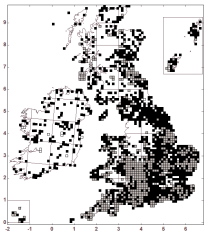
Cryptolechia carneolutea



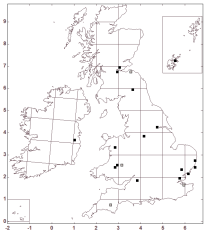
Dimerella lutea



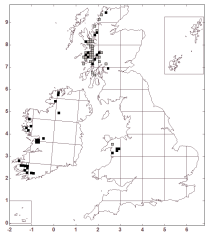
Dimerella pineti



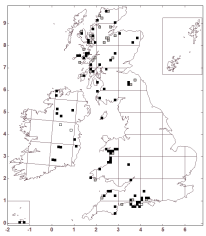
Diplotomma alboatrum



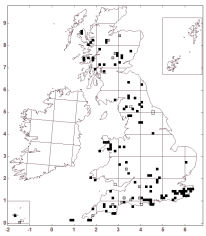
Fellhanera subtilis



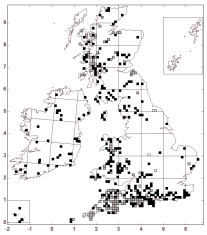
Gomphillus calycioides



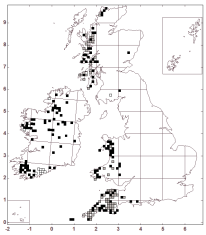
Gyalecta derivata



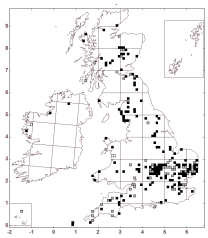
Gyalecta flotowii



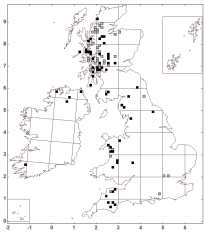
Gyalecta truncigena



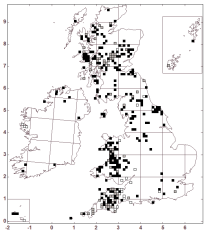
Japewiella tavaresiana



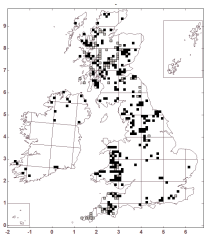
Lecidella carpathica



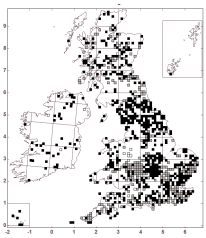
Micarea adnata



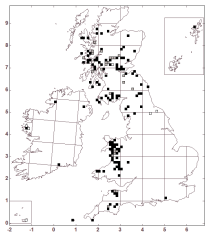
Micarea bauschiana



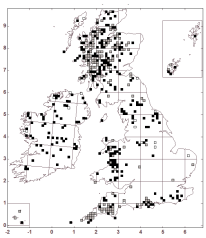
Micarea botryoides



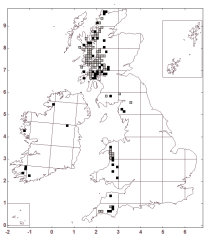
Micarea denigrata



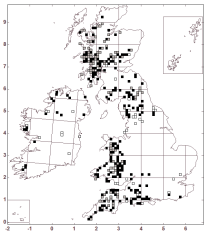
Micarea lutulata



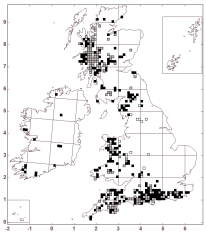
Micarea peliocarpa



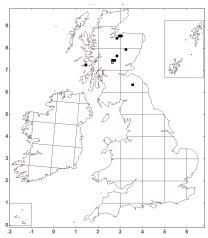
Micarea stipitata



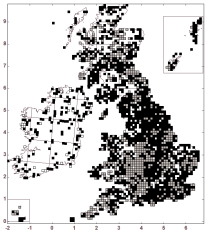
Mycobilimbia pilularis



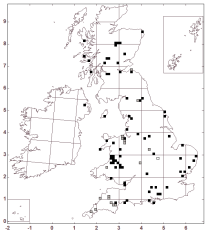
Pachyphiale carneola



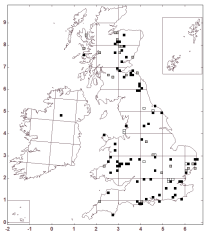
Pachyphiale fagicola



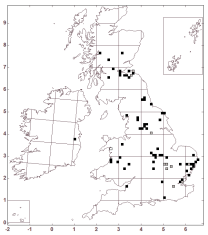
Scoliciosporum umbrinum



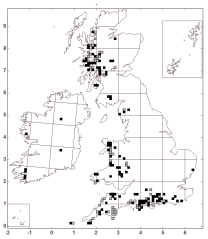
Steinia geophana



Strangospora moriformis



Strangospora pinicola



Thelopsis rubella

Key E – Lichens growing directly on bare or sawn wood (e.g. fences, gates and benches)

(The maps for these species will be found in the main key or at the end of this section)

1. Fruticose (Fig. 92) and *Cladonia* (Figs. 97, 98) or foliose (Fig.93) **2**
– Crustose (Fig. 94) including species with pin-like fruits (Fig. 100), placodioid (Fig. 95) or squamulose (Fig. 96) **75**

2. Fruticose or erect to pendent foliose **3**
– Foliose, more or less flat attached over whole lower surface **45**

3. Contains a central core if main stem or branch is pulled (*Usnea*) (Fig. 101) **4**
– No central core **8**

4. Black on or just above holdfast (Fig. 102) **5**
– Not black at basal holdfast **6**

5. Branches not constricted at junction with main stem. Rather bushy. Medulla K+ yellow or K– **Usnea subfloridana** (Ph. 4)
– Branches constricted at junction with main stem. becomes pendulous. K+ orange. **Usnea fragilescens**

6. Main branches angular in section, ridged, pitted and covered in long, thin isidia **Usnea hirta**
– Main branches rounded, not covered in long isidia **7**

7. Branches constricted where they join the main stem (Fig. 103) No pale annular rings . Olive-green **Usnea cornuta**
– Branches not strongly constricted at junction with main stem. Often with pale annular rings (Fig. 103). Yellow-green to green **Usnea flammea**

8. Main stems brownish with numerous short, finger-like side branches [all branches solid] **Sphaerophorus globosus**
– Various colours. Not with short, finger-like branches **9**

9. Fruiting bodies hollow, often growing from granules or squamules on the substratum (*Cladonia* species e.g. Figs. 97, 98)**10**
– Strap-like or hair-like lobes, fruiting bodies (if present) solid but the lobes may be hollow especially near the tip. **30**

10. Red tipped podetia **11**
– Brown tipped or no coloured tips to podetia **17**

11. Primary squamules dominant, to 1 cm diam, sorediate on lower surface, often orange at base **Cladonia digitata**
– Primary squamules not dominant, smaller and not sorediate **12**

12. Podetia cup-shaped **C. diversa** (Fig. 97)
– Podetia not cup-shaped and/or extensions growing from tip **13**

13. Yellow to yellow grey. Basal squamules to 1 cm diam **14**
– Grey to grey-green. Basal squamules much smaller **15**

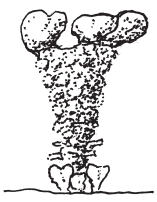


Fig. 97. *Cladonia diversa* x3

Fig. 98. *Cladonia polydactyla* x3

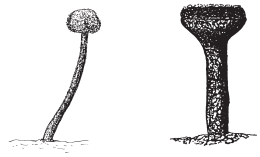


Fig.100. Pin-like fruits x 10

Fig.92. Fruticose lichen (*Ramalina* sp.) x1

rhizines on lower surface

Fig. 93. Foliose lichen (*Parmelia* sp.) x2

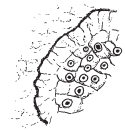


Fig. 94 Crustose species x2. These may, or may not, have a coloured margin.

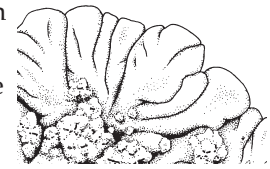


Fig. 95. Placodioid lichens
Above: Edge of wide lobed placodioid lichen (*Diploicia canescens*) x4
Below: Part of the edge of a crustose, placodioid lichen (*Caloplaca* sp.) x4

Fig. 96 Squamules x4 (above).
Section through squamule showing lack of lower cortex (below)

14. Podetia 2–5 mm tall. Basal squamules dominant, to 4 mm lon **C. incrassata**
– Podetia to 5 cm tall, often with split in side **C. sulphurina**

15. Extentions on tip of podetia **C. polydactyla** (Fig. 98)
– No extensions to tips of podetia **16**

16. Podetia squamulose to granular, usually K– **C. floerkeana** (Fig. 104))
– Podetia partially sorediate, K+ yellow **C. macilenta** (Ph. 64)

17. Podetia if present not dominant to primary thallus **18**
– Podetia large and dominant **19**

18. Podetia with squamules and granules. Primary squamules sorediate. K+yellow **C. parasitica** (Ph. 67)
– Podetia without squamules or granules, almost colourless, no soredia. K– **C. caespiticia**

19. Podetia terminate in a wide cup **20**
– Podetia do not terminate in a definite wide cup **23**

20. Podetia expand widely just below the tip. Finely sorediate **21**
– Podetia expand from the base. Coarsely sorediate (Fig. 24) **22**

21. Yellow-green, translucent when wet **C. carneola**
– Grey to green, not translucent **C. fimbriata** (Fig. 104, Ph. 63)

22. Podetia with medium size soredia **C. chlorophaea** (Fig. 105)
– Podetia with corticate granules/squamules **C. pyxidata**

23. Podetia not squamulose except sometimes near the base **24**
– Podetia with numerous squamules **27**

24. Podetia brownish green or grey **C. cornuta**
Podetia grey-green or green **25**

25. Podetia with antler-like tips (resembles Fig. 98), occurs on rotting wood) **C. subulata**
– Podetia with no or narrow cups, no antler-like tips **26**

26. Podetia to 2.5 cm tall, does not widen near tip **C. coniocraea** (Fig. 106**,** Ph. 65)
– Podetia to 5 cm tall, slightly wider at the tip **C. ochrochlora**

27. Thallus K+ yellow. Poditia almost covered in squamules formed by a peeling cortex **C. subsquamosa**
– Thallus K– **28**

28. Poditia almost covered in squamules formed by a peeling cortex **C. squamosa (**Ph. 69)
– Squamules not formed by peeling cortex, squamules brittle or podetia have a split in the side **29**

29. Squamules on poditia break off easily when dry. No slit in side **C. ramulosa** (Fig. 107)
– Squamules flexible. Podetia usually with slit in the side **C. glauca**

30. Not sorediate or isidiate **31**
– Sorediate or isidiate when mature **32**

31. Thallus K–. Fawn-grey lobes **Anaptychia ciliaris**
– Thallus K+ yellow. Grey lobes **Physcia leptalea**


Fig. 101. *Usnea* with central core x4


Fig.102. Black holdfast x5

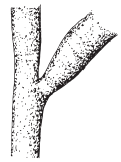


Fig. 103. Pale rings on *U. flammea* x7


Fig.104. *Cladonia floerkeana* x3


Fig. 104. *Cladonia fimbriata* x3

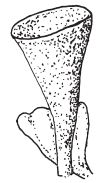


Fig. 105. *Cladonia chlorophaea* x3

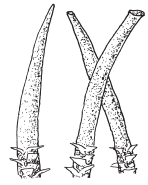


Fig. 106. *Cladonia coniocrea* x3

32. Soralia marginal or laminal, not in inflated lobe tips **33**
– Lobe tips inflated and split to reveal soredia
Ramalina canariensis (Fig.108)

33. Grey with white or black under-surface. Upper surface with numerous isidia when mature **Pseudevernia furfuracea** (Ph. 53)
– Yellowish to grey-green, green, brown or mauvish. Not isidiate **34**

34. C+ red cortex. Mauve-grey thallus. White soredia
Roccella phycopsis (rare, do not collect))
– C–. Yellowish to grey-green, green or brown thallus **35**

35. Strap-shaped at least near the base. Thallus yellow-green to grey-green or green **36**
– Not strap-shaped. Thallus brown, hair-like to 1mm diam. Pale soredia in splits **Bryoria fuscescens (**Fig. 109)

36. Numerous marginal, eyelash-like cilia (pale with dark tips, Fig. 110). Thallus pale grey to pale brownish grey. (Spores brown 1-septate) **37**
– No cilia. Thallus yellowish to grey-green, green. (Spores simple)**38**

37. Lobe tips swollen, helmet-shaped, bursting open to reveal powdery soredia (Fig. 111) **Physcia adscendens**
– Lobe tips not swollen, lip-shaped with powdery soredia on under surface (Fig. 110, 112) **Physcia tenella** (Ph. 50)

38. Under surface white often with green patches. Mature upper surface with soredia on ridges **Evernia prunastri** (Ph. 12)
– Green to yellow-green or grey-green, colour continuous on under surface. Upper surface without soredia on ridges **39**

39. Often fertile, not powdery, often glossy, sorediate
Ramalina siliquosa
(If matt, blackened at the base and at the pycnidia , rare on wood.
Ramalina cuspidata)
– Rarely fertile. Powdery soredia in swollen tips or in oval splits in sides of the branches **40**

40. Swollen areas towards tips of branches which open to reveal soredia (Fig. 114) **41**
– Not swollen towards tips of branches. Soredia in splits on the edges of branches **43**

41. Towards the tips of the lobes the upper and lower cortex splits to show the soredia **Ramalina canariensis** (Fig.108)
– Soredia not in splits in cortex but discrete soralia **42**

42. Lobes to 1 cm wide with ridges **Ramalina lacera** (Fig.114)
– Lobes to 0.5 cm wide without ridges **Ramalina pollinaria**

43. Lobes flattened towards the base, becoming rounded above and hollow, lobes shiny, to 1 mm wide, splitting to show soredia [K+ yellow turning red]**.** Very rare, SW and W **Ramalina portuensis**
– Lobes not hollow **44**

Fig. 113. *Ramalina farinacea* x5

Fig.114 Lobe tip of *Ramalina lacer*a x5

Fig. 107. *Cladonia ramulosa* x3

Fig. 108. Lobe tip of *Ramalina canariensis* x5

Fig.109. *Bryoria fuscescens* x2

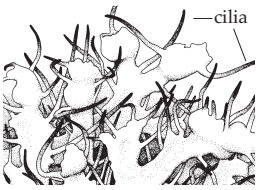


Fig. 110. *Physcia tenella*

Fig.111. Lobe tip of *Physcia adscendens*

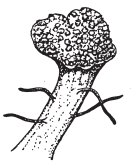


Fig. 112. Lobe tip of *Physcia tenella* x5

Fig.115. Lobe tip showing white marks

44. Grows from single basal holdfast **Ramalina farinacea** (Fig. 113)
– Grows from a multiple base, forming swards **Ramalina subfarinacea**

Foliose

45. Sorediate or isidiate **46**
– Not sorediate or isidiate **72**

46. Isidiate or with knobby outgrowths **47**
– Sorediate **54**

47. Upper surface grey **48**
– Upper surface orange-yellow, pale yellow-grey or shades of brown to near black **50**

48. White lines and dots on lobes (Fig. 115) develop into coralloid isidia (Fig. 116) **Parmelia saxatilis** (Ph. 40)
– No white lines or dots. **49**

49. Lobes to 0.8 mm wide, widening at tips, often wrinkled. Centre covered in granular to wart-like isidia. Rare **Physcia clementii**
– Lobes to to 3 mm wide.Very coralloid isidiate **Imshaugia aleurites** (Ph. 22)

50. Upper surface orange-yellow. Knobby outgrowths 0.1–0.7 mm diam. towards the centre, few or no fruits **Xanthoria calcicola** (If very fertile probably *Xanthoria parietina* (see couplet 74)
– Upper surface pale yellow-grey or brown or near black **51**

51. Upper surface pale yellow-grey to green. Lobes shiny. Coralloid isidia. [Medulla K+ yellow-orange. Lobes overlapping to 2 mm wide] **Xanthoparmelia conspersa**
– Upper surface brown to near black **52**

52. Dark brown. Lobes transversely wrinkled. Isidiate clusters (like broccoli). Medulla C– or C+ pink (rare on wood) **Xanthoparmelia verruculifera**
– Reddish to green-brown or near black. Lobes not transversely wrinkled. Coralloid isidia (Fig. 116). Medulla C+ red (Fig. 117) **53**

53. Green-brown often with reddish tinge, green when wet. Numerous coralloid isidia **Melanelixia glabratula**
(If lobe surface matt not glossy, isidia coarse and rather globose and erode to pale areas, ***Melanelixia subaurifera*** *is probable. These two species are difficult to separate without experience).*
– Dark brown to near black. Densely coralloid isidiate, can look almost like velvet. Rare on wood **Melanelixia fuliginosa**

54. Upper surface grey, yellowish grey, brown or black when dry. Often greener when wet **55**
– Upper surface yellowish green to green (at least near the margin. Centre may be blackish), yellow or orange. Usually little changed when wet **68**

55. Under surface pale but may be darker towards centre **56**
– Under surface dark brown to black almost to the edge **62**

56. Thallus K+yellow **57**
– Thallus K– **60**

57. Lobes with dark tipped cilia (Fig. 110) **58**
– Lobes lack cilia **59**

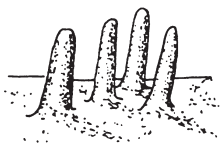


Fig. 116. Coralloid isidia x10

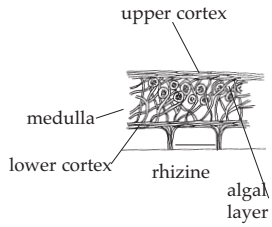


Fig. 117. Cross-section of foliose thallus x20

58. Lobe tips swollen, helmet-shaped, bursting open to reveal powdery soredia (Fig. 111) **Physcia adscendens**
– Lobe tips not swollen, lip-shaped with powdery soredia on back surface of lobe tip (Fig. 112) **Physcia tenella** (Ph. 50)

59. Globose soredia (often blue-flecked) in centre and apex of lobes. Lobes adpressed. Medulla/cortex K+ yellow **Physcia caesia**
– Soredia towards the tips, not blue flecked. Lobes separate, slightly convex. Medulla K–. Cortex K+ yellow **Physcia dubia**

60. Medulla (Fig. 117) C+ red (fleetingly). Lobes up to 1 cm wide. Grey to grey-green. Distinct pinhead, white markings on upper surface that become sorediate **Punctelia subrudecta** (Ph. 54)
– Medulla C–. Lobes to 4 mm wide **61**

61. Lobes overlapping with pruinose tips, to 2 mm wide. Thallus grey to brown, adpressed. Marginal and/or central coarse soredia, grey when dry, greenish when wet **Physconia grisea**
– Lobes sometimes pruinose, to 4 mm wide. Thallus grey, lobes separate, convex. Soralia on inner lobe tips **Arctoparmelia incurva**

62. Lobes hollow in cross section (Fig. 118). Attached to substrata by patches of fungal hairs **63**
– Lobes solid in cross section. Attached to substrata by root-like rhizines **64**

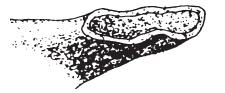


Fig. 118. Hollow lobe of *Hypogymnia* x4

63. Lobes flat with tips splitting to show powdery soredia on back of upper surface (Fig. 119) **Hypogymnia physodes** (Ph. 22)
– Lobes finger-like with soredia on tips (Fig. 120) **Hypogymnia tubulosa** (Ph. 23)

Fig. 119. Lobe of *Hypogymnia physodes* x4

64. Interior of thallus (medulla, Fig. 117) C+ red. Lobe tips down-turned **Hypotrachyna revoluta** (Ph. 25)
– Medulla C– **65**

65. Lobes to 1.5 mm wide, grey, grey-brown to almost black when dry, bright green when wet **Phaeophyscia orbicularis**
Lobes larger than 1.5 mm wide, grey to green when dry **66**

66. Medulla K+ yellow-orange **67**
– Medulla K–. [Towards the centre it is finely wrinkled across the lobes. Coarsely sorediate] **Flavoparmelia caperata** (Ph. 19)

67. No white lines or marks on lobes. Lobe tips turned up, sometimes with black 'eye lash' cilia on edges. Sorediate margins on lobes **Parmotrema perlatum** (Ph. 45)
– White lines and dots on lobes that develop powdery soredia along them. No cilia **Parmelia sulcata** (Ph. 41)

Fig. 120. Lobe of *Hypogymnia tubulosa* x4

68. Thallus orange, yellow to yellow-green, apple-green, yellow-grey or green. More or less flat, not upright **69**
– Thallus yellow-orange to orange. Lobes leaf-like to 2 mm long, becoming upright with powdery soredia on frilly tips **Xanthoria ucrainica** group inc. **X. candelaria** (Ph. 59)

69. Thallus orange-red. Lobes to 1 mm wide, separated, strap-like, convex **Xanthoria elegans**
– Thallus yellow-grey to green. Lobes to 15 mm wide variously shaped **70**

70. Thallus to 3 cm diam. Lobes 0.2–0.5 mm wide, elongated and separated **Parmeliopsis ambigua** (Ph. 44)
– Thallus to 20 cm diam. Lobes to 15 mm wide, overlapping flattened **71**

71. Medulla K–. Lobes to 15 mm wide, finely wrinkled towards centre **Flavoparmelia caperata** (Ph. 19)
– Medulla K+ yellow slowly turning to red. Lobes to 7 mm wide, rather flattened, as if ironed **Flavoparmelia soredians** (Ph. 20)

72. Thallus grey to dark brown **73**
– Thallus orange **74**

73. Lower surface dark. Attached by many dark, 'bottle-brush' rhizines (Fig. 120a). Pruinose lobe tips. K– **Physconia distorta**
– Lower surface pale. Attached by simple or branched rhizines. Lobe tips not pruinose. K+ yellow **Physcia aipolia** (Ph. 48)

74. Knobby outgrowths 0.1–0.7 mm diam. towards the centre. Few or no fruits **Xanthoria calcicola**
– No knobby outgrowths. Usually very fertile with fruits to 4 mm diam **Xanthoria parietina** (Ph. 57)

75. Lobed (placodioid Fig. 121) or scale-like (squamulose Fig. 122 **76**
– Crustose **80**

Squamulose or placodioid.

76. Squamulose. Squamules brown to green-grey **77**
– Placodioid. Thallus grey to green **79**

77. Thallus C+ red. Squamules to 2 mm diam, numerous and often overlapping, sorediate margins. Fruits often pruinose **Hypocenomyce scalaris** (Fig. 123, Ph. 60)
– Thallus C–. Squamules not overlapping. Not sorediate **78**

78 Squamules convex, sometimes ascending with incised margins, matt **Hypocenomyce caradocensis**
– Squamules mainly adpressed,entire margins, shiny **Hypocenomyce friesii**

79. White to pale grey lobes. Cream to yellow soredia. Fruits black but rare. (Fig. 121b) **Diploicia canescens** (Ph. 87)
– Grey to green lobes with pale edges. No soredia. Yellow to reddish brown fruits **Lecanora muralis**

Crustose, not placodioid

80. Without fruits, may have minute pycnidia 0.1-0.2 mm diam. (commonly infertile species) **81**
– With fruits which may be on stalks **96**

81. Thallus brown, minutely coralloid (Fig. 116). Often on post top [Thallus C+ red, best seen in a squash] **Placynthiella icmalea**
– Thallus not brown or finger-like **82**

82. Soredia C+ yellow. Thallus grey. Soralia grey in lines or covering thallus **Ochrolechia turneri**
– Thallus and/or soredia C– or C+ orange to red **83**

83. Thallus and/or soredia K+ yellow or yellowish red **84**
– Thallus and/or soredia K– **89**

Fig. 120a. Squarrose bottle-brush' rhizines'

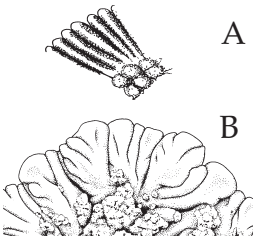


Fig. 121. Placodioid lichens
A: Part of the edge of a crustose, placodioid lichen (*Caloplaca* sp.) x4
B: Edge of wide lobed placodioid lichen

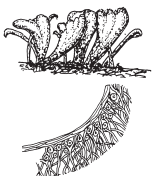


Fig. 122. Squamules x4 (above).
Section through squamule showing lack of lower cortex (below)

Fig. 123. *Hypocenomyce scalaris* x6

84. Thallus not sorediate, pale grey, numerous black pycnidia 0.1-0.2 mm diam **Cliostomum griffithii** (Ph. 85)
(If pycnidia 0.2–0.5 mm diam, E. Anglia on old barns, jetties and fences, mainly coastal, possibly the very rare **C. corrugatum**)
– Thallus sorediate **85**

85. Thallus grey-green, granular [becoming covered in coarse soredia which scratch to a paler colour] **Lecidella scabra**
– Thallus grey to yellow-green, smooth wrinkled or cracked **86**

86. Soredia grey to bluish green-grey, indigo or brown; may become pale yellow when scratched **87**
– Soredia pale yellow to yellow-green throughout **88**

87. Soredia bluish green-grey scratching to yellowish **Buellia griseovirens** (Ph. 80)
– Soredia brown to indigo, scratching to cream (Fig.129) **Xylographa vitiligo**

88. Thallus yellowish green, C– **Lecanora orosthea**
– Thallus grey. C+ yellow, orange or red **Lecanora expallens** (Ph. 98)

89 . Thallus C– **90**
– Thallus at least in parts C+ orange to red. **93**

90. Thallus membranous, gelatinous when wet **Steinia geophana**
– Thallus not gelatinous or membranous **91**

91. Thallus white to black, thin or just a dark stain. Frequently with white-tipped minute pycnidia. No soredia **Micarea denigrata** (Ph. 127)
– Thallus grey to green or yellowish. Thallus rather granular or sorediate **92**

Fig. 124. Apothecium of *Chaenotheca brunneola* x5

92. Coarse grey-green granules. **Lecanora conizaeoides** (Ph. 125)
– Pale grey thallus becoming covered with yellow-green soredia except at thallus margin. Not fertile **Lecanora compallens**

93. Soredia bluish green to dark blue green. Thallus blue-grey to green-grey of flattened granules **Trapeliopsis flexuosa** (Ph. 128)
– Soredia yellowish to grey. Thallus grey to pinkish, or thin and black. [Frequently on slightly decayed wood] **94**

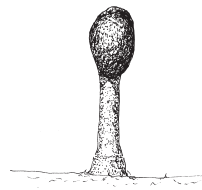


Fig. 125. Apothecium of *Stenocybe septata* x10

94. Thallus with orange patches that are K+ purple **Trapeliopsis pseudogranulosa**
– No K+ purple orange patches **95**

95. Thallus grey to pinkish, of rounded granules. Yellowish clumps of soredia frequently present **Trapeliopsis granulosa**
– Thallus pale grey to brown-grey, Becomes covered in yellowish green soredia with brown surface **Micarea leprosula**

Fig.126. Apothecium of *Calicium viride* x8

96. Fruits pin-like, indian club or golf-tee shaped (Figs.124-127). **97**
– Fruit types various, not stalked **107**

Stalked fruits

97. Fruits on a thin stalk or almost stalkess with a powdery, brown spore mass on tip of stalk (*Chaenotheca* species Fig. 124) **98**
– Fruits indian club or golf tee shaped. With or without powdery black spore mass (Figs. 124–127)) **103**

Fig. 127. Apothecium of *Calicium salicinum* x8

98. Thallus yellow to yellow-grey **99**
– Thallus orange, grey, green or absent **100**

99. Thallus granular to warted, bright yellow. Apothecia 0.6–1.3 mm tall **Chaenotheca chrysocephala**
– Thallus powdery, bright yellow-green. Apothecia 1.6–2.6 mm tall **Chaenotheca furfuracea** (Ph. 121)

100. Thallus pale grey to orange grey with orange patches (K+ red). Fruit stalks often very short **Chaenotheca ferruginea** (Ph. 84)
– Thallus green or grey or immersed **101**

101. Thallus granular to almost squamulose, greenish grey. White pruina on upper stalk and apothecial rim **Chaenotheca trichialis**
– Thallus immersed or a few granules **102**

102. Stalk to 1.4 mm tall. Stalk, apothecium spore mass covered in a greenish yellow pruina **Chaenotheca brachypoda**
– Stalk to 2 mm tall. Shiny black **Chaenotheca brunneola** (Fig. 124)

103. Fruits are indian-club shaped, without a loose spore mass **104**
– Fruits are golf tee shaped with a loose spore mass **105**

104. Fruits to 2 mm high. Mainly on holly **Stenocybe septata** (Fig.125)
– Fruits to 1 mm high. On alder **Stenocybe pullatula**
(Other similar but rarer genera are difficult to separate in the field, *Stenocybe* has 3-septate spores and *Phaeocalicium* and *Chaenothecopsis* has simple or 1-septate spores).

105. Thallus bright green to sulphur yellow, thick, granular. Often in cracks on rough bark **Calicium viride** (Fig 126, Ph.81)
– Thallus thin or absent, greyish **106**

106. Apothecia black or pale grey, open **Calicium glaucellum**
(*Calicium glaucellum* spores 9–13 x 5–7 µm. *Calicium abietinum* is similar but with spores 11.5–15 x 5–7 µm)
– Apothecia light to dark brown, almost globose
Calicium salicinum (Ph. 120, Fig 127)
(*Microcalicium* species are difficult to identify in the field but have green-black spore masses, *Calicium* have black spore masses)

Fruit types various, not stalked

107. Fruits stretched out in lines; lirellate (Ph. 105, Figs. 128, 129) **108**
– Fruits perithecia (Figs. 130, 131) or more rounded apothecia **111**

108. Fruits densely crowded, often branched
Opegrapha atra (Ph.105, Fig.128)
– Fruits separated, usually following the grain of wood **109**

109. Thallus sorediate **Xylographa vitiligo** (Fig. 129)
– Thallus not sorediate **110**

110. Fruits persistantly brown **Xylographa trunciseda**
– Fruits becoming black as they mature **Xylographa parallela**

111. Thallus brown or black **112**
– Thallus white, grey, yellow, orange, yellow-green or green **113**

112. Thallus black. Fruits perithecia (Figs. 130, 131). Occurs on or very near the coast **Verrucaria maura**
– Thallus and fruits brown to almost black. Thallus rather coralloid. Fruits apothecia (Figs. 132) **Placynthiella icmalea**

113. Fruits yellow or orange **114**
– Fruit colours various not yellow or orange **117**

114. Thallus and fruits K– **Candelariella vitellina**
– Thallus and/or fruits K+ crimson/purple **115**

Fig. 128. *Opegrapha atra* x10

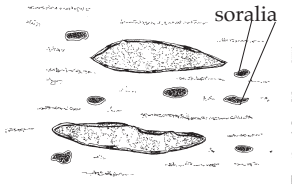


Fig. 129. *Xylographa vitiligo* x8

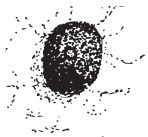
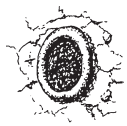


Fig. 130. Perithecium viewed from above x10

Fig. 131. Cross-section of perithecium x10



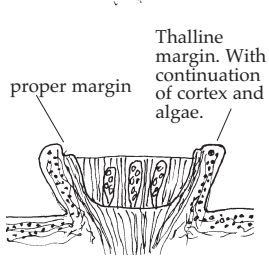


Fig. 132. Lecanorine apothecium x5 and cross-section x20

115. Disc margin grey. Fruit disc K+ crimson **Caloplaca cerina** (Ph. 82)
– Disc margin yellow-grey to deep orange. Thallus K+ crimson **116**

116. Thallus deep orange, granular, coastal **Caloplaca marina**
– Thallus whitish to yellow-green, areolate. Often a large isolated single thallus **Caloplaca flavovirescens**

117. Fruits lack a thalline margin (Fig. 133) **118**
– Fruits with a thalline margin (Fig.132) **127**

118. Sorediate. C+ orange **119**
– Not sorediate. Reactions various **120**

119. Densely sorediate. Thallus grey-green **Lecidella scabra**
– Soredia in discrete patches. Thallus yellow-grey to yellow-green to grey-green **Lecidella elaeochroma** f. **sorediata**

120. Spores loose in fruit. (Usually rub off as a black mark on the finger) **121**
Fruits firm, young fruits with a margin. Spores not loose **122**

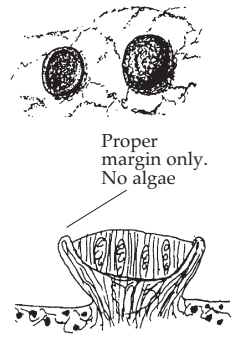


Fig. 133. Lecideine apothecia x5 and cross-section x20

121. Thallus white to dark grey **Cyphelium inquinans** (Ph. 122)
– Thallus bright yellow-green **Cyphelium notarisii** (Fig. 134)

122. Thallus C+ red. Thallus granular green to black crust **123**
– Thallus C– or C+ orange. Thallus variable **124**

123. Thallus cream to dark green, often just a black crust. Fruits 0.1– 0.4 mm diam. black **Micarea melaena**
– Thallus pale green to bluish grey. Fruits 0.3–1.3 mm diam cream to grey-black **Micarea cinerea**

124. Thallus yellow-grey to yellow-green, more grey-green in shade. C+ orange, K+ yellow **Lecidella elaeochroma** (Ph. 100)
– Thallus white, grey, brownish or green-grey. Spot reactions negative **125**

125. Fruits orange to red–brown, 0.2–0.5 mm diam. Thallus green-grey to dark grey (100–200 spores per ascus) **Strangospora pinicola**
– Fruits black, 0.2–1 mm diam (8 spores per ascus) **126**

126. Thallus greenish grey to dark grey, smooth to areolate. Fruits 0.2– 0.5 mm diam. **Amandinea punctata** (Ph. 70)
– Thallus white to grey, warted or granular. Fruits 0.5–1 mm diam **Lecidella carpathica**

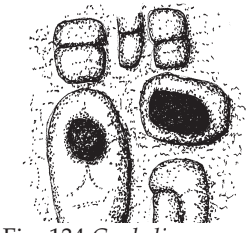


Fig. 134 *Cyphelium notarisii* x6

127. With granular or fine, powdery soredia **128**
– Not sorediate or thallus absent **131**

128. Thallus green-grey covered in granular soredia. Fruits with granular, persistent margins **Lecanora conizaeoides** (Ph. 125)
– Thallus grey or yellowish green with powdery soredia. Fruit margins smooth or becoming excluded by the disc **129**

129. Thallus/soredia K+ yellow to orange or yellow-brown **130**
– Thallus/soredia K–. Thallus yellowish green of flat-topped, often separate, areoles with powdery soredia in centre of each. (Fig. 135) **Lecanora soralifera**

130 . Thallus continously areolate with sorediate yellow margins, the soredia spreading out over the surface. K+ yellow turning brownish **Lecanora orosthea**
– Thallus grey becoming covered with with yellow-green soredia. K+ orange-yellow **Lecanora expallens** (Ph. 98)

131. Fruit disc brown, black, emerald, bluish green or brownish green or yellow turning blackish or black **132**
– Fruit disc persistently yellow to green **142**

132. Fruit disc green-brown to brown. Fruit margin persistent **133**
– Fruit disc black, bluish green, emerald, yellowish green turning blackish or black. Fruit margin persistent or not **139**

133. Thallus absent or yellowish to grey-green **Lecanora polytropa**
– Thallus white to creamy or fawn to grey **134**

134. Thallus with a white fimbriate, cottony margin **Lecanora campestris** (Fig. 136)
– No white fimbriate, cottony margin **135**

135. Thallus continuous, smooth to rough. Fruit margin circular except where distorted by pressure from other fruits (difficult to separate in this key and in the field) **136**
– Thallus granular, often thin but may form a crust. Fruit margin wavy, crenulate or excluded **137**

136. No prothallus. Fruit margins usually smooth and rounded **Lecanora chlarotera** (Ph. 96)
– White or dark prothallus often present, at least in parts. Fruit margins often slightly contorted **Lecanora pulicaris** (Ph. 124)

137. Fruits attached at centre up to 3.5 mm diam. Coastal on thrift and sawn wood **Lecanora zosterae**
– Fruits attached by the base up to 1.5 mm diam **138**

138. Discs pink to greenish brown. Fruits scattered to abundant.(*If some fruit discs are black, these are probably a parasitic lichen* ***Ramboldia insidiosa***) **Lecanora varia**
– Discs pale reddish brown. Fruits usually cover the thallus **Lecanora saligna** (Ph. 126)

139. Thallus creamy white to grey or absent. Fruit disc green-black to black **140**
– Thallus yellow to yellow-green, or grey-green. Areoles with notched edges. Fruits rather immersed in thallus. Disc brown-green to emerald-green **Lecanora intricata**

140. Fruits 0.2–0.5 mm diam. Green, red-brown turning black **Lecanora aitema**
– Fruits to 2mm diam. Black **141**

141. Thallus light to mid-grey. Disc margins often thin and irregular (Fig. 137, 139) **Tephromela atra**
– Thallus mid-grey to green-grey. Disc margins smooth and entire. (Fig. 138) **Lecanora gangaleoides**

142. Fruit margin persistent, except in mature fruits **143**
– Fruit margin absent or disappears very early in all fruits **Lecanora symmicta** (Ph. 99)

143. Fruits and thallus C– **Lecanora polytropa**
– Fruits and thallus C+ yellow to orange-red **144**

144. Fruit margin rarely excluded, paler than disc **Lecanora confusa** (Ph. 97)
– Fruit margin becomes excluded, not paler than disc **Lecanora expallens** (Ph. 98)

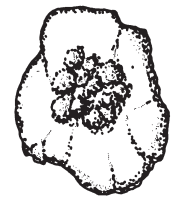


Fig. 135. Areole of *Lecanora soralifera* x6

Fig.136. *Lecanora campestris* x3

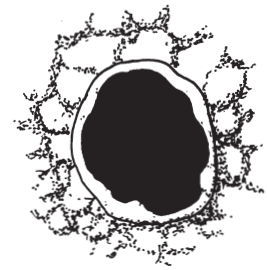


Fig.137. *Tephromela atra* x10

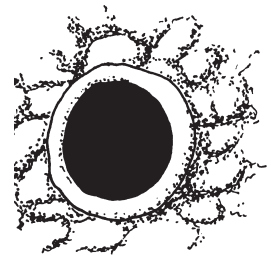
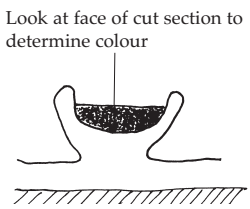
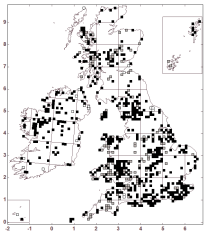


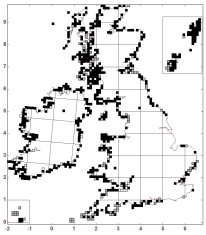
Fig. 138. *Lecanoa gangaleoides* x10

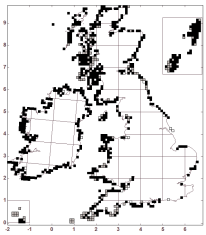


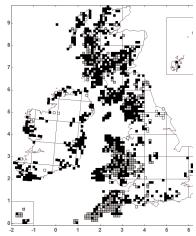
Orange layer often occurs at base of thallus in *Lecanora gangaeioides*

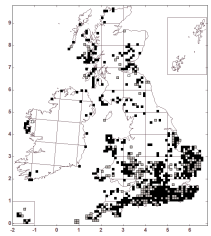
Fig.139. Section through *Lecanora gangaleoides*/ *Tephromela atra*


Caloplaca flavovirescens


Caloplaca marina


Verrucaria maura


Xanthopamelia conspersa


Xanthopamelia veruculifera

Notes on some rare species

Except where a site is given, the following species are listed as :infrequent, rare or very rare. It should be noted that a species that is rare in the context of the British Isles may be very abundant locally. These notes are brief and identifications are better confirmed using a flora.

Fruticose

Thallus to 10 cm long. Branches to 2 mm diam. dark grey to black, glossy. Soralia sparse or absent. On horizontal branches. N & W Britain. *Rare* **Bryoria chalybeiformis**

Thallus orange, K+ purple. Forming bushy tufts. Apothecia abundant, orange, to 5 mm diam with long spines on margins. Well-lit trees. *Very rare* **Teloschistes chrysophthalmus**

Thallus grey-green to yellow-grey, to 10 cm tall. Fish-bone like side branches to stems. Medulla K+ yellow-orange. Trees in open areas. *Rare* **Usnea fulvoreagens**

Foliose

Thallus K+ yellow, red or purple.

Thallus grey, lower surface black, hollow lobes to 3 mm wide. Soralia diffuse. On trunks of pines in Caledonian pine forest. *Rare but increasing* **Hypogymnia farinacea**

Thallus grey. Lobes to 1 mm wide with white to blue-grey soralia that burst open to reveal granular soredia. On conifers and fences. *Rare*. **Parmeliopsis hyperopta**

Thallus grey, brown at tips. Lobes have many pale psueudocyphellae and sharp edged ridges. Isidiate. On leached bark. NW Scotland, Northumberland *Rare*. **Platismatia norvegica**

Thallus orange, forming bushy tufts. K+ purple Abudantly fertile. Apothecia to 5 mm diam, long spines on.margins.Well-lit treees *Very rare* **Teloschistes chrysophthalmus**

Thallus brownish orange to orange-red. K+ purple. Lobes to 1mm wide and to 2 mm tall. Lower surface white, sorediate. Mature trees. *Very rare* **Xanthoria fulva**

Thallus K–

Thallus yellow, lower surface almost black in centre with a few pale rhizines. Lobe margins with bright yellow soredia. On Juniper and wood. *Rare* **Vulpicida pinastri**

Squamulose or stalked apothecia

Squamules 2–3 mm diam,red-brown to tan on a black hypothallus becoming covered in cream coloured soredia. Not known fertile. On old sheltered trees amongst moss in West, *Rare* **Fuscopannaria sampaiana**

Squamules 0.05–0.25 x 0.05–0.12 mm, grey-green. Perithecia 0.46–0.8 mm up to half immersed, globose. Old sheltered trees amongst moss in West, *Rare* **Agonimia octospora**

Thallus green to brownish, granular to squamulose. Perithecia half immersed, 0.14–0.2 x upper part roughened and cracked. Mossy bark near water. *Rare* **Agonimia repleta**

As *Agonimia repleta* but with smooth perithecia. 'Old woodland', bark **Agonimia allobata**

Thallus immersed. Apothecia yellow to grey on stalks to 0.7 mm tall. Spore mass K+ purple-violet. Dry crevices on trees and wood. *Rare* **Sclerophora peronella**

Thallus powdery,pale grey. Very abundant pseudopodia to 0.4 mm tall, the tips covered in green, granular soredia. On trees often coastal. *Rare on trees* **Leprocaulon microscopicum**

Crustose – Fruits perithecia

Thallus yellow, green or brown. K+ orange-red. Pseudocyphellae often absent. Perithecia 0.6–1 mm diam. On smooth, dry, shaded bark, S. England. *Very rare* **Pyrenula nitida**

Thallus creamy orange to yellowish brown usually with brownish flecks. K+ yellowish, brown flecks are K+purple. Sheltered, smooth bark. *Rare* **Pyrenula occidentalis**

Thallus silvery white. Perithecia 0.3—0.8 mm diam, in stroma to 15 cells often in a ring with a paler centre. Occurs mainly holly trunks. Mainly in West *Rare* **Mycoporum lacteum**

Thallus absent or pale grey. Perithecia 0.3—0.6 mm diam, half immersed (smaller than *A. gemmata*). Occurs on wood and bark. Mainly Scotland *Rare* **Acrocordia cavata**

Squamules 0.05–0.25 x 0.05–0.12 mm, grey-green. Perithecia 0.46–0.8 mm up to half immersed or more, globose. Old sheltered trees amongst moss in West, *Rare* **Agonimia octospora**

Thallus green to brownish, granular to squamulose. Perithecia half immersed or more, 0.14 x 0.2 upper part roughened and cracked. Mossy bark near water. *Rare* **Agonimia repleta**

Similar to *Agonimia repleta* but with smooth perithecia **Agonimia allobata**

Thallus immersed or granular, covered in yellow-green richly branched isidia. Perithecia black up to 0.7 mm diam. On old oaks. *Rare* **Porina hibernica**

Thallus grey-green to brownish, covered in yellow-green clumps of isidia. Perithecia very rare. On old oaks, especially New Forest. *Rare* **Porina rosei**

Thallus purplish grey, covered in blue-brown, often pale tipped isidia. Perithecia rare to 0.4 mm diam, dark brown. Rough bark trees. *Rare* **Porina coralloidea**

Thallus fawn to brown with a pink tinge. Perithecia 0.1–0.2 x 0.1–1.6 mm. Smooth bark, mainly hazel. Mostly occcurs in the West. *Infrequent* **Arthopyrenia carneobrunneola**

As *Arthopyrenia carneobrunneola* but white to very pale fawn **Arthopyrenia nitescens**

Thallus White to pale grey, immersed. Perithecia, black half immersed 0.1–0.2 mm diam. On bark and exposed roots sheltered woodland. *Infrequent* **Strigula jamesii**

Crustose – Fruits apothecia

Crustose – gelatinous when wet or membranous

Thallus gelatinous, thin, green to brown-black. Fruits barrel-shaped, 0.1 – 0.4 mm diam, dark red-brown. Appears in autumn on many substrates including tree stumps and plant debris. *Rare* **Sarcosagium campestre**

Thallus membranous grey to dark green. Apothecia to 0.6 mm diam, brown-black and very convex. On various substrates including decaying wood. Probably ephemeral. *Infrequent* **Steinia geophana**

Crustose – Sorediate

Thallus grey, film-like,dark prothallus, K± yellow. Soredia bright yellow. apothecia bluish black, glossy On dead pine trunks in North. *Rare* **Mycoblastus alpinus**

Thallus green to green-brown, minutely areolate. Soredia C+ red, buff to greenish. On trees in sheltered woodland in West. *Infrequent* **Trapelia corticola**

Thallus absent or areolate. Prothallus white. Soralia to 0.4 mm diam, green to brownish Occcurs on bare wood of Scots pine. Scotland, S. England. *Rare* **Buellia arborea**

Thallus smooth, tan to chocolate-brown, dark prothallus, forming mosaics. Soralia to 2.5 mm diam, yellow–grey to brown, C+ red. *Infrequent* **Opegrapha gyrocarpa**

Thallus cracked, brown with a mauve tinge, dark prothallus, often in mosaics. Pale mauve to brown soralia. Apothecia rare 0.2–0.4 x 0.1–0.3 mm. Shaded smooth bark. *Rare*
Opegrapha zonata

Thallus grey to pale brown. Soredia concolourous, often in lines or along cracks. On the dry side of trees in old forests. In S. England. *Rare* **Enterographa sorediata**

Thallus chestnut-brown, glossy, globose areoles. Apothecia 0.3–1.1 mm diam, reddish brown. In crevices in pines and fences. *Rare* **Protoparmelia ochrococca**

Thallus grey becoming areolate. Soralia dark brown, Soralia C+ pink, scratches greenish. Apothecia black, to 0.3 mm diam. Mainly on old Juniper. *Rare* **Schaereria corticola**

Thallus pale grey minutely warted, white prothallus. K+ yellow. Soralia grey-green. On nutrient or dust enriched tree bases. *Rare* **Lecanora barkmaniana**

Thallus grey to grey-green, deeply cracked. Soralia white, to 2 mm diam. Apothecia rare with a pink disc. On pines in Caledonian Forest. *Rare* **Pertusaria borealis**

Thallus white to grey, dark prothallus. Soralia abundant, 0.1–1 mm diam. Grey to blue-grey or dark grey. On worked wood. *Infrequent*. **Porpidia tubercolosa**

Thallus white to grey-green, K+ reddish. Soralia flat, yellowish. Fertile warts, one apothecium in each with red-black disc. On smooth bark. *Infrequent* **Pertusaria pupillaris**

Thallus greenish to yellow-brown, soft granules. Apothecia rare, dark brown. On rotting wood, mosses. *Infrequent* **Placynthiella dasaea**

Thallus green to pale brown. Brown to black prothallus. Soralia concolorous with thallus. On underside of overhanging trees, mainly *Sorbus*. *Rare* **Schismatomma umbrinum**

Thallus grey with blue-black prothallus but usually covered in blue-grey granular soredia. K+ yellow. On wood. *Rare* **Tephromela grumosa**

Crustose – Isidiate or granular

Thallus greenish brown to dark brown, fine isidia in centre, areoles to 0.3 mm diam. Apothecia green-brown to 1 mm diam. On pines and fences. *Rare* **Protoparmelia oleagina**

Thallus greenish to brownish grey. K+ yellow-orange. Prothallus white to tan. Abundant cylindrical unorientated isidia. On trees. *Rare* **Pertusaria coronata**

Thallus grey-green, immersed or granular, covered in dull orange, richly branched isidia. Perithecia black up to 0.7 mm diam. On old oaks. *Rare* **Porina hibernica**

Thallus yellowish grey to brownish, areolate or granular with a scurfy surface. Apothecia buff to black up to 0.5 mm diam. On bark and wood. *Rare* (common on stone) **Lecania erysibe**

Thallus white to grey. Numerous isidia. Fruit disc deep orange, K+ purple. On well-lit old trees especially oak. *Rare* **Caloplaca herbidella**

Thallus grey, thick, isidia in blue to brown-black clumps. On weathered wood, mainly in nutrient-enriched lowland sites. *Rare* **Thelomma ocellatum**

Thallus grey-green to brownish, covered in yellow-green clumps of isidia. Perithecia very rare. On old oaks, especially New Forest, Wales. *Rare* **Porina rosei**

Thallus purplish grey. covered in blue-brown, often pale tipped isidia. Perithecia rare to 0.4 mm diam, dark brown. Rough bark trees. *Rare* **Porina coralloidea**

Thallus pale green to blue-green. A continuous granular crust. Fruits to 3 mm diam bright pink. On rotting wood. Mainly in the north. *Infrequent* **Icmadophila ericetorum**

Crustose not isidiate or granular or sorediate

Any part K+ yellow, orange, purple, crimson or red *and* C–

Thallus grey to green-grey, granular, warted, K+ yellow.. apothecia black, concave. Numerous pycnidia. On acid bark, conifers. Mainly in West. *Infrequent* **Mycoblastus affinis**

All parts K+ purple. Thallus pale yellow-green. Pale prothallus . Apothecia to 3mm diam. Disc orange. On wayside trees , mainly limestone areas. Decreasing.
Caloplaca flavorubescens

K+ yellow. Thallus uneven dark grey or brown. Apothecia large, immersed, persistent margin. On tree trunks. Mainly easterly. *Rare* **Rinodina teichophila**

Apothecia K+purple, 0.1–0.8 mm diam, usually crowded. Disc yellow-orange. Thallus K–, grey to black. On wood and trees. *Infrequent* **Caloplaca holocarpa**

Apothecia K+ purple, 0.1–0.5 mm diam, tan to orange-red, domed and pruinose. (100+ spores per ascus). On sheltered trees and mosses. *Rare* **Piccolia ochrophora**

K+ yellow. Thallus white to dark grey. Apothecia to 1 mm diam, black, thin ,wavy margin becoming excluded. On wood. Mainly easterly. *Rare, probably overlooked* **Lecidella carpathica**

C+orange, pink or red *and* K–

Thallus thin, pale yellow-grey, black prothallus. C+ red. Apothecia to 2.5 mm diam, cracked margin, disc dark brown to bluish black, C+yellow (Thallus C–). On acid bark,in north and West**.** *Rare* **Ochrolechia szatalaënsis**

Thallus cottony, pink, dark fimbriate margin. C+ red (fleeting,) initally growing on other lichens. On bases of trees, initially *Enterographa* and *Lecanactis***.** *Rare* **Tylophoron hibernica**

Thallus areolate, grey-green. C+ red. Apothecia 0.1–0.3 mm diam.whitish. Numerous pale pycnidia. On smooth bark mainly beech and holly. *Rare* **Micarea pycnidiophora**

Spot reactions negative

Thallus pale greenish/yellowish grey, granular to rimose. Apothecia pale pink to brown. 0.1–0.5 mm diam. Tree roots in underhangs. *Infrequent* **Psilolechia clavulifera**

Thallus thick, white with brown flecks, scratches orange, to 0.3 mm diam. In crevices of roots on sheltered old woodland. *Rare* **Lecanographa amylacea**

Thallus immmersed. Apothecia 0.25–0.8 x 0.2–0.3 mm with a smooth ,rather glossy margin. Nutrient-enriched, rough bark. *Rare* **Wadeana minuta**

Thallus absent or scurfy, white to pale pink. Apothecia brown to black, often in small groups, thinly pruinose. On acid barked trees in W. *Infrequent* **Arthonia leucopellaea**

Thallus immersed, but brown prothallus usually present. Apothecia often branched, to 2 mm diam, red-brown. On smooth bark, mainly in W. *Rare* **Arthonia stellaris**

Thallus immersed, or white and thin. Apothecia 0.3–0.6 mm diam, dark brown to black, crenulate margins and transverse cracks. Pines and wood. *Rare* **Xerotrema megalospora**

Thallus thick grey-green. Apothecia white to pale orange, 0.07–0.25 mm diam. Occurs in knot holes and tree roots (often beech) *Rare* **Absconditella delutula**

Thallus scurfy, grey-green to black. Apothecia 0.3–0.8 mm diam, red-brown to brown-black, crenulate margins and transverse cracks. Trees and wood. (spirally twisted ascospores) *Infrequent* **Scoliciosporum umbrinum**

Thallus cracked or scurfy, greenish grey often tinged brown. Apothecia to 0.7 mm diam convex to globose, blue-grey to black. On tree roots**.** *Infrequent* **Micarea bauschiana**

Thallus cracked or areolate, bluish grey. Apothecia to 1.2 mm diam. covex to globose, black. On tree roots and fence posts. *Infrequent* **Micarea sylvicola**

Thallus white to pale grey. Apothecia 0.3–2.0 x 0.08–0.2 mm, often branched and irregular, almost immersed. Well-lit trunks. *Very rare*. **Schismatomma graphidioides**

Thallus grey-green. Apothecia in warts with a narrow, raised proper margin, 0.2–0.7 mm wide. (Single spored asci). On smooth, shaded bark often hazel. *Rare* **Thelotrema macrosporum**

Thallus white to pale tan. Apothecia 0.4–0.8 mm diam. Proper margin has radiating cracks. (Single spored asci). On smooth, shaded bark, often hazel. *Rare* **Thelotrema petractoides**

Thallus flat to warted, grey or brownish, rather glossy. Apothecia to 1.2 mm diam, dark brown, glossy. On fence posts. *Infrequent* **Miriquidica leucophaea**

White to greenish grey crust on heather stems, Sorbus. Thallus scratches orange. Apothecia 0.3–0.6 mm diam, black discs. W. Scotland and W. Ireland. *Rare* **Arthothelium norvegicum**

Thallus dark grey to green, forming mosaics, areoles separated by black lines. Apothecia comma shaped or lines. On tree roots and trunks. *Rare*. **Enterographa hutchinsiae**

Thallus pale grey to grey-green, thin and scurfy. Apothecia 0.2–0.4 mm diam, pink to grey brown. On bark,twigs and pine needles. Mainly in the South. *Rare* **Fellhaneropsis vezdae**

Thallus shiny, thin or warted, blue-grey to green-grey in patches up to several cms. diam. Apothecia brown to blue-black, often abundant. On leaves, bamboo and heather. *Infrequent* **Fellhaneropsis myrtillicola**

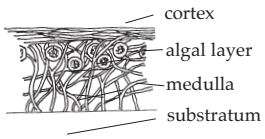
Thallus pale grey or immersed. Apothecia 1–2 x 0.1–0.3 mm brown. Prominant black pycnidia. Wooden posts. *Infrequent* **Opegrapha areniseda**

Leprose or powdery or may appear completely powdery

Thallus diffuse, pale bluish grey to greenish cream. Granules 0.04–0.3 mm diam. K+ yellow, C+ faint yellow or pink. Basic bark. *Infrequent* **Lepraria eburnea**

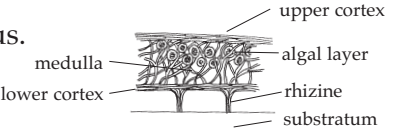
Thallus immersed or granular, covered in orange to greenish, richly branched isidia. Perithecia, black up to 0.7 mm diam. On old oaks. *Rare* **Porina hibernica**

Glossary

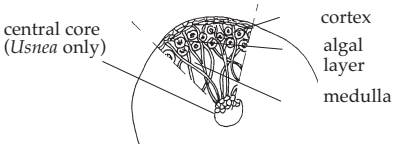


Cross-section of crustose thallus

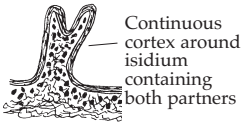
Acid bark, with a low pH such as oak and birch
Acid rock (siliceous), does not react to acid such as lemon juice.
Adpressed, flattened; usually to the surface of the substratum.
Apothecium (pl. **-ia)**, disc-shaped fruiting body.
Areoles, **(areolate)**, paving-like islands forming the thallus.
Ascus (pl. **asci)**, bag-shaped cell containing the spores.
Basic bark, with a high pH such as elder and poplar
Basic rock (calcareous), fizzes slightly with lemon juice.
Blastidium (pl. -a), minute rounded bodies containing both partners whch are budded off the lichen.
Bullate, with blister-like bumps on the upper surface, that often appear as depressions on the lower surface.
Calcareous (calc.), chalky, alkaline rock or soil
Cephalodium, an area containing blue-green cyano-bacteria in a lichen that normally has green algae.
Cilia, 'eye lash-like' hairs, usually on the margin of lobes.
Conidia, spores produced asexually from fungal cells.
Cortex, outer layer of a thallus.
Corticate, having a cortex.
Crustose, lichen having no lower cortex, and is not easily removed from the substrate (see diagram).
Disc, the central area of an apothecium.
Excluded, disappearing at maturity.
Fertile, having fruiting bodies e.g. apothecia or perithecia.
Fimbriate, cottony, like a fringe on a rug
Foliose, leaf-like with both an upper and lower cortex, easily removed from the substrate (see diagram).
Fruit, the fruiting body of the fungus containing the spores.
Fruticose, bushy, with a continuous ring of algae (see diagram).
Holdfast, structure that attaches the lichen to the substratum.
Hypha (pl. **-ae)**, very thin fungal filament.
Hypothallus, a felted layer of fungal hyphae under the thallus.
Isidium (pl. **-ia)**, detachable outgrowth of the thallus (see diagram).
Laminal, on the surface of a lobe not the edges.
Lecanorine, apothecium with a thalline margin (see diagram). This margin is of similar colour to the thallus.
Lichenicolous, growing on another lichen.
Lecideine, apothecium lacking a thalline margin (see diagram). The margin is a different in colour from the thallus.
Lirellate, having long, thin black fruits like strange writing.
Leprose, a more or less unstructured mixture of fungal strands and algal cells (see diagram). *Note that this key includes other lichens that appear to be powdery or granular.*



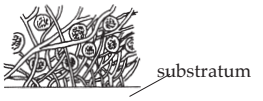
Cross-section of foliose thallus x20



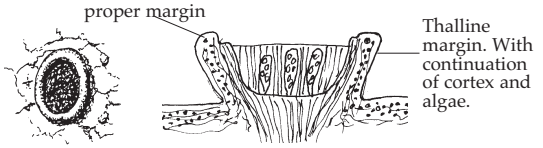
Fruticose thallus x15



Cross-section of isidium x30



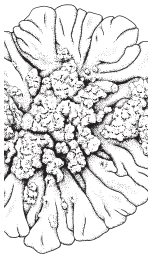
Cross-section of leprose thallus x20



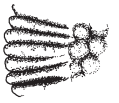
Lecanorine apothecium x5 and cross-section x20

Lecideine apothecia x5 and cross-section x20

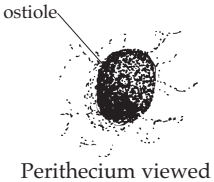
Lobules, small secondary lobes.
Margin, may refer to the edge of a fruit or the edge of the whole lichen.
Medulla, inner part of a thallus below the algae.
Mosaic, forming a community growing together but with each thallus clearly defined.
Nutrient-enriched, enriched by bird droppings, fertilizer etc.
Osmotic pressure, the water pressure created by differing concentrations of salt solutions, inside and outside the cell membrane.
Ostiole, opening in top of perithecium for the escape of spores (see diagram).
Palmate, speading outwards at the top like a palm and wrist.
Perithecium (pl. **-ia)**, flask-shaped fruiting body (see diagram).
pH, a meaure of acidity and alkainity. 7 is neutral, higher is alkaline and lower acid.
Photobiont, photosynthetic partner i.e. the algae or cyanobacteria.
Placodioid, crustose with marginal lobes (see diagram).
Podetium (pl. **-ia)**, hollow, stalk-like structure bearing the fruiting body e.g. *Cladonia.*
Prothallus, area lacking algae at the edge of a crustose lichen.
Pseudocyphella (pl. -**ae**), pale patch, dot or line where the cortex is thin or absent.
Pseudopodetium (pl. -**a**), solid stalk-like structures that arise from a basal thallus.
Pruina, **pruinose**, powdery substance like the bloom on a plum.
Pycnidia, small bodies in the thallus that produce conidia.
Rhizine, root-like outgrowth of fungal threads used for attachment.
Septum (pl. -**a**), internal wall dividing cells or parts of cells or spores.
Sessile, more or less sitting on the surface.
Siliceous, see acid rock.
Soralium (pl. -**ia**), structure producing soredia (see diagram).
Soredium (pl. -**a**), small powdery granules containing both fungus and algae (see diagram).
Spore, a reproductive structure produced by the fungus with a similar purpose to a seed in flowering plants (see diagram).
Squamule, small leaf-like forms often occurring in *Cladonia*.
Submuriform, a spore having only one or two longitudinal septa.
Sub sp., subspecies.
Substratum (pl. -**a**), the surface on which the lichen is growing.
Thalline margin, margin of a fruit containing alga (see diagram).
Thallus, the body of a lichen.
Tomentum, covered in very fine, short hairs, like felt.



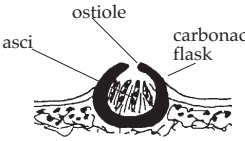
Palmate placodioid crustose thallus x3



Finger-like placodioid crustose thallus x3

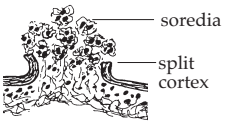


Perithecium viewed from above x10



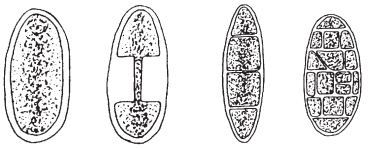
Cross-section of perithecium x10

Podetium x3



Cross-section of a soralium showing soredia being released x15

Spore types x1000 approx.



Simple Polarilocular Septate Muriform

Species included in the keys

Abbreviations Those species included in the supplementary key (W); Lichens that overgrow mosses on trees (M). The species in the rare notes are not included in the main key (R). In this key 'rare' means on trees and wood, they may be common in other habitats. Bold numbers indicate the number of the photograph in the plates e.g. **47**. Italic numbers indicate the page on which the map appears e.g. *58*.

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Rinodina isidioides, *73*
Rinodina oleae, *85*
Rinodina roboris **116**, *83*
Rinodina sophodes, *85*
Rinodina teichophila R
Ropalospora viridis, *78*
Sarcosagium campestre R
Schaereria corticola R
Schismatomma cretaceum, *76*
Schismatomma decolorans **117**, *78*
Schismatomma graphidioides R
Schismatomma niveum, *78*
Schismatomma quercicola, *78*
Schismatomma umbrinum R
Sclerophora peronella R
Scoliciosporum chlorococcum, *78*
Scoliciosporum umbrinum, *88*
Sphaerophorus globosus, *44*
Steinia geophana, *88*
Stenocybe pullatula W, *62*
Stenocybe septata W, *62*
Strangospora pinicola W, *88*
Strangospora moriformis W, *88*
Strigula jamesii, *65*
Tephromela atra, *83*
Tephromela grumosa R
Thelenella muscorum M, *65*
Thelomma occellatum R
Thelopsis rubella, *65, 88*
Thelotrema lepadinum **118**, *85*
Thelotrema macrosporum R
Thelotrema petractoides R
Tomasellia diffusa, *65*
Tomasellia gelatinosa **119**, *65*
Trapelia corticola, *74*
Trapeliopsis flexuosa W **128,** *76*
Trapeliopsis granulosa W, *74*
Trapeliopsis pseudogranulosa W, *71*
Tylophoron hibernica R
Verrucaria maura W, *99*
Wadeana dendrographa, *68*
Wadeana minuta R
Xerotrema megalospora R
Xylographa parallela W, *68*
Xylographa trunciseda W, *68*
Xylographa vitiligo W, *68*

Species included in the supplementary key

This key can help to identify specimens on bare wood, fences, benches and sawn wood. This key contain most of the species that occur in these situations but in certain situations unusual species for the habitat may be present. If after using the key you do not obtain a result, use the main key which also contains the species listed below. if you are still unsuccessful look in the 'rare species' list.

Key E – Lichens growing directly on bare or sawn wood (e.g. fences, gates and benches)

Amandinea punctata
Anaptychia ciliaris
Arctoparmelia incurva
Bryoria fuscescens
Buellia griseovirens
Calicium abietinum
Calicium glaucellum
Calicium salicinum
Calicium viride
Caloplaca cerina
Caloplaca marina
Caloplaca flavovirescens
Candelariella vitellina
Chaenotheca brachypoda
Chaenotheca brunneola
Chaenotheca chrysocephala
Chaenotheca ferruginea
Chaenotheca furfuracea
Chaenotheca trichialis
Chaenotheca furfuracea
Cladonia caespiticia
Cladonia carneola
Cladonia chlorophaea
Cladonia coniocraea
Cladonia cornuta
Cladonia digitata
Cladonia diversa
Cladonia fimbriata
Cladonia floerkeana
Cladonia glauca
Cladonia incrassata
Cladonia macilenta
Cladonia ochrochlora
Cladonia parasitica
Cladonia polydactyla
Cladonia pyxidata
Cladonia subulata
Cladonia sulphurina
Cladonia ramulosa
Cladonia squamosa
Cladonia subulata
Cliostomum corrugatum
Cliostomum griffithii
Cyphelium inquinans
Cyphelium notarisii
Diploicia canescens
Evernia prunastri
Flavoparmelia caperata
Flavoparmelia soredians
Hypocynomyce caradocencis
Hypocenomyce friesii
Hypocenomyce scalaris
Hypogymnia physodes
Hypogymnia tubulosa
Hypotrachyna revoluta
Imshaugia aleurites
Lecanora aitema
Lecanora campestris
Lecanora chlarotera
Lecanora compallens
Lecanora confusa
Lecanora conizaeoides
Lecanora expallens
Lecanora gangaleoides
Lecanora intricata
Lecanora muralis
Lecanora orosthea
Lecanora polytropa
Lecanora pulicaris
Lecanora saligna
Lecanora soralifera
Lecanora symmicta
Lecanora varia
Lecanora zosterae
Lecidella carpathica
Lecidella elaeochroma
Lecidella scabra
Melanelixia glabratula

Melanelixia subaurifera
Micarea cinerea
Micaria denigrata
Micarea leprosula
Micarea melaena
Mycoporum lacteum
Ochrolechia turneri
Opegrapha atra
Parmelia saxatilis
Parmelia sulcata
Parmeliopsis ambigua
Parmotrema perlatum
Phaeophyscia orbicularis
Physcia adscendens
Physcia aipolia
Physcia caesia
Physcia clementei
Physcia dubia
Physcia leptalea
Physcia tenella
Physconia distorta
Physconia grisea
Placynthiella icmalea
Pseudevernia furfuracea
Punctelia subrudecta
Ramalina canariensis
Ramalina cuspidata
Ramalina farinacea
Ramalina lacera
Ramalina pollinaria
Ramalina portuensis
Ramalina siliquosa
Ramalina subfarinacea
Ramboldia insidiosa
Roccella phycopsis
Sphaerophorus globosus
Strangospora pinicola
Stenocybe pullatula
Stenocybe septata
Tephromela atra
Trapeliopsis flexuosa
Trapeliopsis granulosa
Trapeliopsis pseudogranulosa
Usnea cornuta
Usnea flammea
Usnea fragilescens
Usnea hirta
Usnea subfloridana
Verrucaria maura
Xanthoria calcicola
Xanthoria candelaria
Xanthoria parietina
Xanthoparmelia conspersa
Xanthoparmelia verruculifera
Xanthoria calcicola
Xanthoria elegans
Xanthoria parietina
Xanthoria ucrainica
Xylographa parallela
Xylographa trunciseda
Xylographa vitiligo

Species included in 'notes on some rare species'

(These species are not included in the main key)

It should be noted that a species that is rare in the context of the whole British Isles may be abundant locally or in a habitat other than trees.

Absconditella delutula
Acrocordia cavata
Agonimia octospora
Arthonia leucopellaea
Arthonia stellaris
Arthothelium norvegicum
Buellia arborea
Bryoria chalybeiformis
Caloplaca herbidella
Caloplaca holocarpa
Caloplaca flavorubescens
Enterographa hutchinsiae
Enterographa sorediata
Fellhaneropsis myrtillicola
Fellhaneropsis vezdae
Gyalecta peliocarpa
Hypogymnia farinacea
Icmadophila ericetorum
Lecania erysibe
Lecanographa amylacea
Lecanora barkmaniana
Lepraria eburnea
Leprocaulon microscopicum
Micarea bauschiana
Micarea pycnidiophora
Micarea sylvicola
Miriquidica leucophaea
Mycoporum lacteum
Mycoblastus affinis
Mycoblastus alpinus
Mycoblastus affinis M, R
Mycoblastus alpinus
Opegrapha areniseda
Opegrapha gyrocarpa
Opegrapha zonata
Parmeliopsis hyperopta
Pertusaria borealis
Pertusaria coronata
Pertusaria pupillaris
Picclolia octophora
Placynthiella dasaea
Platismatia norvegica
Porina hibernica
Porina rosei
Porina coralloidea
Pyrenula hibernica
Pyrenula nitida
Pyrenula nitidella
Pyrenula occidentalis,
Porpidia tuberculosa
Protoparmelia ochrococca
Protoparmelia oleagina
Psilolechia clavulifera
Rinodina teichophila
Sarcosagium campestre
Schaereria corticola
Schismatomma graphidioides
Schismatomma umbrinum
Sclerophora peronella
Steinia geophana
Strigula jamesii
Teloschistes chrysophthalmus
Tephromela grumosa
Thelotrema macrosporum
Thelotrema petractoides
Tylophoron hibernica
Usnea fulvoreagens
Vulpicida juniperinus
Wadeana minuta
Xanthoria fulva
Xerotrema megalospora

SELECTED BIBLIOGRAPHY

BARON G. *Understanding Lichens* (1999) The Richmond Publishing Co. Ltd.

This book covers most areas of lichenology including lichen communities, uses, botanical classification and has an extensive bibliography.

BROAD K. *Lichens of southern woodlands, Forestry Commission Handbook 4* (1989) Her Majesty's Stationery Office

This book contains much useful information but is out of print..

DOBSON Frank S. *Lichens – An Illustrated guide* (6th ed. 2011) The Richmond Publishing Co. Ltd.

Generic and species keys, distribution maps, many line drawings and about 850 species described and illustrated with colour photographs.

DOBSON Frank S. *Lichen-identifier* (Ver.3.2. 2010) Frank S. Dobson.

A multi-access computer key to over 1800 species of the lichens of Great Britain and Ireland, including distribution maps to all the species and about 750 colour photographs.

GILBERT O. *Lichens* (The New Naturalist Library) (2000) Harper Collins.

A very readable account that covers many aspects of the biology of lichens. It is especially strong on lichen habitats.

ORANGE A. *Lichens on trees.* (1994) National Museum of Wales

A useful guide to some of he commonest species illustated with photographs and line drawings. Out of Print but worth finding secondhand.

PURVIS O.W. *Lichens* (2000) The Natural History Museum & Smithsonian Institution.

A popular guide to lichen biology, biodiversity, ecological and economic importance etc. Contains 150 colour photographs and diagrams.

SMITH C.W,. APTROOT A., COPPINS B.J., FLETCHER A., GILBERT O.L., JAMES P.W., WOLSELEY P.A.
The Lichens of Great Britain and Ireland (2009). The British Lichen Society.

The definitive flora that includes all the British and Irish species

WOLSELEY P., JAMES P., & ALEXANDER D. *A key to lichens on twigs* (2002) The Field Studies Council.

A folded card illustrating, in colour, 60 species of lichen occuring on twigs. It also includes a key to the species. A useful guide to lichens on trees on the seashore.

The British Lichen Society

The British Lichen Society is the main lichenological organisation in Britain and has many overseas members. Membership is open to all and it particularly welcomes newcomers to lichenology. Information regarding the Society and membership may be obtained from: The Secretary, The British Lichen Society, c/o The Natural History Museum, Cromwell Road, London SW7 5BD.

The BLS website is at http://www.britishlichensociety.org.uk. This website contains information about the Society including a prospectus and a printable application form and much other lichen information including links to other sites that, between them, cover most aspects of lichenology catering for all levels of knowledge.