Generic Keys

1 Thallus scale-like, leaf-like or bushy to beard-like 2
Thallus crustose, resembling either a crust which is continuous, rimose-cracked, areolate, evanescent, immersed, or powdery, in all cases embedded, at least partially, in the substratum 3

2(1) Thallus fruticose, shrub- or beard-like, rarely worm- or thread-like with erect to decumbent or hanging branches, terete or angular in section, if flattened then with photobiont cells above and below arranged round a central strand or hollow, fastened only at the base or attached by a few scattered hapters ..... **KEY 1**
Thallus foliose, squamulose or placodioid (with marginal lobes differing from the centre); large to minute, leaf-like, compacted or mostly horizontally spreading, often attached to substratum by rhizines, hapters or by a central disc, dorsiventral with photobiont cells arranged in a ± horizontal layer below the upper cortex, upper surface differing in colour from the lower; or squamulose and of small flattened,often compacted squamules or lobes; not dimorphic and without podetia and pseudopodetia ..... **KEY 2**

3(1) Thallus fertile (fruits globose, volcano-like, disc-like, elongate, stalked, shelf, or mushroom-like) 4
Thallus sterile (often with isidia or ± delimited soredia, or entirely leprose) 9

4(3) Fruits basidiomata, producing basidiospores 5
Fruits ascomata, producing ascospores 6

5(4) Basidiomata crust- to bracket-shaped ..... ***Dictyonema interruptum***
Basidiomata stalked, mushroom-shaped ..... ***Lichenomphalia***
Basidiomata club-shaped ..... ***Multiclavula vernalis***

6(4) Ascomata distinctly stalked ..... **KEY 4**
Ascomata sessile or immersed 7

7(6) Ascomata perithecia or perithecia-like, globose, opening by a minute pore at apex (occasionally several perithecia may occur within a receptacle with 3-15 minute surface pores) ..... **KEY 3**
Ascomata not perithecia 8

8(7) Ascomata elongate (lirellae), the disc exposed or a slit, sometimes short, straight, curved or serpentine, sometimes star-like or arranged in ± parallel lines ..... **KEY 5**
Ascomata disc-shaped, the disc ± exposed, at least at maturity, concave to convex or globose (sometimes deeply immersed in the thallus or enclosed within warts) ..... **KEY 6**

9(3) Growing on bark, wood, leaves etc. ..... **KEY 7**
Growing on rock, soil, detritus, glass, iron, rubber etc. ..... **KEY 8**

GENERIC KEY 1
Fruticose Lichens

1 Thallus yellow to orange-red, K+ purple-red 2
Thallus variously coloured, if yellow to orange-red then not K+ purple-red 3

2(1) Thallus of small, flattened, compacted lobes, to 1 mm wide and 2 mm tall, without marginal fibrils; marginal soredia present ..... ***Xanthoria***
Thallus either entirely terete, angular, richly branched and with small oval soralia, sterile, or with ± flattened lobes, to 2.5 mm wide with numerous marginal fibrils; without soralia, and often fertile ..... ***Teloschistes***

3(1) Thallus dimorphic, with a crustose, leprose or squamulose basal thallus from which arises an erect, secondary thallus with or without apothecia 4
Thallus not dimorphic 7

4(3) Basal thallus crustose, leprose or granular 5
Basal thallus squamulose or of rounded, peltate or flattened phyllocladia (sometimes disappearing early) 6

5(4) Basal thallus leprose, erect thallus of short, white podetia within a ± continuous, sorediate crust; apothecia unknown ..... ***Leprocaulon microscopicum***
Basal thallus not leprose, erect thallus without soredia; apothecia often present, podetia hollow ..... ***Pycnothelia papillaria***

6(4) Erect thallus hollow, often with squamules (at least at the base) and cups; phyllocladia and cephalodia absent; ascospores simple ..... ***Cladonia***
Erect thallus solid, without cups and squamules; granular, peltate or finger-like phyllocladia and often sessile, wrinkled to convoluted, pale brown to blackish cephalodia present; ascospores septate ..... ***Stereocaulon***

7(3) Thallus flattened, strap-shaped, distinctly dorsiventral (with differently coloured upper and lower surface); algae concentrated near the upper surface only 8
Thallus not flattened, terete or, if flattened, algae distributed on both lower and upper sides 11

8(7) Marginal cilia present 9
Marginal cilia absent 10

9(8) Upper surface pale grey-brown, K–, with pale marginal cilia ..... ***Anaptychia ciliaris***
Upper surface white, K+ yellow, with black marginal cilia ..... ***Heterodermia leucomelos***

10(8) Thallus green, sorediate; lower surface white, never black (see also *Ramalina lacera*) ..... ***Evernia prunastri***
Thallus grey, isidiate; lower surface at least partly black ..... ***Pseudevernia furfuracea***

11(7) Thallus gelatinous, dark green- to brown-black or black; photobiont blue-green 12
Thallus not gelatinous, colour various; photobiont various 16

12(11) Thallus forming dense swards on coastal rocks associated with seaweeds and barnacles; apothecia ± globose, sunken in lobe apices ..... ***Lichina***
Thallus on a variety of substrata, not forming dense swards on coastal rocks; apothecia various 13

13(12) Thallus very small, 1-4 mm tall; apothecia very rare, poriform, with swollen thalline exciple; ascospores simple; photobiont *Gloeocapsa* 14
Thallus large, >4 mm tall; apothecia various; ascospores septate or muriform; photobiont *Nostoc* 15

14(13) Thallus coralloid branched, without main branches ..... ***Synalissa ramulosa***
Thallus irregularly but densely branched, with a few, stout, long, main branches and many small side branches ..... ***Lichinodium sirosiphoideum***

15(13) Thallus without an upper cortex (microscope); thallus usually brown- or green-black ..... ***Collema***
Thallus with an upper cortex consisting of a single layer of cells (microscope); thallus usually blue-grey, brown or grey-black ..... ***Leptogium***

16(11) Thallus to *c*. 1 cm tall, consisting of very slender, minutely tufted, spreading filaments 17
Thallus *c*. 1-20 cm tall, filamentous or otherwise 24

17(16) Thallus with blue-green photobiont (photobiont cells not I+ blue); filaments >0.05 mm diam. ..18
Thallus with *Trentepohlia* (photobiont cells I+ blue); filaments <0.02 mm diam.;on vertical or recessed rock faces; thallus black; if orange or yellow, check for free-living *Trentepohlia* algae 23

18(17) Thallus richly branched, ± erect, brown to black 19
Thallus little branched, ± decumbent; blue-green if erect 20

19(18) Surface shiny; surface cells mosaic-forming ..... ***Polychidium***
Surface matt, tomentose near the base; surface cells rounded ..... ***Lobaria amplissima*** (*Dendriscocaulon* morph)

20(18) Thallus blue-green, erect ..... ***Dictyonema interruptum***
Thallus brown to black, ± decumbent 21

21(20) Thallus often matted and spreading with a combed appearance; photobiont *Stigonema* .... ***Ephebe***
Thallus small, fluffy, if spreading, then not combed in appearance; photobiont *Stigonema* or not 22

22(21) Filaments to 15 µm wide; rhizine-like hyphae absent; photobiont *Scytonema* .. ***Thermutis velutina***
Filaments to 40 µm wide; rhizine-like, N+ purple-red hyphae attaching thalli to substratum; photobiont *Stigonema* ..... ***Spilonema***

23(17) Central *Trentepohlia* chain surrounded by elongate, straight, ± parallel-orientated septate hyphae; filaments smooth ..... ***Racodium rupestre***
Central *Trentepohlia* chain surrounded by twisted, irregularly septate hyphae; filaments nodulose ..... ***Cystocoleus ebeneus***

24(16) Thallus and/or soralia C+ red; exclusively coastal, firmly attached to rock or bark; photobiont *Trentepohlia* (if alpine and photobiont trebouxioid, cf. *Alectoria nigricans*) ..... ***Roccella***
Thallus and soralia (if present) C–; ecology various 25

25(24) Thallus filamentous, with a tough axial strand, not easily broken when branches are pulled; ascospores simple ..... ***Usnea***
Thallus filamentous or otherwise, without a tough, axial strand (breaking cleanly when pulled apart) 26

26(25) Thallus thread-like, with thin, often pointed, apices 27
Thallus not thread-like, apices mostly blunt 30

27(26) Terminal branchlets with hook-shaped apices; thallus pendent or erect, pale grey to yellow-white ..... ***Ramalina chondrina***
Terminal branchlets without hook-shaped apices; thallus pendent, erect or decumbent, colour various 28

28(27) Thallus with distinct, white, ± elongate, often convex pseudocyphellae; yellow-grey .... ***Alectoria***
Thallus with or without indistinct pseudocyphellae which are never convex; colour various, not yellow 29

29(28) Thallus densely divergently branched; soralia never present; dark brown-black; forming a spreading, decumbent mat attached by spreading hapters ..... ***Pseudephebe***
Thallus not densely branched, or if so then ± erect; soralia present or absent; pale to brown-black; mostly only attached at one end ..... ***Bryoria***

30(26) Thallus yellow-grey or yellow-green 31
Thallus not yellow 33

31(30) Thallus decumbent, straggling over low vegetation ..... ***Alectoria sarmentosa*** subsp. ***vexillifera***
Thallus erect, tufted 32

32(31) Thallus solid, wrinkled and lacunose with wavy margins ..... ***Flavocetraria nivalis***
Thallus hollow, without wrinkles or lacunose with wavy margins ..... ***Cladonia***

33(30) Thallus chalk white 34
Thallus not chalk white 35

34(33) Thallus hollow, ± decumbent and worm-like, apices pointed ..... ***Thamnolia vermicularis***
Thallus solid, ± erect and compacted, apices blunt ..... ***Siphula ceratites***

35(33) Thallus green-grey to grey 36
Thallus brown to brown-black 43

36(35) Thallus distinctly pubescent-tomentose; thallus terete, often partly angular and flattened ..... ***Tornabea scutellifera***
Thallus not tomentose, smooth; thallus terete or flattened 37

37(36) Branches hollow..... 38
Branches solid 40

38(37) Thallus terete ..... ***Cladonia***
Thallus somewhat flattened..... 39

39(38) Lower surface of thallus not blackened; thallus often with terminal apothecia; cortex K– ..... ***Ramalina***
Lower surface of thallus partly blackened; apothecia rare, not terminal; cortex K+ yellow ..... ***Hypogymnia tubulosa***

40(37) Thallus sparingly branched, without fragile branchlets or phyllocladia, yellowish (usnic acid always present); apothecia when present with disc ± concolorous with the thallus ..... ***Ramalina***
Thallus usually richly branched, with fragile branchlets or phyllocladia, not yellowish (usnic acid absent); apothecia when present with dark disc or with powdery mazaedium 41

41(40) Thallus often with cephalodia and/or soralia; apothecia with dark brown disc; sphaerophorin absent ..... ***Stereocaulon***
Thallus without cephalodia or soralia; apothecia forming black powdery mazaedium; sphaerophorin present 42

42(41) Thallus terete throughout; apothecia globose with thalline exciple persisting and at least partly enclosing the mazaedia which are exposed apically; spores broadly ellipsoid, dark violet to black ..... ***Sphaerophorus***
Thallus at least partly flattened; apothecia losing enclosing thalline exciple early and exposing the mazaedia ventrally; spores globose, colourless to dark grey ..... ***Bunodophoron melanocarpum***

43(35) Medulla C+ red, branches >3 mm wide with spinulose margins, distinctly flattened; stems erect, often reddish below ..... ***Cetrariella delisei***
Medulla C–; branches 1-3 mm wide, slightly flattened or ± terete 44

44(43) Thallus forming compact tufts to 2 cm tall, firmly attached to rock, sparingly branched; apothecia terminal, frequent with brown-black discs often surrounded by short projections ..... ***Cornicularia normoerica***
Thallus forming loosely interwoven, to 5 cm tall tufts amongst mosses on the ground, richly branched; apothecia rare ..... ***Cetraria***

GENERIC KEY 2
Foliose, Squamulose or Placodioid Lichens

1 Thallus (when dry) bright yellow, bright yellow-green to orange-red (pigments anthraquinones or pulvinic acid derivatives) 2
Thallus not as above; sometimes dull yellow-green owing to usnic acid 11

2(1) Thallus K+ purple-red (pigments anthraquinones) 3
Thallus K± yellow, not purple-red (pigments pulvinic acid derivatives) 5

3(2) On bark, wood or stone; schizidia absent; ascospores polarilocular 4
On calcareous soil, often spreading to mosses; schizidia often present; ascospores simple or 1-septate, not polarilocular ..... ***Fulgensia***

4(3) Thallus closely attached to substratum by entire lower surface, often placodioid, rhizines and other attachment organs absent ..... ***Caloplaca***
Thallus ± loosely attached to substratum by a basal sheath, attachment discs or rhizines ..... ***Xanthoria***

5(2) Thallus foliose, markedly incised with ± granular or marginal soralia 6
Thallus placodioid to squamulose 7

6(5) Thallus lobes to *c*. 1 cm wide; soralia marginal ..... ***Vulpicida pinastri***
Thallus lobes very small, 0.3-0.5(-1.5) mm wide; soralia granular ..... ***Candelaria concolor***

7(5) Marginal lobes elongated, convex 8
Marginal lobes not much different from internal squamules, flattened 10

8(7) Thallus irregularly granular-isidiate towards centre with white-pruinose marginal lobes ..... ***Candelariella medians***
Thallus without soralia, lobes not pruinose 9

9(8) Thallus on rock, flattened ..... ***Pleopsidium chlorophanum***
Thallus on soil, uneven ..... ***Catolechia wahlenbergii***

10(7) Thallus on soil; lobes pruinose; apothecia black; ascospores septate ..... ***Arthrorhaphis alpina***
Thallus usually on rock, wood or bark; lobes not pruinose; apothecia yellow; ascospores simple ..... ***Candelariella vitellina***

11(1) Thallus distinctly foliose, small to large, often rosette-forming or strap-shaped, attached to substratum by rhizines, hapters, tomentum, folds or by an umbilicus ..... **Key 2a**
Thallus squamulose, sometimes minutely so, squamules mostly closely attached to substratum or elevated towards margins, scattered, contiguous or overlapping, or thallus placodioid and ± crustose at the centre with contiguous lobed margins ..... **Key 2b**

Generic Key 2a - Foliose Lichens.

1 Thallus attached to substratum at a central point by an umbilicus 2
Thallus not attached to substratum by an umbilicus, attachments various 4

2(1) Thallus dotted with abundant black perithecia on upper surface ..... ***Dermatocarpon***
Thallus with apothecia or sterile 3

3(2) Thallus surface with distinctive, coarse, oval pustules; isidia black, coralloid, very rarely fertile ..... ***Lasallia pustulata***
Thallus surface without coarse pustules, surface smooth, wrinkled or ridged, sometimes cracked; soredia, phyllidia or thalloconidia sometimes present, or often fertile ..... ***Umbilicaria***

4(1) Photobiont in thallus mainly blue-green (cyanobacterial) 5
Photobiont in thallus mainly green (chlorococcoid) 13

5(4) Thallus not zoned in cross-section (homoiomerous); thallus blue-grey or brown throughout (c.f. also free-living *Nostoc* which lacks fungal hyphae in microscopical section) 6
Thallus zoned in cross-section (heteromerous); upper and lower surfaces distinctly different 7

6(5) Thallus without a cellular upper cortex (microscope); swelling rapidly when wet ..... ***Collema***
Upper cortex of a single layer of well-defined cells (microscope), thallus not swollen when wet ..... ***Leptogium***

7(5) Thallus on a distinct blue/black hypothallus 8
Thallus without a distinct blue-black hypothallus 9

8(7) Thallus plate-like, Pd–; thalline exciple absent ..... ***Degelia***
Thallus with distinct lobes, Pd+ red; thalline exciple present ..... ***Pannaria***

9(7) Cyphellae or pseudocyphellae present on lower surface 10
Cyphellae and pseudocyphellae absent from lower surface, but bald patches may be present amongst the tomentum 11

10(9) Cyphellae present with distinct raised margins, thallus smelling of fish when wet ..... ***Sticta***
Pseudocyphellae present without distinct raised margins, thallus not smelling of fish when wet ..... ***Pseudocyphellaria***

11(9) Lower surface naked or sparingly tomentose (but tomentose in two extinct species), apothecia (if present) on lower surface of lobe ends ..... ***Nephroma***
Lower surface tomentose, apothecia (if present) on upper surface of thallus or lobe ends 12

12(11) Lower surface with a ± well-developed coarse network of white or brown veins; apothecia (if present) on short marginal projections ..... ***Peltigera***
Lower surface without veins, but with bald patches amongst the tomentum; apothecia (if present) laminal ..... ***Lobaria scrobiculata***

13(4) Thallus of strap-shaped ± erect lobes attached at base by holdfast 14
Thallus lobes spreading, or if lobes strap-shaped closely adnate, attachments various 15

14(13) Lower surface white, never black (see also *Ramalina lacera*), not isidiate ..... ***Evernia prunastri***
Lower surface at least partly black, isidiate ..... ***Pseudevernia furfuracea***

15(13) Thallus lobes rounded, with a single urceolate apothecia ± immersed in the centre of the thallus ..... ***Solorina*** (***bispora*** and ***spongiosa***)
Thallus lobes spreading, apothecia if present not immersed in thallus 16

16 (15) Thallus lobes inflated, hollow in section, lower surface without rhizines 17
Thallus lobes solid in section, flat or convex 19

17(16) Thallus without perforations on the upper or lower surface ..... ***Hypogymnia***
Thallus with perforations on the upper or lower surface 18

18(17) Thallus with scattered round perforations <1 mm diameter on the upper surface ..... ***Menegazzia***
Thallus with puncture-like perforations on the lower surface ..... ***Cavernularia hultenii***

19(16) Lobes with tomentum on lower surface, with or without lower cortex 20
Lobes with distinct lower cortex, tomentum absent 25

20(19) Thallus lobes rounded, with a single urceolate apothecia ± immersed in the centre of the thallus or if absent lower surface orange and without distinct veins ..... ***Solorina***
Thallus lobes spreading, or if rounded then with distinct raised veins; apothecia if present on margins of the thallus 21

21(20) Lobes without a lower cortex; rhizines often conspicuous to the margin ..... ***Peltigera***
Lobes with a distinct lower cortex; rhizines absent from the margin of the lower surface 22

22(21) Cyphellae and pseudocyphellae absent on lower surface 23
Cyphellae or pseudocyphellae present on lower surface 24

23(22) Thallus straw-yellow to yellow-green (usnic acid) ..... ***Nephroma arcticum***
Thallus shades of green or brown ..... ***Lobaria***

24(22) Cyphellae white, with distinct raised margins present on lower surface ..... ***Sticta canariensis*** (green algal morph)
Pseudocyphellae yellow, present as punctiform or effigurate breaks in the lower cortex ..... ***Pseudocyphellaria aurata***

25(19) Thallus white, grey or brownish grey, lobes up to 5 mm wide, usually matt, often pruinose: spores brown, 1-septate (*Physciaceae*) 26
Thallus yellow-green, grey or brown, lobes from 1 mm to several centimetres wide, usually ± shiny in younger parts, rarely pruinose; spores colourless, simple (*Parmeliaceae*) 32

26(25) Lobes strap-like, erect, elongated and narrowly linear, lower cortex absent 27
Lobes rounded or if linear, branching regularly, adnate, forming rosette-like thalli 28

27(26) Lobes grey-green to white; thallus K+ yellow (atranorin) ..... ***Heterodermia***
Lobes pale to dark brown; thallus K– ..... ***Anaptychia***

28(26) Thallus whitish to bluish grey, maculate and sorediate or with isidia or lobules 29
Thallus grey brown to brown, emaculate 30

29(28) Upper cortex and hyphae running parallel to the upper surface (microscope) ..... ***Heterodermia***
Upper cortex and hyphae with a cellular structure (microscope) ..... ***Physcia***

30(28) Thallus ± loosely appressed to substratum, lobes pruinose at tips ..... ***Physconia***
Thallus closely appressed to substratum, lobes not pruinose at tips 31

31(30) Rhizines absent or sparse ..... ***Hyperphyscia adglutinata***
Rhizines numerous ..... ***Phaeophyscia***

32(25) Thallus lobes brown throughout 33
Thallus lobes yellow-green, green to grey-green or whitish 42

33(32) Thallus erect, ± tufted 34
Thallus adnate to loosely overlapping 36

34 (33) Thallus lobes strap-shaped or <2 mm wide, not closely attached to substratum ..... ***Cetraria***
Thallus lobes rounded, overlapping or, if narrow, closely appressed 35

35(34) Lobes bilaterally symmetrical ..... ***Cornicularia normoerica***
Lobes with distinct upper and lower surfaces ..... ***Tuckermanopsis chlorophylla***

36(33) Rhizines absent, lobes contorted and closely adpressed to substratum .. ***Allantoparmelia alpicola***
Rhizines present at least in the centre of the thallus, lobes loosely to closely attached to the substratum 37

37(36) Lobes with globose pycnidia along the margins ..... ***Cetrariella commixta***
Lobes without globose pycnidia along the margins 38

38(37) Thallus with discrete blackish convex 'soralia' (clustered isidia); on rock .... ***Melanelia disjuncta***
Thallus without discrete blackish soralia, but sometimes with irregular clusters of isidia or pale-coloured soralia; substrata various 39

39(38) Medulla UV+ white, saxicolous ..... ***Xanthoparmelia***
Medulla UV–, corticolous or saxicolous..... 40

40(39) Medulla C+ red (lecanoric acid) ..... ***Melanelixia***
Medulla C– 41

41(40) Medulla Pd– (without lichen substances in British material); lobes flat to concave . ***Melanohalea***
Medulla usually Pd+ yellow or red; if Pd– than with convex lobes and whitish punctiform pseudocyphellae ..... ***Melanelia***

42(32) Pseudocyphellae present on upper surface, punctiform or effigurate 43
Pseudocyphellae absent 45

43(42) Pseudocyphellae effigurate ..... ***Parmelia***
Pseudocyphellae punctiform 44

44(43) Lobes overlapping with wavy crisped margins and marginal soralia ..... ***Cetrelia***
Lobes with soredia developing from laminal and marginal pseudocyphellae ..... ***Punctelia***

45(42) Rhizines absent ..... ***Brodoa intestiniformis***
Rhizines present (at least in the older part of the thallus) 46

46(45) Rhizines branched dichotomous or squarrose (simple rhizines may also be present) ..... ***Hypotrachyna***
Rhizines simple (or at most forked) 47

47(46) Thallus closely appressed to substratum 48
Thallus not appressed to substratum with loosely overlapping lobes 54

48(47) Lower surface pale tan to white 49
Lower surface dark brown to black 50

49(48) Thallus grey-white, K+ bright yellow, densely isidiate ..... ***Imshaugia aleurites***
Thallus yellow-grey to greenish yellow, K– or K+ faintly yellow, with conspicuous laminal soredia ..... ***Arctoparmelia incurva***

50(48) Thallus yellow-green or yellow-grey (usnic acid in cortex) 51
Thallus grey or blue-grey (without usnic acid in cortex) 52

51(50) Medulla Pd–, UV+ white (divaricatic acid) ..... ***Parmeliopsis ambigua***
Medulla Pd+ orange UV– (stictic acid) ..... ***Xanthoparmelia mougeotii***

52(50) Thallus without cilia on the margins; soralia present; medulla UV+ white (divaricatic acid) ..... ***Parmeliopsis hyperopta***
Cilia present in axils and/or on the apices of lobes; soralia absent; medulla UV– 53

53(52) Cilia abundant also on apices of lobes ..... ***Parmelinopsis***
Cilia mainly restricted to lobe axils ..... ***Parmelina***

54(47) Thallus grey-green (usnic acid absent) 55
Thallus yellow-green (usnic acid present) 59

55(54) Thallus lobes very small, 0.3-0.5(-1.5) mm wide ..... ***Candelaria concolor***
Thallus lobes more than 2 mm wide 56

56(55) Lower surface strongly veined and wrinkled ..... ***Platismatia***
Lower surface not strongly wrinkled 57

57(56) Lower surface pale tan to white ..... ***Pleurosticta acetabulum***
Lower surface dark brown to black 58

58(57) Medulla C+ red ..... ***Hypotrachyna***
Medulla C– ..... ***Parmotrema***

59(54) Thallus with discrete or pustular soralia ..... ***Flavoparmelia***
Thallus without soralia; isidia sometimes present ..... ***Xanthoparmelia***

Generic Key 2b - Squamulose or Placodioid Lichens.

1 Thallus of pale green-grey (dark green when moist), ± rounded squamules, with a white margin when young; fruiting body a yellow-white mushroom (basidioma) ..... ***Lichenomphalia hudsoniana***
Thallus and fruiting body various, never a mushroom 2

2(1) Squamules shell- or ear-like with raised, sorediate margins, glaucous to green-grey ..... ***Normandina pulchella***
Squamules variously shaped and coloured, but not as above 3

3(2) Perithecia present, mostly ± immersed; photobiont green 4
Apothecia present, emergent or sessile, or fruits absent; photobiont green or blue-green 7

4(3) Hymenial photobiont cells present ..... ***Endocarpon***
Hymenial photobiont cells absent 5

5(4) Squamules minute, 0.05-0.3(-0.5) mm wide; ascospores muriform; asci 2- or 8-spored ..... ***Agonimia***
Squamules small to medium, 0.5-4(-7) mm wide; ascospores simple or septate; asci 8-spored ... 6

6(5) Ascospores simple ..... ***Catapyrenium***
Ascospores 1-septate ..... ***Placidiopsis***

7(3) Photobiont blue-green; thallus blue-grey, brown, black-green, blue-black or black, sometimes gelatinous and swelling when wet ..... c.f. **Key 6f**
Photobiont green; thallus white, grey, green, yellow-green or brown, not gelatinous or swelling when wet 8

8(7) Thallus of appressed or ascending, individual squamules, overlapping or ± dispersed, not forming radiating and elongated marginal lobes 9
Thallus ± forming rosettes or placodioid when ± crustose in centre with distinctly elongated radiating marginal lobes 33

9(8) Asci 50- to 300-spored; ascospores minute, 3-6(-13) × 1-3(-6) µm ..... ***Acarospora***
Asci to 8-spored; ascospore size various; or thallus sterile 10

10(9) Thallus sorediate or with clusters of coarse, irregular, isidia-like protuberances 11
Thallus without soredia and isidia 19

11(10) Thallus microsquamulose, squamules to 0.3 mm wide, green; with isidia-like structures ..... ***Phyllopsora rosei***
Thallus with wider squamules, generally not green 12

12(11) Squamules ± ascending, at least at edges, often ± elongate, margins frequently incised; small podetia frequently present ..... ***Cladonia***
Squamules ± closely appressed to substratum, mostly rounded, with ± entire margin; podetia absent (see also *Baeomyces rufus*) 13

13(12) Squamules C+ red 14
Squamules C– 16

14(13) Squamules irregular, clusters of coarse, irregular, isidia-like protuberances present on upper surface ..... ***Trapeliopsis wallrothii***
Squamules sorediate 15

15(14) Squamules orientated in one direction, overlapping, the margin and lower surface sorediate; thallus brownish, Pd–..... ***Hypocenomyce scalaris***
Squamules radiating; thallus whitish, Pd+ yellow ..... ***Pycnora leucococca***

16(13) Squamules peltate, with a conspicuously darker central area; ascospores (1-)3- to 5-septate ..... ***Stereocaulon***
Squamules not peltate, without a darker central area; ascospores simple or 1-septate 17

17(16) Thallus ± uniformly covered in coarsely granular soredia; ascospores 1-septate; on coastal soil ..... ***Solenopsora vulturiensis***
Soredia lip-shaped, ± restricted to marginal soralia; ascospores simple; on peat or wood 18

18(17) Cortex Pd+ red; on coniferous wood ..... ***Hypocenomyce anthracophila***
Cortex Pd–; on peat or rotting wood ..... ***Trapeliopsis***

19(10) Squamules ± ascending, at least at edges, often ± elongate, margins frequently incised; often green; small podetia frequently present ..... ***Cladonia***
Squamules ± closely appressed to substratum, mostly rounded, with ± entire margin; podetia absent 20

20(19) Thallus on wood or bark 21
Thallus on rocks or soil..... 22

21(20) Squamules very small, to 0.5 mm, granular, shiny; apothecia dark brown, ascospores simple ..... ***Protoparmelia ochrococca***
Squamules mostly >0.5 mm, bullate or flattened, matt or shiny; apothecia black; ascospores simple to 1(-3)-septate ..... ***Hypocenomyce***

22(20) Thallus with schizidia; squamules minute, forming a ± continuous crust ..... ***Baeomyces***
Thallus without schizidia; squamules varied 23

23(22) Thallus C+ red ..... ***Trapelia glebulosa***
Thallus C– 24

24(23) Thallus with lip-shaped soralia on lobe ends; on peaty turf or wood ..... ***Trapeliopsis***
Soralia absent 25

25(24) Apothecia without a thalline margin 26
Apothecia with a thalline margin 31

26(25) Ascospores simple 27
Ascospores 1- to 5-septate or muriform 29

27(26) Ascospores nearly globose; on siliceous rock ..... ***Schaereria***
Ascospores ellipsoid; on soil or limestone 28

28(27) Apothecia brown-black; on soil amongst limestone rocks ..... ***Psora* & *Romjularia***
Apothecia dark red-brown; on acid soil, montane ..... ***Lecidoma demissum***

29(26) Ascospores pale brown, muriform ..... ***Lopadium***
Ascospores colourless, 1- to 5-septate 30

30(29) Paraphyses free, each with a distinct swollen apical cell, covered by a pigmented cap ..... ***Toninia***
Paraphyses conglutinated, without cap ..... ***Bilimbia lobulata***

31(25) Thalline margin ± granular-crenulate, thallus minutely granular-squamulose; cephalodia present, at times inconspicuous ..... ***Psoroma hypnorum***
Thalline margin smooth; thallus with appressed, ± overlapping squamules 32

32(31) Squamules yellow-grey or grey-green; ascospores simple ..... ***Squamarina***
Squamules grey-brown; ascospores 1-septate ..... ***Solenopsora holophaea***

33(8) Thallus sorediate, leprose or with irregular, isidia-like protuberances 34
Thallus not sorediate, without irregular, isidia-like protuberances 40

34(33) Pink-grey cephalodia present on upper surface ..... ***Placopsis***
Cephalodia absent 35

35(34) Thallus surface leprose ..... ***Lepraria***
Thallus sorediate or isidiate 36

36(35) Thallus C+ red 37
Thallus C– 38

37(36) Soralia developing from the sides of areoles or cracks in the thallus ..... ***Trapelia placodioides***
Thallus with clusters of coarse, irregular, isidia-like protuberances ..... ***Trapeliopsis wallrothii***

38(36) Thallus K+ yellow, thallus pruinose, with distinct lobes closely contiguous for most of their length; apothecia without a thalline exciple ..... ***Diploicia canescens***
Thallus K– ; thallus non-pruinose; apothecia with a thalline exciple 39

39(38) Thallus lobes corticate; soralia discrete; thallus greenish to brown ..... ***Hyperphyscia adglutinata***
Thallus not corticate; soredia irregular and confluent; thallus whitish ..... ***Caloplaca teicholyta***

40(33) On soil 41
On rocks 43

41(40) Thallus green when wet, pale brown when dry; flattened papillae present towards centre; apothecia rare, ± stalked; on acid soil ..... ***Baeomyces placophyllus***
Thallus ± white, or white-pruinose; without papillae; apothecia frequent, sessile; on calcareous soil 42

42(41) Apothecia without a thalline exciple; ascospores brown, 1-septate ..... ***Buellia asterella***
Apothecia with a thalline exciple; ascospores colourless, simple ..... ***Squamarina lentigera***

43(40) Thallus ± crustose with elongated marginal lobes; apothecia immersed; asci >200-spored; thallus C+ red ..... ***Sporastatia***
Thallus squamulose, apothecia sessile; asci <8-spored, thallus C– 44

44(43) Ascospores 1-septate; on limestone and coastal serpentine ..... ***Solenopsora***
Ascospores simple; on a range of substrata, especially nutrient enriched rocks and building materials ..... ***Lecanora*** (placodioid species)

GENERIC KEY 3
Crustose with Perithecioid Ascomata

Synopsis

1 Photobiont a cyanobacterium 2
Photobiont a green alga, or absent 7

2(1) Ascospores 1-septate; all parts of hymenium I–, hamathecium of branched and anastomosing interascal filaments (when ascospores 3-septate cf. *Petractis clausa*) 3
Ascospores simple; thallus and hymenium various 4

3(2) Thallus of small globose or flattened squamules up to 0.5 mm diam., connected to the base of the ascoma by thick-walled, dark hyphae; on dead bryophytes or plant debris in montane habitats ..... ***Frigidopyrenia bryospila***
Thallus a continuous, patchy, or cracked crust, not connected to base of ascoma by dark hyphae; on wet or calcareous rock or sand, or in marine habitats ..... ***Collemopsidium***

4(2) Photobiont *Calothrix* filaments or loose chlorococcoid cells 5
Photobiont gloeocapsoid, surrounded by reddish gel 6

5(4) Photobiont *Calothrix* filaments ..... ***Porocyphus***
Photobiont loose chlorococcoid cells ..... ***Pyrenocarpon thelostomum***

6(4) Hamathecium of simple to branched and anastomosing interascal filaments, periphysoids absent; asci various ..... ***Pyrenopsis***
Hamathecium comprising a zone of periphysoids near to the ostiole; interascal filaments either absent or inconspicuous and much shorter than the asci; asci thin-walled ..... ***Cryptothele rhodosticta***

7(1) Asci with >8 spores 8
Asci with (1-)2-8 spores 12

8(7) Photobiont trentepohlioid; hamathecium of mostly unbranched interascal filaments and of periphyses; hymenial gel I– or almost; asci thin-walled, ascospores 0-3(-5)-septate, size in the range 10-20 µm long ..... ***Thelopsis***
Photobiont not trentepohlioid, or absent 9

9(8) Ascospores brown, 1-septate ..... ***Muellerella***
(lichenicolous fungus, one possibly lichenized, not treated)
Ascospores colourless, 0- to 1-septate 10

10(9) Exciple without dark pigments, yellow-green vulpinic acid derivatives sometimes present, as a pruina on thallus or ascoma, or within the exciple ..... ***Thelocarpon***
Exciple with dark pigments, vulpinic acid derivatives absent 11

11(10) Ascospores simple; hamathecium without interascal filaments ..... ***Trimmatothele perquisita***
Ascospores 1-septate; hamathecium with thin interascal filaments ..... ***Epigloea***

12(7) Ascoma wall not carbonized 13
Ascoma wall carbonized at least in part 32

13(12) Ascospores simple 14
Ascospores septate 15

14(13) Ascospores thin-walled; thallus often with cephalodia ..... ***Coccotrema citrinescens***
Ascospores with thick, layered wall; without cephalodia ..... ***Pertusaria***

15(13) Ascospores transversely septate or with occasionally a few longitudinal septa 16
Ascospores muriform 25

16(15) Paraphyses absent 17
Paraphyses present 18

17(16) Thallus thin, superficial on living leaves, composed of a weft of brown, branched hyphae with cells mostly 8-22 × 3-6.5 µm, often constricted at the septa ..... ***Phylloblastia inexpectata***
Thallus cells often with minute papillae; on bark, wood, soil, or on thin soil or bryophytes over rock ..... ***Psoroglaena***

18(16) Paraphyses branched or even anastomosing and often agglutinated 19
Paraphyses simple, lax 21

19(18) Paraphyses anastomosing, not agglutinated; ascoma wall bright blue-green, K–, N+ red ..... ***Cercidospora discolorella***
(not treated, although possibly lichenized)
Paraphyses branched, agglutinated; ascoma wall with whitish to brown colours 20

20(19) Ascospores fusiform, remaining colourless ..... ***Enterographa***
Ascospores clavate, becoming brown ..... ***Peterjamesia circumscripta***

21(18) Periphysoids present; hymenium in a layer; ostioles becoming wide open, especially when wetted 22
Periphysoids absent; hymenium filling the whole ascoma; ostioles remaining tiny 23

22(21) Thallus firm, ascomata in section without angular cells near the ostiole ..... ***Thelotrema***
Thallus often inconspicuous, ascomata in section with angular cells near the ostiole ..... ***Ramonia***

23(21) Ascospores ellipsoid, 1- to 3-septate; algae with gelatinous sheath ..... ***Epigloea***
Ascospores fusiform to filiform; algae trebouxioid or *Trentepohlia* 24

24(23) Photobiont trebouxioid or *Trentepohlia*; ascospores multiseptate, long and narrow; asci without a refractive ring in the apex ..... ***Belonia***
Photobiont *Trentepohlia*; ascospores generally 3- to 9-septate, sometimes multiseptate; asci sometimes with a chitinous ring in the apex ..... ***Porina***

25(15) Periphysoids present; hymenium in a layer; ostioles becoming wide open, especially when wetted 26
Periphysoids absent; hymenium filling the whole ascoma; ostioles remaining tiny 27

26(25) Thallus firm, ascomata in section without angular cells near the ostiole ..... ***Thelotrema***
Thallus often inconspicuous, ascomata in section with angular cells near the ostiole ..... ***Ramonia***

27(25) Ascomatal wall bright green, K–, N+ red; on smooth bark ..... ***Mycoglaena***
Ascomatal wall shades of brown, reddish or green-brown, but not bright green 28

28(27) Ascomatal wall pallid to reddish, ascospores with pointed to acuminated ends 29
Ascomatal wall shades of brown or green-brown, ascospores rounded 30

29(28) Photobiont green, not trentepohlioid ..... ***Paranectria oropensis***
(lichenicolous fungus, not treated)
Photobiont trentepohlioid ..... ***Belonia nidarosiensis***

30(28) Photobiont trentepohlioid …..... ***Leucocarpia biatorella***
Photobiont green, not trentepohlioid 31

31(30) Ascus wall K/I+ blue, apex with a darker staining internal structure; hymenial gel I+ red, K/I+ blue (hemiamyloid) ..... ***Protothelenella***
Ascus wall and hymenial gel I– ..... ***Thelenella***

32(12) Ascospores simple, ellipsoid 33
Ascospores septate, rarely simple and then narrowly fusiform 34

33(32) Hamathecium of periphyses and periphysoids only (lining the ostiolar canal and upper part of centrum), interascal filaments absent; hymenial gel I+ red (blue at very low concentrations of iodine), K/I+ blue ..... ***Verrucaria***
Hamathecium at least partly comprising interascal filaments; on soil ..... ***Thrombium epigaeum***

34(32) Ascospores transversely septate 35
Ascospores muriform 67

35(34) Ascospore wall brown at maturity 36
Ascospore wall colourless at maturity, only brown when over-mature 48

36(35) Ascospores 1-septate 37
Ascospores at least 3-septate 43

37(36) Ascomata united below a common involucrellum; hamathecium of pseudoparaphyses with lumpy outline; not lichenized; on *Alnus* ..... ***Tomasellia diffusa***
Ascomata not united under a common involucrellum (exceptionally a few ascomata clustered) 38

38(37) Growing on (lichens on) rock 39
Growing on bark 40

39(38) Paraphyses absent ..... ***Endococcus***
(lichenicolous fungus often thought to be a lichen; not treated)
Paraphyses present, branched ..... ***Lichenothelia renobalesiana***
(lichenicolous fungus often thought to be a lichen; not treated)

40(38) On rough bark or smooth dead bark; wall brown to black; not lichenized 41
On smooth, living bark, mainly branches; wall green to brown 42

41(40) Ascomatal wall without angular cells ..... ***Peridiothelia*** (not treated)
Ascomatal wall with angular cells ..... ***Kirschsteiniothelia*** (not treated)

42(40) Ascospores in the range 13-21(-25) µm long, distinctly brown at maturity; hymenial gel I± violet ..... ***Mycomicrothelia***
Ascospores in the range 27-40 µm long, at most pale brown at maturity; hymenial gel always I– ..... ***Mycoporum antecellens***

43(36) Ascospore walls strongly and unequally thickened, so that the lumina appear angular or lenticular in optical section, 3-septate; hamathecium of more or less unbranched interascal filaments (paraphyses) and periphyses; always on bark ..... ***Pyrenula***
Ascospores not angularly thickened 44

44(43) Growing on (lichens on) rock 45
Growing on bark 46

45(44) Thallus black; not lichenized ..... ***Lichenothelia convexa*** (not treated)
Thallus not black; lichenicolous ..... ***Phaeospora***
(lichenicolous fungus often thought to be a lichen; not treated)

46(44) Ostiole shortly linear; ascospores more than 3-septate; not lichenized ..... ***Navicella pileata*** (not treated)
Ostiole punctiform 47

47(46) Ascomatal wall thick, cells invisible; on old bark; ascospores 3-septate ..... ***Lithothelium phaeosporum***
Ascomatal wall thin, cellular; mostly on young bark; ascospores 3- to 7-septate ..... ***Eopyrenula***

48(35) Ascospores very narrowly ellipsoid to filiform, 5-85 times as long as wide, 1.5-4.5 µm wide, simple or 1- to multiseptate; always on bark 49
Ascospores broadly to narrowly ellipsoid, 2-5 times as long as wide, 1- to multiseptate or muriform 53

49(48) Hamathecium without interascal filaments; ascospores sometimes dumb-bell-shaped; on rock ..... ***Sarcopyrenia***
Hymenium with interascal filaments; ascospores never dumb-bell-shaped; on bark 50

50(49) Hymenial gel K/I+ deep blue; hamathecium of smooth, branched and anastomosing interascal filaments 1.5-2 µm wide (paraphysoids); periphyses present in ostiolar canal; ascospores filiform, 7- or more septate; ascomata solitary, not united under a common involucrellum ..... ***Rhaphidicyrtis trichosporella***
Hymenial gel K/I– or K/I+ blue-green 51

51(50) Ascus functionally unitunicate, thin or slightly thickened at apex; periphyses sometimes present in the ostiolar canal; hamathecium of smooth, sometimes branching and anastomosing interascal filaments 1.5-2 µm wide (paraphyses) ..... ***Cresporhaphis***
Ascus with two functional wall layers, fissitunicate; hamathecium of pseudoparaphyses or paraphysoids; periphyses absent 52

52(51) Hamathecium of branched, anastomosing, frequently septate interascal filaments, constricted at the septa (pseudoparaphyses); ascospores 1- to 5-septate, *c.* 5-30 times as long as wide ..... ***Leptorhaphis***
Hamathecium of anastomosing, narrow interascal filaments, not constricted at the septa (paraphysoids); ascospores 5- to 14-septate, *c*. 30-80 times as long as wide ..... ***Celothelium ischnobelum***

53(48) Ascospores with consistently 5 or more septa 54
Ascospores 1-3(-4)-septate 56

54(53) Hymenium absent; ascospores predominantly *c.* 7-septate, narrowly ellipsoid, 3.5-6.5 times as long as wide; involucrellum absent, exciple dark more or less throughout ..... ***Normandina acroglypta***
Hymenium present 55

55(54) Ascospores at one end strongly pointed into a tail; not lichenized ..... ***Rebentischia*** (not treated)
Ascospores not strongly asymmetrical; lichenized ..... ***Strigula***

56(53) Ascomata with stiff black hairs ..... ***Antennulariella lichenisata***
Ascomata without hairs 57

57(56) Ascomata united below a common involucrellum; ascospores 1- to 3-septate, colourless or brown; hamathecium of pseudoparaphyses with lumpy outline; not lichenized; always on bark 58
Ascomata not united under a common involucrellum (exceptionally a few ascomata clustered) 59

58(57) Ascomata regularly circular or broadly ellipsoid in outline in surface view; ascospores 3-septate when mature, colourless (a few old spores may be brownish) ..... ***Tomasellia gelatinosa***
Ascomata elliptical or irregular in outline in surface view; ascospores 1-septate and colourless when mature (a few old spores may be 3-septate and/or lightly browned) ..... ***Mycoporum***

59(57) Hamathecium without interascal filaments 60
Hamathecium with interascal filaments 61

60(59) Ascospores constricted at the septum; upper cell larger than lower cell; ascospores < 7 µm wide ..... ***Stigmidium*** (not treated; lichenicolous fungi although at least one species, *S. marinum*, may be lichenized)
Ascospores not constricted; cells not markedly uneven; broader ..... ***Thelidium***

61(59) Ascospores (in water mounts) with a warty perispore which disintegrates in K; ascus with a convex structure in the apical wall ..... ***Acrocordia***
Ascospores not warty; ascus variously thickened at apex, but without such a structure 62

62(61) Hamathecium of interascal filaments (paraphysoids) which are mostly unbranched except adjacent to the exciple 63
Hamathecium of interascal filaments which are usually branched and anastomosing (rarely absent, and then periphyses present) 64

63(62) On bleached wood, not lichenized; ascospores symmetrical, not constricted ..... ***Exarmidium*** (not treated)
On other substrata, lichenized with *Trentepohlia*; ascospores asymmetrically septate; often constricted; 1-septate spores sometimes disarticulating into part-spores within the ascus; ascus with a narrow ocular chamber; macroconidia subapically inserted on the conidiogenous cell, 0- to several septate, sometimes with gelatinous appendages ..... ***Strigula***

64(62) Involucrellum more or less cellular, not containing bark cells 65
Involucrellum of compacted hyphae and often with layers of bark cells; hamathecium of slender or lumpy, branched and anastomosing pseudoparaphyses, or (rarely) interascal filaments absent and then periphyses present; ascospores 1- to 3-septate, the first-formed septum generally at or above the middle of the spore; perispore absent or present; lichenized or not 66

65(64) Ascomatal wall with K+ green/black pigment; hamathecium of slender, branched and anastomosing pseudoparaphyses; lichenized ..... ***Anisomeridium***
Ascomatal wall K–; hamathecium of wider, *c.* 2 µm wide, branched but not anastomosing pseudoparaphyses; not lichenized ..... ***Lophiostoma corticolum*** (not treated)

66(64) Ascospores 27-40 × 8-13 µm, often becoming brown and verruculose (ascospores 1-septate; involucrellum brown in K) ..... ***Mycoporum antecellens***
Ascospores <27 µm long or <8 µm wide, colourless ..... ***Arthopyrenia***

67(34) Hymenium without interascal filaments 68
Hymenium with interascal filaments 71

68(67) Hymenium containing photobiont cells ..... ***Staurothele***
Hymenium not containing photobiont cells 69

69(68) Involucrellum absent; exciple more or less three layered, the outer layer pigmented; ascospores colourless; cortical cells of thallus sometimes with minute papillae; on bark, soil and bryophytes (these sometimes over rock) ..... ***Agonimia***
Involucrellum present or absent; if involucrellum absent then exciple only one- to two-layered; cortical cells without papillae; on soil, bryophytes over rock, or directly on rock 70

70(69) Ascospores brown, with a distinct perispore (ascospores (18-)22.5-27.5(-31) µm long, with 6-15 cells visible in optical section) ..... ***Merismatium deminutum***
Ascospores colourless or brown, but if brown then without a distinct perispore ..... ***Polyblastia* & *Atla***

71(67) Ascospores brown when mature, large, (57-)70-135(-l40) µm long, muriform; hamathecium of mostly unbranched interascal filaments (paraphyses) and periphyses; ascomata large, 1-1.2 mm diam., ostioles lateral, often joined in groups; on bark ..... ***Pyrenula hibernica***
Ascospores colourless (sometimes faintly brown when old) 72

72(71) Photobiont trentepohlioid; forming a distinct thallus; interascal filaments not or sparsely branched except adjacent to the exciple ..... ***Strigula***
Not lichenized, or at most with an indistinct thallus weakly lichenized with a trentepohlioid alga; interascal filaments branched and anastomosing (exclusively on bark) 73

73(72) Interascal filaments slender; ascospores with a perispore ..... ***Julella***
Interascal filaments lumpy in outline; ascospores without a perispore ..... ***Cyrtidula***

GENERIC KEY 4
Crustose with Stalked Apothecia

There are many fungi with conidia that resemble species with stalked apothecia; their spores originate singly at the end of hyphae, not inside asci; these are not keyed out here.

1 Apothecia with a dry spore mass (asci disintegrating early) 2
Apothecia without a dry spore mass (asci persistent) 7

2(1) Ascospore mass black; ascospore walls dark brown 3
Ascospore mass green or brown; ascospore walls colourless, green or brown 4

3(2) Ascospores 1-septate ..... ***Calicium***
Ascospores simple ..... ***Sphinctrina***

4(2) Ascospore mass green; ascospore walls green with spirally arranged ridges ..... ***Microcalicium***
Ascospore mass brown or pink; ascospore walls colourless or pale brown; ornamentation various 5

5(4) Ascospores globose with colourless walls and warted, ± cog-like ornamentation; thallus immersed; photobiont *Trentepohlia* ..... ***Sclerophora***
Ascospores globose, ellipsoid or oblong with pale brown walls, ornamentation various 6

6(5) Thallus immersed or usually superficial; photobiont chlorococcoid, *Stichococcus* or *Trentepohlia* ..... ***Chaenotheca***
Without algae, mainly on roots ..... ***Roesleria subterranea*** (not treated)

7(1) Ascospores brown; thallus mainly on twigs, bark, wood, or on lichens 8
Ascospores colourless; thallus on rock, soil, peat or rotting wood or debris 12

8(7) Ascospores 3-septate at maturity ..... ***Stenocybe***
Ascospores simple to 1-septate at maturity 9

9(8) Thallus on living twigs and small branches of deciduous trees (especially *Populus*) ..... ***Phaeocalicium***
Thallus on various substrata, but not on living twigs or small branches 10

10(9) Ascospores simple, globose or ellipsoid with pointed apices and >4.5 µm wide ..... ***Sphinctrina***
Ascospores simple to 1-septate, oblong to ellipsoid, <4.5 µm wide 11

11(10) Ascus apex unevenly thickened; ascus apex penetrated by a canal, visible at least in semi-mature stages; ascospores simple or 1-septate ..... ***Chaenothecopsis***
Ascus apex unevenly thickened; ascospores simple ..... ***Mycocalicium subtile***

12(7) Apothecia borne on tips of hollow, turgid, simple or branched stalks ..... ***Pycnothelia papillaria***
Apothecia borne on tips of solid, rarely branched stalks 13

13(12) Apothecia black, even when wet 14
Apothecia pallid, pink or brown to reddish 15

14(13) Thallus white, corticate, areolate; ascospores simple ..... ***Pilophorus strumaticus***
Thallus various; ascospores 1- to 7-septate ..... ***Micarea*** (***lignaria*** & ***prasinella***)

15(13) Ascospores filiform, multiseptate, over 25 µm long ..... ***Gomphillus calycioides***
Ascospores ellipsoid, simple to 3-septate, under 25 µm long 16

16(15) Ascomata under 0.5 mm diam., paraphyses lax ..... ***Vezdaea***
Ascomata often larger; paraphyses not lax 17

17(16) Hymenium jelly I+ blue; apothecium pink ..... ***Dibaeis baeomyces***
Hymenium jelly I–; apothecium reddish brown ..... ***Baeomyces***

GENERIC KEY 5
Crustose with Lirellate Apothecia

1 Apothecia lacking true exciple or rarely rudimentary and developed only laterally 2
True exciple present; photobiont various 4

2(1) Apothecia crowded, immersed together in round-irregular, black, often pruinose stroma .....***Syncesia myrticola***
Apothecia single, not combined in a black, carbonaceous stroma 3

3(2) Ascospores 1- to 7-septate, ovoid to oblong-ovoid ..... ***Arthonia***
Ascospores submuriform to strongly muriform, ovoid-ellipsoid ..... ***Arthothelium***

4(1) Ascospores simple 5
Ascospores septate or muriform 9

5(4) Asci 100- to 200-spored; photobiont *Trentepohlia*; exciple with periphysoid filaments .. ***Wadeana***
Asci 8-spored; photobiont chlorococcoid; periphysoid filaments absent 6

6(5) Outer surface of apothecium pale brown; paraphyses simple or sparingly branched .. ***Xylographa***
Outer surface of apothecium black and brittle; paraphyses various 7

7(6) On rock; thallus K+ yellow to red ..... ***Lithographa tesserata***
On wood, rarely bark; thallus K– 8

8(7) Apothecia narrow with slit-like disc ..... ***Ptychographa xylographoides***
Apothecia angular with expanding disc ..... ***Elixia flexella***

9(4) Ascospores 1-septate 10
Ascospores multiseptate or muriform 11

10(9) Hypothecium colourless to brown; ascospores colourless, brown when old, N–; photobiont *Trentepohlia*, chlorococcoid or absent; asci with K/I– apical dome ..... ***Melaspilea***
Hypothecium dark red-brown; ascospores colourless, grey-green to violet-black when old, N+ red; photobiont chlorococcoid; asci with K/I+ blue apical dome (*Rhizocarpon*-type - Fig. 9h) ..... ***Poeltinula cerebrina***

11(9) Ascospores I+ violet, thick-walled, their cells with lens-shaped, round or oval lumina; hamathecium of simple paraphyses 12
Ascospores I– , with cylindrical or cuboid lumina; hamathecium variable 14

12(11) Ascospores muriform, colourless ..... ***Graphina***
Ascospores multi-transversely septate, colourless or not 13

13(12) Ascospores distinctly grey-brown when mature, but often remaining colourless for some time; apothecia flat with inconspicuous, scarcely raised margins and widely expanded discs ..... ***Phaeographis***
Ascospores not coloured when mature, occasionally becoming brown when old; apothecia with surfaces becoming longitudinally grooved or ridged and narrow discs ..... ***Graphis***

14(11) Ascospores muriform, colourless; not lichenized ..... ***Gloniopsis praelonga*** (not treated)
Ascospores multi-transversely septate, colourless or not 15

15(14) Ascospores brown 16
Ascospores colourless 17

16(15) True exciple black and friable; end cells of the ascospores often markedly paler than middle cells; not lichenized ..... ***Hysterium*** (not treated)
True exciple not friable; ascospores often becoming rough ..... ***Opegrapha***

17(15) Lateral exciple in section well-developed, brown to black 18
Lateral exciple not developed, not coloured 19

18(17) Thallus Pd+ yellow; on rock; ascospores 3(-5)-septate ..... ***Lecanactis dilleniana***
Thallus not Pd+ yellow ..... ***Opegrapha*** & ***Lecanographa***

19(17) Hypothecium dark red-brown; ascospores 3-septate ..... ***Schismatomma graphidioides***
Hypothecium colourless or pale brown 20

20(19) Ascospores fusiform, remaining colourless ..... ***Enterographa***
Ascospores clavate, becoming brown ..... ***Peterjamesia circumscripta***

GENERIC KEY 6
Crustose with rounded apothecia

1 Photobiont green 2
Photobiont blue-green ..... **Key 6f**

2(1) Photobiont chlorococcoid 3
Photobiont *Trentepohlia* ..... **Key 6e**

3(2) Ascospores colourless 4
Ascospores brown, grey or black when mature ..... **Key 6d**

4(3) Ascospores simple 5
Ascospores septate or muriform ..... **Key 6c**

5(4) Asci >8-spored ..... **Key 6b**
Asci to 8-spored ..... **Key 6a**

Generic Key 6a - Crustose Lichens: apothecia rounded; photobiont chlorococcoid; ascospores colourless, simple; asci to 8-spored.

Synopsis

1 Apothecia yellow to deep red and K+ purple (sometimes only apparent in sections) 2
Apothecia not yellow to deep red and K+ purple 5
5(1) Apothecia and thallus pale to deep yellow-orange, sometimes green-tinged 6
Apothecia and thallus not as above 7
7(5) Ascospores very large, >(30-)40 µm long; asci often <8-spored 8
Ascospores small to medium, <30 µm long; asci mostly 8-spored 13
13(7) Mature apothecia sessile with raised thalline exciple (in sections containing algae usually extending below the hypothecium) 14
Mature apothecia immersed or sessile without a raised thalline exciple 20
20(13) Apothecia urceolate or aspicilioid; disc concave to flat, at or below the level of the thallus surface; exciple thin or inconspicuous; on rocks (rarely worked timber) 21
Apothecia emergent to sessile; disc flat to convex at maturity, raised above level of thallus surface; exciple distinct or not; substratum various 39
39(20) Paraphyses unbranched, if branched then only at the tip 40
Paraphyses branched, anastomosing or netted 68

1 Apothecia yellow to deep red and K+ purple or red (sometimes only apparent in sections) 2
Apothecia not yellow to deep red and K+ purple 5

2(1) Thalline exciple of apothecia absent 3
Thalline exciple of apothecia present 4

3(2) Thallus entirely finely granular-sorediate, C+ orange; apothecia dark reddish brown ..... ***Pyrrhospora quernea***
Thallus immersed, or smooth and continuous or ± evanescent, never sorediate, C–; apothecia yellow to orange-red ..... ***Protoblastenia***

4(2) Thallus yellow-orange, rather thick, granular-squamulose; lowland, calcareous soil ..... ***Fulgensia***
Thallus grey, thin, minutely granular to film-like; montane on mosses ..... ***Caloplaca nivalis***

5(1) Apothecia and thallus pale to deep yellow-orange, sometimes vivid yellow-green (pulvinic acid derivatives) 6
Apothecia and thallus not strongly yellow-green, without pulvinic acid derivatives 7

6(5) Thallus entirely finely granular-sorediate; apothecia convex without a thalline exciple; ascospores to 7 µm long, ovoid (tear-shaped) ..... ***Psilolechia lucida***
Thallus granular; apothecia ± flat with a thalline exciple; ascospores >9 µm long, ellipsoid ..... ***Candelariella***

7(5) Ascospores very large, >(30-)40 µm long; asci often <8-spored 8
Ascospores small to medium, <30 µm long; asci mostly 8-spored 13

8(7) Apothecia sessile, immarginate; thalline exciple absent; true exciple poorly developed, appearing pseudoparenchymatous at base of apothecium; internal pigments brown, N-; on soil ..... ***Aphanopsis coenosa***
Apothecia immersed in thallus, or sessile with well-developed true or thalline exciple; if sessile and immarginate then internally with green, violet, or purple N+ red pigments; substrata various 9

9(8) Apothecia without a thalline exciple, sessile ..... ***Mycoblastus***
Apothecia with a thalline exciple or immersed in thallus and bordered by areoles 10

10(9) Apothecia sessile, always single with a widely expanded disc and thick thalline exciple; ascospores thin-walled ..... ***Ochrolechia***
Apothecia lacking the above combination of characters 11

11(10) Cephalodia often present; periphysoids present ..... ***Coccotrema citrinescens***
Cephalodia always absent; periphysoids absent 12

12(11) Thallus on mosses and decaying plants in calcareous environments, K–, KC–, Pd–; disc grey-black; epithecium K+ brown; ascospores 30-60 µm long ..... ***Megaspora verrucosa***
Thallus on bark, wood or rock, or if on mosses and decaying plant remains then epithecium K+ violet and thallus with a positive reaction to K, KC or Pd, or ascospores >65 µm long ..... ***Pertusaria***

13(7) Mature apothecia sessile with raised thalline exciple (in sections containing algae usually extending below the hypothecium) 14
Mature apothecia immersed or sessile without a raised thalline exciple 20

14(13) Ascospores with a distinctly warted epispore (×400) ..... ***Psoroma hypnorum***
Ascospores without a warted epispore 15

15(14) Hymenium purple-red or purple-violet throughout ..... ***Tephromela***
Hymenium colourless, or green or brown in uppermost part (epithecium) 16

16(15) Epithecium dull green, K+ violet ..... ***Pertusaria***
Epithecium colourless or differently coloured, if green then not K+ violet…..... 17

17(16) Ascus in I/KI with dark blue axial tube (*Porpidia*-type - Fig. 9g) ..... ***Koerberiella wimmeriana***
Ascus in I/KI without dark blue axial tube (*Bacidia*-, *Lecanora*- or *Trapelia*-type - Fig. 9a,e,m) .. 18

18(17) Thallus C+ red; red-brown, wart-like cephalodia often present; asci in K/I with colourless or pale blue apical dome ..... ***Placopsis***
Thallus C–, or if C+ red then cephalodia absent and ascus in K/I with dark blue apical dome ... 19

19(18) Cortex of thallus, thalline exciple and epithecium brown, K–; apothecia not pruinose; paraphyses mostly simple, with gelatinous apical hood that usually contains a dark brown cap; ascospores fusiform or narrowly ellipsoid, 7-13 × 2-5 µm; conidia bacilliform to short-acicular; atranorin absent (cf. also *Bryonora curvescens*) ..... ***Protoparmelia***
Without above combination of characters; atranorin (K+ yellow) often present ..... ***Lecanora***

20(13) Apothecia urceolate or aspicilioid; disc concave to flat, at or below the level of the thallus surface; exciple thin or inconspicuous; on rocks (rarely worked timber) 21
Apothecia emergent to sessile; disc flat to convex at maturity, raised above level of thallus surface; exciple distinct or not; substratum various [**NB:** check also the key to *Lecidea*, as many species of *Lecidea* s.lat. will not key out below] 39

21(20) Medulla I+ blue; asci *Porpidia*-type (Fig. 9g); exciple thin or inconspicuous, colourless in section; ascospores with amyloid perispore ..... ***Bellemerea alpina***
Medulla I–, but if I+ blue then either asci not of *Porpidia*-type, or exciple pigmented in section; ascospores without amyloid perispore 22

22(21) Paraphyses unbranched or sparingly branched only towards the apex 23
Paraphyses branched or anastomosing 32

23(22) Epithecium blue-green, N+ green, red or violet 24
Epithecium brown or black, N– 28

24(23) Hypothecium dark brown to black 25
Hypothecium colourless or pale 26

25(24) Asci with a conspicuous apical dome, *Candelaria*-type; thallus sections C– ..... ***Claurouxia chalybeioides***
Asci lacking an apical dome, *Schaereria*-type (Fig. 9j); thallus sections C+ red ..... ***Schaereria fuscocinerea***

26(24) Paraphysis cells distinctly bead-like (moniliform); epithecium N+ green, K+ brown ..... ***Aspicilia***
Paraphysis cells not bead-like; epithecium N+ red or violet 27

27(26) Hymenium <70 µm high; ascus with K/I+ blue tholus ..... ***Eiglera flavida***
Hymenium >70 µm high; ascus with K/I– tholus ..... ***Hymenelia* & *Ionaspis***

28(23) Paraphysis tips distinctly swollen, apical cell with a dark brown cap ..... ***Fuscidea***
Paraphysis tips not or only slightly swollen, apical cell without a dark brown cap 29

29(28) On chalk stones; ascus apex with K/I– apical dome ..... ***Lecidea lichenicola***
Not on chalk; ascus with K/I+ blue apical dome 30

30(29) Hymenium >90 µm high; hypothecium dark red-brown; ascus apex *Biatora*-type (Fig. 9b) ..... ***Lecidea phaeops***
Hymenium <80 µm high; hypothecium colourless, brown or black; ascus apex *Lecanora*- or *Lecidea*-type (Fig. 9e,f) 31

31(30) Hypothecium colourless; ascus apex *Lecanora*-type (Fig. 9e) ..... ***Lecanora***
Hypothecium colourless to brown-black; ascus apex *Lecidea*-type (Fig. 9f) ..... ***Lecidea***

32(22) Ascospores with a perispore 2 µm thick; hypothecium dense, black ..... ***Porpidia***
Perispore absent; hypothecium colourless to shades of brown 33

33(32) Thallus rust-red; epithecium green; hypothecium K± purple ..... ***Tremolecia atrata***
Thallus white, grey, green or brown; epithecium brown, black or green-brown; hypothecium K– 34

34(33) Hypothecium dark brown; epithecium brown-black; asci *Rimularia*-type (Fig. 9i) ..... ***Rimularia***
Hypothecium colourless to pale orange-brown; epithecium colourless, brown or green-brown; asci not *Rimularia*-type 35

35(34) Hymenium >140 µm high; thallus sometimes with cephalodia; ascus *Porpidia*-type (Fig. 9g) ..... ***Amygdalaria***
Hymenium <120 µm high; cephalodia absent; ascus *Porpidia*-type or otherwise 36

36(35) Epithecium brown, K–,N-; asci *Porpidia*-type (Fig. 9g); on calcareous rocks ..... ***Clauzadea***
Epithecium (in water or K–) green, N+ red; asci not *Porpidia*-type; on siliceous rocks 37

37(36) Thallus (in sections) C+ red; asci *Schaereria*-type (Fig. 9j); conidia bacilliform ..... ***Schaereria***
Thallus (in sections) C–, KC± pink; asci *Lecanora*-type (Fig. 9e); conidia if present curved and thread-like 38

38(37) Algal cells present below hypothecium; conidia unknown ..... ***Clauzadeana macula***
Algal cells absent below hypothecium; conidia curved, thread-like ..... ***Miriquidica***

39(20) Paraphyses unbranched, if branched then only at the tip 40
Paraphyses branched, anastomosing or netted 68

40(39) True exciple absent or excluded early 41
True exciple present and obvious 50

41(40) Apothecia dark brown or black, even when wet 42
Apothecia pallid, pale brown, or orange to reddish 45

42(41) Hypothecium brown, K+ orange or purplish 43
Hypothecium colourless, K– 44

43(42) Exciple K+ purple …..... ***Phaeopyxis varia***
(not treated; lichenicolous fungus on *Trapeliopsis gelatinosa*, often thought to be a lichen)
Exciple K–, hypothecium K+ orange ..... ***Protomicarea limosa***

44(42) Epithecium blue-green; apothecia glossy, black; asci *Bacidia*-type (Fig. 9a) ..... ***Calvitimela***
Epithecium red brown ..... ***Lecidoma demissum***

45(41) Hymenium <40 µm high 46
Hymenium >40 µm high 48

46(45) Thallus minutely squamulose, ascospores ellipsoid to fusiform, 2-3 µm wide; conidia bacilliform; asci *Bacidia*-type (Fig. 9a) ..... ***Phyllopsora rosei***
Thallus crustose 47

47(46) Ascospores ovoid, narrow (1-2 µm wide); asci *Porpidia*-type (Fig. 9g) ..... ***Psilolechia***
Ascospores fusiform-ellipsoid. broader (2-3 µm wide); asci *Bacidia*-type (Fig. 9a) ..... ***Cliostomum tenerum***

48(45) Hymenium 120-160 µm high, ascus *Trapelia*-type (Fig. 9m) ..... ***Coppinsia minutissima***
Hymenium usually <100 µm high; asci *Lecanora*-type (Fig. 9e), rarely *Bacidia*-type (Fig. 9a).. 49

49(48) Paraphyses without cap; apothecia sessile from the beginning ..... ***Lecanora***
Paraphyses with a dark cap; apothecia starting in closed thallus warts ..... ***Ameliella***

50(40) Hymenium >90 µm high 51
Hymenium <90 µm high 52

51(50) On rock or bark; hypothecium brown; asci lacking an apical dome, *Schaereria*-type (Fig. 9j) ..... ***Schaereria***
On leafy liverworts; hypothecium colourless; asci with conspicuous, K/I– apical dome ..... ***Mniaecia***

52(50) Exciple K+ magenta; on siliceous rocks ..... ***Adelolecia pilati***
Exciple K– or K+ not magenta; substrata various 53

53(52) Ascus apex internally K/I– or K/I+ very faintly blue 54
Ascus apex with K/I+ deep blue apical dome or internal zone 55

54(53) Apothecia on short stalks (section), ascospores mostly 3-4 µm wide; on rock or soil, rarely on wood ..... ***Baeomyces***
Apothecia not stalked; ascospores 4.5-6 µm wide; on wood ..... ***Xylographa trunciseda***

55(53) Ascus apex with narrow, internal K/I+ blue zone (*Fuscidea*-type - Fig. 9d); paraphysis apices swollen, with dark brown cap; apothecial pigments brown (never with green, red or purple hues) ..... ***Fuscidea***
Ascus apex with distinct K/I+ blue apical dome; apothecial pigments often with green, red or purple hues in water or K) 56

56(55) Ascus apex with dark blue axial tube, *Psora*-type; hypothecium brown, K+ orange; epithecium blue-green ascospores ellipsoid-fusiform, 10-14 × 3-5 µm; on soil, montane ..... ***Protomicarea limosa***
Asci not *Psora*-type, without dark blue axial tube 57

57(56) Asci in K/I with a broad clear zone through the otherwise dark blue apical dome (*Candelaria*- or *Lecanora*-types - Fig. 9c,e) 58
Asci in K/I without, or with only a narrow clear zone through the apical dome (*Bacidia*-, *Biatora*- or *Lecidea*-types - Fig. 9a,b,f) 66

58(57) True exciple black and brittle, continuous with the hypothecium; asci *Candelaria*-type with very broad clear zone in the apical dome; on siliceous rock ..... ***Claurouxia chalybeioides***
True exciple pale, or if dark then not brittle; substrata various 59

59(58) Thallus C+ red, Pd+ yellow (alectorialic acid); conidia ellipsoid to subglobose; on acid bark or wood ..... ***Pycnora***
Thallus with a different combination of reactions with C and Pd; conidia and substrata various 60

60(59) On soil, plant debris or bryophytes in montane habitats; apothecia dark blue-grey to black 61
On rock, wood or bark; but if on soil, plant debris or bryophytes then apothecia paler 62

61(60) Apothecia thinly blue-grey pruinose (with bluish bloom when wet) ..... ***Frutidella caesioatra***
Apothecia not pruinose (without bluish bloom when wet) siliceous rock or lichenicolous ..... ***Lecidella wulfenii***

62(60) Ascospores thick-walled (*c*. 0.5 µm thick), ellipsoid with rounded ends, 6-9 µm wide; thallus usually pale-coloured [NB: if thallus dark-grey brown on siliceous rocks cf. ***Carbonea assimilis***] ..... ***Lecidella***
Ascospores thin-walled (<0.5 µm thick); mostly narrowly ellipsoid and up to only 6 µm wide .. 63

63(62) Exciple hyphae I+ violet; beginning as lichenicolous on *Lecanora varia*, on wood ..... ***Ramboldia insidiosa***
Exciple hyphae I–; substrata various 64

64(63) Lichenicolous with thallus inapparent or immersed in the host thallus; on *Candelariella* or *Lecanora* species ..... ***Carbonea***
Not lichenicolous 65

65(64) Hypothecium dark brown; on siliceous rock ..... ***Carbonea vorticosa***
Hypothecium colourless ..... ***Lecanora***

66(57) Thallus on bark or overgrowing bryophytes; asci *Biatora*-type (Fig. 9b) ..... ***Biatora***
Thallus growing directly on rock 67

67(66) Asci ± *Bacidia*-type (Fig. 9a); hypothecium pale, extending well into the thallus; epithecium pale brown; ascospores fusiform, 18-22 × 8-10 µm; conidia falcate, 17-20 × 1 µm ..... ***Herteliana gagei***
Asci *Lecidea*-type (Fig. 9e); hypothecium colourless, pale or brown to black, usually not extending into the thallus; conidia elongate-bacilliform ..... ***Lecidea***

68(39) Ascospores with distinct perispore; asci *Porpidia*-type (Fig. 9g) 69
Ascospores lacking a perispore; asci not *Porpidia*-type 75

69(68) Apothecia immersed in or between areoles and with true exciple absent or poorly developed (sections); on siliceous rocks 70
Apothecia emergent to sessile; but if immersed then either true exciple distinct in sections or thallus on calcareous rocks 72

70(69) Ascospores with an I+ blue perispore; on rocks near alpine permanent snow patches ..... ***Bellemerea alpina***
Ascospores with an I– perispore; in various, mostly upland habitats 71

71(70) Medulla I–; areoles matt, without an epinecral layer; cephalodia often present ..... ***Amygdalaria***
Medulla I+ blue; areoles ± glossy, with an epinecral layer; cephalodia absent ..... ***Immersaria athroocarpa***

72(69) On siliceous rocks or other 'acid' substrata; but if on weakly calcareous rocks (especially schists) then apothecia sessile ..... ***Porpidia***
On calcareous rocks or stonework 73

73(72) Apothecial pigments reddish or orange-brown, never with green or purple hues in water or K; medulla I–..... ***Clauzadea***
Apothecial pigments partly with green or purple hues in water or K; medulla I+ blue or I– 74

74(73) Thallus immersed or thin and whitish grey (but never chalky white); apothecia sessile; usually with K+ purplish pigment in hypothecium and exciple ..... ***Farnoldia jurana***
Thallus well-developed, chalky white; apothecia immersed; without K+ purplish pigment in hypothecium and exciple ..... ***Porpidia speirea***

75(68) True exciple poorly developed or excluded early 76
True exciple well-developed and persistent 80

76 (75) Asci thick-walled throughout, often longer than hymenium; hymenial gel absent ..... ***Vezdaea***
Asci not thick-walled throughout, shorter than hymenium; hymenial gel present 77

77(76) Ascospores thick-walled (>0.5 µm); paraphysis apices swollen; asci *Lecanora*-type (Fig. 9e) ..... ***Japewia***
Ascospores thin walled; paraphysis apices not or only slightly swollen; asci *Lecanora*-, *Bacidia*-, ± *Psora*- or *Trapelia*-type (Fig. 9a,e,m) 78

78(77) Hymenium 85-90 µm high; ascus *Trapelia*-type (Fig. 9m); non-lichenized, on wood, very rarely on bark ..... ***Agyrium rufum***
Hymenium <90 µm high; asci *Lecanora*-, *Bacidia*- or ± *Psora*-type (Fig. 9a,e); lichenized, on various substrata 79

79(78) Asci *Lecanora*- or *Bacidia*-type (Fig. 9a) (without dark axial tube in K/I) ..... ***Lecanora***
Asci ± *Psora*-type (with dark axial tube in K/I) ..... ***Micarea***

80(75) Apothecia densely clustered on remains of old hymenia; on old Pinus bark and wood ..... ***Hertelidea botryosa***
Apothecia single, scattered 81

81(80) Hypothecium dark brown to black 82
Hypothecium colourless to pale brown or greenish 87

82(81) Apothecial disc umbonate or gyrose; asci *Lecidea*- or *Rimularia*-type (Fig. 9i) 83
Apothecial disc not gyrose; hymenium <110 µm high; asci *Catillaria*-, *Lecidea*-, ± *Psora*- or *Trapelia*-type 84

83(82) Not lichenicolous, or lichenicolous on *Lecanora rupicola*; ascus *Rimularia*-type (Fig. 9i) ..... ***Rimularia***
Lichenicolous, sometimes gall-forming, on saxicolous *Lecidea* or *Porpidia* species; ascus *Lecidea*-type (Fig. 9e) ..... ***Cecidonia***

84(82) True exciple of distinct, brown-walled pseudoparenchymatous cells; paraphysis apices with dark brown caps; ascus *Trapelia*-type; on soil, rock, wood or bark ..... ***Placynthiella***
True exciple without distinct cells; paraphysis apices various; asci not *Trapelia*-type; on rock or occasionally on wood 85

85(84) Ascospores thick-walled; hypothecium with K+ purplish tinge; on submontane to montane, siliceous rocks ..... ***Orphniospora moriopsis***
Ascospores thin-walled; hypothecium K–; on often lowland, siliceous rocks, or occasionally on wood 86

86(85) Thallus of brown, convex to subsquamulose areoles, (0.5-)1-2(-3) mm diam.; paraphysis apices with dark brown caps; asci *Catillaria*-type (Fig. 9c) ..... ***Lecidea fuliginosa***
Thallus indistinct, grey and continuous to finely rimose, or minutely areolate with areoles to 0.2 mm diam.; paraphysis apices without dark brown caps; asci ± *Psora*-type ..... ***Micarea***

87(81) Hypothecium I+ blue; ascospores thick-walled; on bark ..... ***Japewiella tavaresiana***
Hypothecium I–; ascospores thin-walled; siliceous or corticolous 88

88(87) Ascospores 2-5 µm wide 89
Ascospores 5-10 µm wide 90

89(88) Apothecia concave-urceolate, with algae below hymenium; asci *Lecanora*-type (Fig. 9e); on rock ..... ***Clauzadeana macula***
Apothecia plane to convex, lacking algae below hymenium; asci not *Lecanora*-type ..... ***Micarea***

90(88) Conidia curved; ascus *Lecanora*-type (Fig. 9e); thallus C–; on rock ..... ***Miriquidica***
Conidia straight; ascus *Trapelia*-type; thallus often C+ red ..... see ***Trapelia*** Key

Generic Key 6b - Crustose Lichens: apothecia rounded; photobiont chlorococcoid; ascospores colourless, non-septate; asci >8-spored.

1 Asci 32 to over 100-spored; if 32-spored, thallus not yellow 2
Asci 12- to 32-spored, if 32-spored, thallus yellow 13

2(1) Thallus bright yellow, normally with marginal lobes ..... ***Pleopsidium chlorophanum***
Thallus not yellow 3

3(2) Apothecia with punctiform discs, perithecia-like, often in globose to egg-shaped thalline warts, very small, 0.1-0.2 mm diam., usually pale yellow to green-yellow pruinose, rarely black and non-pruinose ..... ***Thelocarpon***
Apothecia mostly with widely exposed discs, >0.2 mm diam., not perithecia-like, rarely punctiform and then thallus not yellow 4

4(3) Apothecia with a thalline exciple in section [microscope], usually immersed in thallus 5
Apothecia lacking a thalline exciple in section, usually sessile, but immersed in *Sporastatia* 6

5(4) Apothecia >0.3 mm diam, immersed and bordered by thallus; thallus often shiny, pale to dark brown, corticate; ascus apical dome K/I– ..... ***Acarospora***
Apothecia minute, 0.2-0.4 mm diam., white to grey, sometimes dirtied pale brown; thallus cortex absent; ascus apical dome K/I+ blue ..... ***Myriospora heppii***

6(4) Thallus well-developed, areolate, C+ red; prothallus distinct; apothecia rough or wrinkled, immersed; ascus apical dome K/I+ blue ..... ***Sporastatia***
Thallus poorly developed, rarely areolate, C–; prothallus absent; apothecia smooth, or, if wrinkled, sessile; ascus apical dome K/I± 7

7(6) Apothecia convex, brown, red-brown to matt black; true exciple often excluded (except in *Sarcosagium campestre*); species mostly ephemeral, on organic substrata; ascus apical dome K/I± blue 8
Apothecia convex to concave, black-brown to shiny black, true exciple persistent; on rocky substrata; ascus apical dome K/I– but outer wall K/I+ blue 12

8(7) On soil, mosses, decaying plants, very rarely on decaying wood; ascospores ellipsoid or bacilliform 9
On bark or wood; ascospores globose 10

9(8) Apothecia pink-red to red-black, ± barrel-shaped, marginate; true exciple well-developed, concolorous, but often grey-pruinose; asci thin-walled, wall K/I+ blue, apical dome absent and tip K/I– ..... ***Sarcosagium campestre***
Apothecia brown-yellow, yellow-red, convex, immarginate; true exciple very thin or absent; paraphyses simple, richly branched at apices; ascus wall K/I+ blue, apical dome present but K/I– ..... ***Biatorella***

10(8) Apothecia yellow due to anthraquinone ..... ***Piccolia ochrophora***
Apothecia not yellow 11

11(10) Apothecia pale coloured; paraphyses simple or a few forked above, scarcely swollen or with clavate apices 4-5 µm wide; ascus wall K/I+ blue, apical dome K/I– ..... ***Biatoridium***
Apothecia brown to black or red; paraphyses branched and anastomosing, apices scarcely swollen <3 µm wide; ascus wall and dome K/I+ blue ..... ***Strangospora***

12(7) Apothecial disc flat, smooth, not warty, folded or carbonaceous; paraphyses simple, distinctly septate, swollen at apices ..... ***Sarcogyne***
Apothecial disc umbonate, often becoming gyrose; paraphyses richly branched and anastomosing ..... ***Polysporina***

13(1) Apothecia and thallus yellow, orange to brown-orange; asci 12- to 32-spored 14
Apothecia pale to dark brown; asci 16-spored 15

14(13) Apothecia K+ purple ..... ***Caloplaca cerinella***
Apothecia K– or faintly red ..... ***Candelariella***

15(13) Ascospores 1-septate 16
Ascospores simple 19

16(15) Ascospores curved, with pointed apices; foliicolous ..... ***Scoliciosporum curvatum***
Ascospores simple, straight or only slightly curved, with rounded apices; corticolous, lignicolous or saxicolous 17

17(16) Saxicolous ..... ***Catillaria gilbertii***
Corticolous or lignicolous 18

18(17) Paraphyses without dark brown caps ..... ***Lecania sambucina***
Paraphysis apices with dark brown caps ..... ***Catinaria neuschildii***

19(15) Apothecia lecanorine ..... ***Lecanora sambuci***
Apothecia without thalline margin 20

20(19) Apothecia black or dark brown ..... ***Steinia geophana***
Apothecia nearly white ..... ***Fellhanera duplex***

Generic key 6c - Crustose Lichens: apothecia rounded; photobiont chlorococcoid; ascospores colourless, septate.

1 Apothecia on short stalks (best seen in a section) 2
Apothecia not on stalks, either sessile, immersed or urceolate 3

2(1) Thallus green-grey, UV–; schizidia brown; apothecial disc pale brown ..... ***Baeomyces***
Thallus pale green, UV+ grey; schizidia absent; apothecia disc pink ..... ***Icmadophila ericetorum***

3(1) Ascospores polarilocular; epithecium K+ purple; thallus and/or soredia often yellow-orange, K+ purple, (*C. obscurella* is K–, *C. nivalis* and *C. approximata* ascospores are only indistinctly polarilocular) ..... ***Caloplaca***
Ascospores not polarilocular; epithecium K– or rarely K+ purple; thallus various colours, rarely orange and K+ purple 4

4(3) Thalline margin present at least when young 5
Thalline margin absent..... 13

5(4) Ascospores muriform when mature ..... ***Phlyctis***
Ascospores transversely septate 6

6(5) Ascospores with a perispore visible in K ..... ***Halecania***
Ascospores lacking a perispore 7

7(6) Thallus yellow-orange, K+ purple, soft, effigurate at margin; on soil ..... ***Fulgensia***
Thallus not yellow-orange, or if so then not K+ purple; not effigurate (though sometimes minutely squamulose); on various substrata 8

8(7) Thallus with numerous soralia, K+ bright yellow, Pd+ yellow ..... ***Loxospora elatina***
Thallus rarely with soralia, but if sorediate, then sorediate areas not K+ bright yellow and Pd+ yellow 9

9(8) Hypothecium orange-red; true exciple thick ..... ***Ophioparma ventosa***
Hypothecium colourless; true exciple thin or indistinct 10

10(9) Epithecium K+ purple-red; paraphyses richly branched–anastomosing; ascospores 3- to 16-septate, fusiform ..... ***Haematomma***
Epithecium K± dull purplish; paraphyses unbranched or sparingly so near apex; ascospores <4-septate, ellipsoid 11

11(10) Thallus bright yellow, K± orange; apothecia disc yellow ..... ***Candelariella***
Thallus grey to brown, Never K+ orange; disc white to dark brown 12

12(11) Paraphysis apices swollen; on mosses, alpine ..... ***Bryonora curvescens***
Paraphysis apices not swollen; on rock or bark, rarely on soil, widespread ..... ***Lecania***

13(4) Periphysoids present; apothecia with incurved margin 14
Periphysoids absent; apothecia with upright or outwardly curved margin 16

14(13) Ascospores filiform, over 100 µm long; not lichenized ..... ***Stictis radiata*** (not treated)
Ascospores ellipsoid to fusiform, under 100 µm long; often lichenized 15

15(14) Exciple with angular cells ..... ***Ramonia***
Exciple irregularly septate hyphae in a gelatinous matrix ..... ***Xerotrema***

16(13) Ascospores muriform 17
Ascospores transversely septate 25

17(16) Apothecia flush, immarginate ..... ***Arthothelium***
Apothecia urceolate to sessile, marginate 18

18(17) Ascospores with a smooth gelatinous outer wall (perispore), at least when young 19
Ascospores with a compact outer wall, lacking a perispore, or perispore thin and warted 20

19(18) Thallus usually distinct and areolate; apothecia black even when wet ..... ***Rhizocarpon***
Thallus thin, rather smooth and ±gelatinous; apothecia pale or becoming translucent when wet ..... ***Gyalidea***

20(18) Apothecium disc golden yellow, K+ purple ..... ***Brigantiaea fuscolutea***
Apothecium disc pale to brown, K– 21

21(20) Exciple hyphae branched and anastomosed and bound in a gelatinous matrix; ascus apical dome K/I–; often with hyphophores 22
Exciple not gelatinous; ascus apical dome K/I+ blue; hyphophores absent 23

22(21) Hyphophores usually present; apothecia reddish brown .when wet ..... ***Jamesiella***
Hyphophores absent; apothecia black when wet ..... ***Gyalideopsis crenulata***

23(21) Paraphyses branched and anastomosed, scarcely swollen at tips; asci 2- to 8-spored ..... ***Schadonia fecunda***
Paraphyses simple or forked, with dark brown apical caps 24

24(23) Asci 1-spored; ascospores 70-115 µm long ..... ***Lopadium***
Asci (4-)8-spored; ascospores 20-32 µm long ..... ***Stereocaulon plicatile***

25(16) Thallus intense yellow-green 26
Thallus dull green, or shades of white to brown 27

26(25) Apothecia black; ascospores 7- to 11-septate ..... ***Arthrorhaphis***
Apothecia rare, yellow-green-brown, ascospores 3-septate ..... ***Chrysothrix***

27(25) Apothecia flush, immarginate, without a well-defined exciple in sections ..... ***Arthonia***
Apothecia urceolate to sessile, marginate, with a well-defined exciple in sections 28

28(27) Ascospores with a gelatinous outer wall (perispore), at least when young 29
Ascospores with a compact outer wall, lacking a perispore 31

29(28) Thallus usually distinct and areolate; apothecia black even when wet ..... ***Rhizocarpon***
Thallus thin, rather smooth and ±gelatinous; apothecia pale or becoming translucent when wet 30

30(29) Paraphyses branched and anastomosed; ascospores 15- to 20-septate; hyphophores often present ..... ***Gyalideopsis muscicola***
Paraphyses mostly simple; ascospores 1- to 3-septate; hyphophores absent ..... ***Gyalidea***

31(28) Apothecia urceolate, with a sunken disc; thallus mostly gelatinous when wet 32
Apothecia disc-like; disc plane to convex at maturity; thallus rarely appearing gelatinous when wet 33

32(31) Hymenium K/I+ blue; ascus with a thin apex ..... ***Bryophagus gloeocapsa***
Hymenium K/I–; ascus with a thick apical dome ..... ***Absconditella***

33(31) Ascospores 70-140 µm long, wall 2 µm thick, 5- to 11-septate, ellipsoid; on mosses ..... ***Megalospora tuberculosa***
Ascospores <30 µm long, wall thin, seldom over 7-septate, ellipsoid 34

34(33) Ascospores with warted epispore; asci thick walled (cf. also *Lecidea hypnorum*) ..... ***Bilimbia***
Ascospores lacking a perispore; asci thin or thick walled 35

35(34) Paraphyses branched-anastomosing 36
Paraphyses simple or sparingly branched near apex 43

36(35) Apothecia with distinct margin (cf. also some *Micarea* species)..... 37
Apothecia without distinct margin 41

37(36) Ascospores sole-shaped, asymmetrically septate ..... ***Melaspilea***
Ascospores not asymmetrically septate 38

38(37) Exciple often tomentose-arachnoid (byssoid), in sections with loosely intricate, thick-walled hyphae ..... ***Byssoloma***
Exciple smooth, in sections without loosely intricate, thick-walled hyphae 39

39(38) Apothecia usually pale (dark in *F. christiansenii*); conidia pyriform ..... ***Fellhanera***
Apothecia usually dark coloured; conidia long and curved or bacilliform..... 40

40(39) Hypothecium dark red-brown, K+ purple; ascospores 11-17 µm long ..... ***Bacidia trachona***
Hypothecium dark brown and K+ green tinge, or red-brown and K–; ascospores mostly longer ..... ***Fellhaneropsis***

41(36) Ascospores spirally twisted in the ascus and/or apothecia glossy ..... ***Scoliciosporum***
Ascospores not twisted, apothecia dull 42

42(41) Asci and paraphyses bound in a gelatinous matrix (cf. also *Scoliciosporum intrusum*) .... ***Micarea***
Asci and paraphyses not bound in a gelatinous matrix, paraphyses often entwining ascus ..... ***Vezdaea***

43(35) Hypothecium and outer exciple dark green, K+ green intensifying, inner exciple a distinct colourless zone; ascospores thick-walled, 1-septate, ellipsoid to oblong-ellipsoid ..... ***Megalaria grossa***
Hypothecium pale or dark, but if K+ green intensifying then ascospores different in shape or septation..... 44

44(43) Lichenicolous, with thallus inapparent or immersed within the host thallus; ascospores 1- or 3-septate at maturity [NB: some untreated genera of lichenicolous fungi may key out here, e.g. *Corticifraga* and *Scutula*] 45
Not lichenicolous, with thallus apparent, but if lichenicolous then ascospores more than 3-septate 46

45(44) Hypothecium dark brown; ascospores 1- or 3-septate at maturity; asci *Bacidia*-type (Fig. 9a) ..... ***Toninia***
Hypothecium pale; ascospores 1-septate at maturity; asci *Catillaria*-type (Fig. 9c) ..... ***Catillaria***

46(44) Thallus areolate with at least some indication of squamule-like structures 47
Thallus without indication of squamules, often continuous, rimose or granular 51

47(46) Thallus with minute isidioid outgrowths, pubescent, Pd+ red; apothecia red-brown ..... ***Phyllopsora rosei***
Thallus without isidia, not pubescent but sometimes pruinose, Pd± orange; apothecia black 48

48(47) Thallus areoles usually grey-white with dark centres, not pruinose; Pd± orange 49
Thallus areoles uniformly coloured, sometimes pruinose; Pd– 50

49(48) Epithecium grey green, N+ red; paraphyses stout, 1.5-3 µm wide; asci *Biatora*-type (Fig. 9b); areoles (medulla) Pd–; on calcareous rock or soil ..... ***Bilimbia lobulata***
Epithecium reddish brown, N–; paraphyses slender, to 1.5 µm wide; asci *Porpidia*-type (Fig. 9g); areoles (medulla) Pd– or Pd+ orange; on acidic rock or soil ..... ***Stereocaulon***

50(48) Apothecium with reddish, green or bluish pigments in part of the section; on rock or soil, very rarely on basic bark ..... ***Toninia***
Apothecium with only brownish pigments in section; on acid bark or wood ..... ***Hypocenomyce caradocensis***

51(46) Ascospores narrowly clavate to acicular, markedly attenuate at one end, often curved, 5- to 7-sepate; apothecia dark brown to black, internally with only brown pigments (no green, red or purplish pigments in water or K); asci *Fuscidea* type ..... ***Ropalospora***
Ascospores variously shaped, but if narrowly clavate to acicular then apothecial pigmentation different and asci not *Fuscidea*-type (Fig. 9d) 52

52(51) Ascospores 3- to 16-septate, fusiform to acicular ..... see ***Bacidia*** Key (including e.g. *Lecania*)
Ascospores 0- to 3-septate, globose, ellipsoid or bean-shaped 53

53(52) Hypothecium of erect hyphae and often poorly delimited from the hymenium above; apothecia dark brown to black, internally with only brown pigments (no green, red or purplish pigments in sections mounted in water or K); asci *Fuscidea* type ..... ***Fuscidea***
Hypothecium of interwoven hyphae or paraplectenchymatous (cellular), usually well delimited from the hymenium; apothecia variously coloured and if dark coloured then usually with green, red or purplish pigments in sections mounted water or K; asci *Bacidia*- *Biatora*- or *Catillaria*-types (Fig. 9a,b,c) 54

54(53) Ascospores 4.5-7 µm wide; apothecia mostly >0.5 mm diam., grey-black but often with a paler margin, internally with green, red or purplish pigments in sections mounted water or K; asci *Bacidia*- or *Biatora*-type (Fig. 9b) (if on rock and not sorediate cf. also *Tylothallia biformigera* ..... ***Megalaria***
Ascospores mostly <4.5 µm wide, but if wider then either apothecia <0.5 mm or apothecial pigmentation different; asci *Bacidia*- *Biatora*- or *Catillaria*-types (Fig. 9a,b,c) 55

55(54) Apothecia large and often irregularly shaped, 0.4-0.8 mm diam. or to 1.5 mm when tuberculate, black; thallus thin to usually rather thick and warted; pycnidia numerous, immersed, with colourless walls; asci *Biatora*-type (Fig. 9b); on siliceous rocks ..... ***Tylothallia biformigera***
Apothecia smaller, but if not then either with dark-coloured pycnidia or not growing directly on siliceous rock 56

56(55) Pycnidia black, usually numerous, wall K+ purple; ascospores 1-septate; thallus K+ pale yellow (atranorin); asci *Bacidia*- or *Biatora*-type (Fig. 9b) ..... ***Cliostomum***
Pycnidia pale or black, but wall not K+ purple; thallus K– (atranorin absent) 57

57(56) Ascospores thick-walled or warted; apothecia dark brown to black, internally with only brown pigments (no green, red or purplish pigments in sections mounted in water or K); asci *Catillaria*-type (Fig. 9c) ..... ***Catinaria***
Ascospores thin-walled and smooth; apothecia variously coloured, if dark then internally often with green, red or purplish pigments in sections mounted in water or K 58

58(57) Ascospores 0- to 3-septate; hypothecium and exciple chondroid, of interwoven hyphae ..... ***Biatora* & *Mycobilimbia***
Ascospores 1(-3)-septate; hypothecium and exciple paraplectenchymatous (cellular) to hyphal 59

59(58) Thallus Pd+ red ..... ***Cliostomum***
Thallus Pd– ..... ***Catillaria***

Generic Key 6d - Crustose Lichens: apothecia rounded: photobiont chlorococcoid; ascospores coloured.

1 Ascospores non-septate 2
Ascospores septate or muriform 5

2(1) Apothecia dark red-brown; epithecium K+ purple (in section); thallus C+ orange ..... ***Pyrrhospora quernea***
Apothecia not deep red and K+ purple (in section); thallus C± red 3

3(2) Hypothecium colourless or pale straw ..... ***Fuscidea***
Hypothecium dark brown 4

4(3) Hypothecium K+ purple; epithecium olive-green, K+ green intensifying, sometimes with additional brown, K+ purple pigment ..... ***Orphniospora moriopsis***
Hypothecium K–, epihymenium K– ..... ***Rimularia limborina***

5 (1) Ascospores soon extruded from asci, forming a dry, black, powdery spore mass..... 6
Ascospores not quickly extruded from asci, nor leaving a black stain on finger when rubbed 7

6(5) Apothecia sessile to immersed, not in warts; true exciple raised..... ***Cyphelium***
Apothecia arising in swollen, raised warts; true exciple inapparent..... ***Microcalicium***

7(5) Ascospores 1-septate or polarilocular 8
Ascospores 2- to 8-septate or muriform 17

8(7) Apothecia flush, immarginate ..... ***Arthonia***
Apothecia urceolate to sessile, marginate 9

9(8) Ascospores sole-shaped, asymmetrically septate ..... ***Melaspilea***
Ascospores not asymmetrically septate 10

10(9) Ascospores with a distinct perispore at least present before maturity, or the inner coloured wall layer coated by a colourless outer layer 11
Ascospores without a perispore or an outer colourless wall layer 12

11(10) Each ascospore cell surrounded by a ring-like, dark wall with a thick, colourless outer layer; apothecia often somewhat angular-contorted, ± umbonate ..... ***Poeltinula cerebrina***
Ascospore wall dark, uniform, surrounded by a distinct halo when young; apothecia round, flat to weakly umbonate to wavy ..... ***Rhizocarpon***

12(10) Thallus vivid green-yellow (rhizocarpic acid); paraphyses densely branched and anastomosing; asci with a small, thin, amyloid structure in the top of the only weakly amyloid tholus (K/I- weakly blued) 13
Thallus mostly white, grey or brown, if yellow then containing usnic acid or xanthones; paraphyses simple or branched above; asci with a thick, distinct, amyloid tholus (K/I+ strongly blued) 14

13(12) Thallus thick; not parasitic..... ***Rhizocarpon***
Thallus thin, parasitic on *Baeomyces* ..... ***Epilichen scabrosus***

14(12) Thalline exciple absent; ascospores septate with thin walls 15
Thalline exciple present; ascospores polarilocular or septate with thickened walls 16

15(14) Exciple hyphal; ascus with K/I+ blue tholus ..... ***Buellia* & *Amandinea***
Exciple cellular; ascus tip with thin K/I+ blue cap ..... ***Dactylospora***
(not treated; lichenicolous and saprophytic fungi often confused with lichens)

16(14) Thallus with numerous soralia, consisting of agglutinated lobes ..... ***Hyperphyscia adglutinata***
Thallus rarely with soredia and when sorediate, thallus continuous ..... ***Rinodina***

17(7) Ascospores submuriform to muriform 18
Ascospores 2- to 8-septate 21

18(17) Paraphyses branched and anastomosing; ascospores surrounded by perispore, at least when young ..... ***Rhizocarpon***
Paraphyses mostly simple, rarely forked; ascospore wall compact, perispore absent 19

19(18) Ascospores submuriform, with 1-2 longitudinal septa and internally thickened walls; asci *Lecanora*-type (Fig. 9e) ..... ***Diplotomma***
Ascospores strongly muriform; ascus apex otherwise 20

20(19) Apothecia at first perithecia-like, expanding and becoming urceolate; thalline exciple present, often scarcely indistinguishable from the verrucose thallus; ascospores 20-40 (-54) µm long, dark brown ..... ***Diploschistes***
Apothecia not perithecia-like, flat or concave from the first; thalline exciple absent; ascospores 70-115 µm long, colourless or pale yellow-brown ..... ***Lopadium***

21(17) Ascospores with a distinct swollen perispore; paraphyses branched and anastomosing or absent 22
Ascospores without a distinct swollen perispore; paraphyses mostly simple or sometimes branched above 24

22(21) Thallus without an internal algal layer, algae, if present, scattered on surface; paraphyses absent or cellular, broad; apothecia a cushion of tissue, becoming disc-like with age; ascus apex K/I– ..... ***Lichenothelia convexa*** (not treated)
Thallus with an internal algal layer; paraphyses thin, branched and anastomosing (paraphysoids); apothecia disc-like from the first 23

23(22) Thallus vivid green-yellow, lichenicolous ..... ***Rhizocarpon intermediellum***
Thallus inconspicuous, lichenicolous ..... ***Opegrapha*** (some lichenicolous taxa)

24(21) Distinct thalline exciple present 25
Thalline exciple absent 26

25(24) Thallus thin and disappearing; apothecia sessile; hypothecium colourless; ascospores *conradii*-type ..... ***Rinodina conradii***
Thallus rimose-cracked or granular; apothecia immersed; hypothecium dark brown; ascospores with rounded lumina, often curved ..... ***Diplotomma***

26(24) Exciple hyphal; ascus with K/I+ blue tholus ..... ***Buellia* & *Amandinea***
Exciple cellular; ascus tip with thin K/I+ blue cap ..... ***Dactylospora***
(not treated; lichenicolous and saprophytic fungi often confused with lichens)

Generic Key 6e - Crustose Lichens: apothecia rounded; photobiont *Trentepohlia*.

1 Apothecia immersed or sessile, not in warts; true exciple indistinct or not separated from thalline margin; ascospores I–, with cuboid or barrel-shaped cells 2
Apothecia immersed in thalline warts; true exciple separated from thalline margin; ascospores mostly I+ purple..... 24

2(1) Apothecia aspicilioid with sunken discs with thick thalline margin; ascospores non-septate ..... ***Hymenelia* & *Ionaspis***
Apothecia discoid or dot-like, often lacking thalline margin; ascospores transversely septate or muriform 3

3(2) Asci appearing multi-spored due to fragmentation of acicular, multiseptate spores ... ***Bactrospora***
Asci obviously 1-8(-12)-spored 4

4(3) Hypothecium dark brown to black 5
Hypothecium colourless to pale fawn-brown 17

5(4) Apothecia immersed in a black stroma, in clusters of up to 15; paraphyses simple and only branched at the tips ..... ***Syncesia myrticola***
Apothecia not immersed in a stroma, not in clusters; paraphyses richly branched or anastomosing throughout 6

6(5) Ascospores muriform ..... ***Arthothelium***
Ascospores transversely septate 7

7(6) Apothecial disc pruinose 8
Apothecial disc lacking pruina 13

8(7) Ascospores lacking a perispore; thalline exciple present ..... ***Dirina massiliensis***
Ascospores with a thin or thick perispore; thalline exciple absent or present only when young .. 9

9(8) Apothecia lacking a distinct true exciple, usually immersed; disc not pruinose or sometimes white or red pruinose; perispore thin (<1 µm) ..... ***Arthonia***
Apothecia with a distinct true exciple, usually sessile, disc pruinose; perispore obvious, sometimes thick 10

10(9) Apothecial disc with green pruina; true exciple shiny; ascospores 5-septate .. ***Cresponea premnea***
Apothecial disc with white-yellow to white-blue pruina; true exciple matt; ascospores 3- to 20-septate 11

11(10) Apothecia immersed, disc plane with thallus; paraphyses apices not swollen . ***Llimonaea sorediata***
Apothecia sessile; paraphyses swollen at tip 12

12(11) Disc pruina white to yellow; ascospore perispore very thick, ascospores becoming warted and brown ..... ***Lecanactis***
Disc pruina white-blue-tinged; perispore thin, ascospores not warted but may become brown when old ..... ***Opegrapha* & *Lecanographa***

13(7) Ascospores 1-septate, sole-shaped..... 14
Ascospores 3-septate 15

14(13) Apothecia lacking a distinct true exciple, usually immersed ..... ***Arthonia***
Apothecia with a distinct true exciple ..... ***Melaspilea***

15(13) Thalline exciple present; true exciple absent ..... ***Schismatomma***
Thalline exciple absent; true exciple distinct 16

16(15) Ascospores with a thin perispore; apothecia sessile ..... ***Rhexophiale rhexoblephara***
Ascospores lacking a perispore; apothecia immersed to sessile ..... ***Sagiolechia protuberans***

17(4) Ascospores 1-septate ..... ***Dimerella***
Ascospores >3-septate..... 18

18(17) Paraphyses richly branched-anastomosing 19
Paraphyses unbranched except near the tips 21

19(18) Apothecial disc soon flattened, margin fissured or crenulate; paraphyses with swollen apices; on bark ..... ***Cryptolechia carneolutea***
Apothecia urceolate with sunken disc; smooth margin; paraphyses usually with apices not swollen; on bark or rock 20

20(19) Asci 8-spored; ascospores transversely septate or muriform, ellipsoid to fusiform; on bark or rock ..... ***Gyalecta***
Asci 16- to 48-spored; ascospores transversely 3- to 15-septate, fusiform to acicular; on bark ..... ***Pachyphiale***

21(18) Apothecia resembling perithecia, with a fissured margin; ascospores 3-septate; on limestone and mortar ..... ***Petractis hypoleuca***
Apothecia not perithecioid, margin entire; ascospores 5- to 7-septate or muriform 22

22(21) Apothecia urceolate, opening to a pink disc, true exciple thick, covering disc at first; ascospores 7- to 14-septate to muriform ..... ***Ramonia***
Apothecia dot-like, immersed in thallus 23

23(22) Ascospores fusiform, remaining colourless ..... ***Enterographa***
Ascospores clavate, becoming brown ..... ***Peterjamesia circumscripta***

24(1) Thallus well-developed; ascomata in section without angular cells near the ostiole .... ***Thelotrema***
Thallus often inconspicuous; ascomata in section with angular cells near the ostiole 25

25(24) Apothecia remaining immersed in wood ..... ***Xerotrema***
Apothecia soon emergent, at first with a thin thalline covering; on bark and mosses ..... ***Topeliopsis azorica***

Generic Key 6f - Crustose Lichens: apothecia rounded; photobiont blue-green.

1 Thallus immersed in a calcareous substratum; apothecia ± conical, pale, with radiating fissures around a central pore-like disc ..... ***Petractis clausa***
Thallus superficial, substratum various; apothecia various but never with radiating fissures 2

2(1) Photobiont bead-like, *Nostoc*, in lax chains suspended in a conspicuous, colourless, gelatinous matrix..... 3
Photobiont not in lax, bead-like chains, if *Nostoc*, then chains folded in packets, compacted, indistinct, gelatinous matrix colourless or yellow-brown to pink-purple 5

3(2) Ascospores simple, subglobose to globose ..... ***Lempholemma***
Ascospores septate, submuriform or muriform, ovoid to ellipsoid 4

4(3) Upper cortex indistinct, never a single layer of clearly defined cells; thallus dark green-black, rarely with a red-brown tinge, often swelling when moist ..... ***Collema***
Upper cortex a single layer of well-defined, rounded to cuboid cells; thallus red-brown-black, rarely blue-grey, not noticeably swelling when moist ..... ***Leptogium***

5(2) Photobiont in chains of 2-3 cells or more, often folded, rarely single-celled or forming packets surrounded by individual pale or coloured gelatinous sheath 6
Photobiont single-celled or in packets surrounded by an individual, often coloured gelatinous sheath 13

6(5) Ascospores 7- to 14-septate, narrowly fusiform; thalline exciple absent ..... ***Arctomia delicatula***
Ascospores simple or 1- to 3(-7)-septate; globose to ellipsoid, rarely fusiform; thalline exciple present or absent, or apothecia absent 7

7(6) Thallus ± uniformly minutely squamulose or rosette-forming, with, at least in part, a distinctly radiating margin of ± flattened or convex lobes 8
Thallus crustose, continuous or ± areolate, sometimes with spreading, terete, filament-like lobes at the margin (best seen when moist) or entirely minutely fruticose 11

8(7) Thallus stellate-radiate, lobes longitudinally grooved and striate and pale below; coarse nodules present, laminal ..... ***Vestergrenopsis elaeina***
Thallus of scattered or overlapping squamules or, if forming rosettes, lobes never grooved and striate and pale below; isidia and soralia, if present, predominantly marginal 9

9(8) Photobiont *Scytonema* or *Rivularia*; isidia coralloid or ± flattened; apothecia very rare; ascospores septate ..... ***Placynthium***
Photobiont *Nostoc*; often with isidia, granular soralia, or richly fertile; ascospores simple 10

10(9) Thallus placodioid, rosette-forming, lobes agglutinating sideways ..... ***Degelia***
Thallus squamulose ..... see ***Parmeliella*** Key

11(7) Thallus blue-grey or pale grey, entirely of small granules; photobiont *Nostoc*; apothecia with a widely expanded red-brown to dark brown disc with a granular thalline exciple; ascospores 0(-l)-septate ..... see ***Parmeliella*** Key
Thallus dark, red-brown to black or blue-black, amorphous or in part minutely filament-like (at least at the margin); photobiont *Calothrix*, *Scytonema*, or *Rivularia*; apothecia dark, with or without a thalline exciple; ascospores simple or 1- to 3(-7)-septate; on rock, rarely basic soils 12

12(11) Thallus red-brown-black, not pruinose, amorphous or indistinctly placodioid, subgelatinous when moist; photobiont *Calothrix*; apothecial disc poriform at first, later ± expanded, thalline exciple present; ascospores simple, globose to ellipsoid ..... ***Porocyphus***
Thallus blue-black or black, partly grey- or blue-grey-pruinose, not subgelatinous when moist; photobiont *Scytonema*; apothecial disc fully expanded from the first; thalline exciple absent ..... ***Collolechia caesia***

13(5) Photobiont *Gloeocapsa*, gelatinous sheaths pink-red-brown, especially towards the upper surface, K+ purplish 14
Photobiont not *Gloeocapsa*, gelatinous sheaths colourless, yellow-brown or red-brown towards the upper surface, K– 17

14(13) Thallus small-squamulose, partly hollow ..... ***Phylliscum demangeonii***
Thallus crustose 15

15(14) Apothecial disc fully expanded from an early stage; inner wall of ascus 1+ blue, apical dome I–; paraphyses slender, not swollen and moniliform above ..... ***Euopsis***
Apothecial disc scarcely expanded, apothecia ± perithecia-like or urceolate; paraphyses, ± swollen and moniliform above, or absent 16

16(15) Hamathecium of simple to branched and anastomosing paraphyses, ± swollen and moniliform above; periphysoids absent; asci various ..... ***Pyrenopsis***
Hamathecium comprising a zone of periphysoids near to the ostiole; interascal filaments either absent or inconspicuous and much shorter than the asci ..... ***Cryptothele rhodosticta***

17(13) Asci with distinctly thickened apices, either K/I+ blue (in part) or entirely brown; apothecia with an indistinct true exciple and a well-developed thalline exciple, often perithecia-like; mainly confined to wet, acid rocks 18
Asci uniformly thin-walled, entirely I–; apothecia often with a well-developed true exciple, not or partly obscured by an evanescent thalline exciple; perithecia-like or with a broad disc; on acid or calcareous rocks and soil 21

18(17) Ascospores muriform ..... ***Epiphloea byssina***
Ascospores simple 19

19(18) Thallus black, tinged red-brown, at least when moist; photobiont *Chroococcidiopsis* (*Xanthocapsa*) ..... ***Pyrenopsis***
Thallus black, tinged brown or greenish, at least when moist; photobiont chroococcoid 20

20(19) Thallus paraplectenchymatous throughout ..... ***Metamelanea umbonata***
Thallus cortex with fan-shaped cells ..... ***Pterygiopsis***

21(17) Apothecial disc remaining pore-like; on acid to neutral rocks, often in seepage tracks or by streams and lake-sides; photobiont *Calothrix* ..... ***Porocyphus***
Apothecial disc expanding; on limestone, mortar and calcareous soils 22

22(21) Thallus ± areolate, surface and edges of areoles with ± globose isidia; ascomata open below; photobiont *Chroococcidiopsis* ..... ***Psorotichia schaereri***
Thallus ± continuous or like a small *Leptogium*; isidia absent; ascomata closed below; photobiont *Nostoc*-like ..... ***Lemmopsis***

GENERIC KEY 7
Sterile crustose, corticolous and lignicolous

Many lichens are frequently found sterile yet have sufficient features to enable them to be identified. In order to identify material correctly it is particularly important to pay attention to its ecology and

specimens may require chemical analysis by t.l.c. for confirmation. The key presented here is in no way exhaustive.

Emphasis in this key is placed on the use of the standard spot test reactions C, K, KC and Pd. Lichen photobionts are also important in identification. The presence of *Trentepohlia* can often be detected in fresh material by the pale to deep orange mark obtained when the thallus is scratched and the cortex or soralia abraded to expose the underlying photobiont. Unfortunately, the carotenoid pigment which imparts the orange colour to the contents of the algal cells is soon degraded, becoming colourless in the herbarium; similarly species with a pink tinge to the thallus when fresh tend to become uniformly pale grey a few weeks after collection, as, for example, in the case of *Schismatomma niveum*. As a rule, under the microscope, the cells of *Trentepohlia* tend to be larger and to have thicker walls than those of *Trebouxia* and other unicellular photobiont algae; sometimes the filamentous habit of the former is also discernible. On dusty or dung-influenced tree bases, many normally saxicolous species are becoming increasingly present. They include species of *Caloplaca, Stereocaulon* and *Verrucaria*, among others, which are keyed out only in the saxicolous keys.

1 Thallus and/or soredia golden- or orange-yellow or vivid yellow-green (not pale yellow) when fresh ..... **Sterile Crustose Key 7a**
Thallus or soredia not golden- or orange-yellow 2

2(1) Thallus sorediate, blastidiate or leprose, pycnidia absent 3
Thallus without soredia, or if with soredia then pycnidia also present 4

3(2) Thallus (not soredia) with at least some positive spot test reactions ..... **Sterile Crustose Key 7b**
Thallus (not soredia) Pd–, K–, C–, KC– ..... **Sterile Crustose Key 7c**

4(2) Thallus with isidia, hyphophores, blastidia or papillae, in some species becoming sorediate, or appearing minutely squamulose, usually without pycnidia ..... **Sterile Crustose Key 7d**
Thallus without isidia, hyphophores or papillae, often with pycnidia 5

5(4) Thallus with pycnidia or sporodochia ..... **Sterile Crustose Key 7e**
Thallus without pycnidia or sporodochia ..... **Sterile Crustose Key 7f**

Sterile Crustose Key 7a - Corticolous and Lignicolous Lichens: thallus and/or soredia golden- or orange-yellow or vivid yellow-green.

Synopsis

1 Thallus and/or soredia K+ bright purple (parietin) 2
Thallus and/or soredia K– or faint red (parietin absent) 10
10(1) Photobiont *Trentepohlia* (orange colours due to the photobiont) 11
Photobiont chlorococcoid (yellow colours mostly pulvinic acid derivatives) 13
13(10) Thallus granular or nodulose with or without delimited soralia 14
Thallus entirely dissolved in soredia or thallus leprose 19

1 Thallus and/or soredia K+ bright purple (parietin) 2
Thallus and/or soredia K– or faint red (parietin absent) 10

2(1) Thallus entirely dissolved in soredia or thallus ± leprose 3
Soralia delimited, soredia often farinose 6

3(2) Thallus entirely dissolved in granular soredia 4
Thallus ± leprose 5

4(3) Soredia starting diffuse (look for young stages) ..... ***Caloplaca citrina***
Soredia originating from soralia ..... ***Caloplaca phlogina***

5(3) Thallus not leprose but fully non-corticate, always variable in colour, partly grey, partly yellow and/or rusty ..... ***Chaenotheca ferruginea***
Thallus leprose, medulla UV+ white; divaricatic acid and zeorin (*Caloplaca borreri* keys out here; its chemistry is unknown) ..... ***Lepraria incana***

6(2) Thallus continuous, C+ red, green; soralia discrete or confluent, pale greenish, but partly stained orange, often over 1 mm diam. ..... ***Trapeliopsis pseudogranulosa***
Thallus continuous or not, C–, not green 7

7(6) Soredia mainly on margins of areoles ..... ***Caloplaca flavocitrina***
Soredia in discrete soralia 8

8(7) Soredia erupting from the non-areolate thallus, bright golden-yellow ..... ***Caloplaca phlogina***
Soredia laminal on areoles, bright yellow or yellow-brown 9

9(8) Soralia bright orange-yellow; on nutrient-enriched bark ..... ***Caloplaca chrysophthalma***
Soralia pale yellow to dirty yellow-brown; on dry, well-lit, non-nutrient-enriched oaks in parkland ..... ***Caloplaca lucifuga***

10(1) Photobiont *Trentepohlia* (orange colours due to the photobiont) 11
Photobiont chlorococcoid (yellow colours mostly pulvinic acid derivatives) 13

11(10) Soralia C– ..... ***Opegrapha multipuncta***
Soralia C+ pink 12

12(11) Soralia yellow-grey often confluent on a dark brown thallus; dark prothallus often present; on hard, smooth bark; gyrophoric and schizopeltic acids ..... ***Opegrapha gyrocarpa***
Soralia pale yellow to buff, small and ± discrete, on an olive to grey-brown thallus; dark prothallus sometimes present, on smooth or rough bark; gyrophoric acid ..... ***Opegrapha sorediifera***

13(10) Thallus granular or nodulose with or without delimited soralia 14
Thallus entirely dissolved in soredia or thallus leprose 19

14(13) Thallus ± immersed or weakly areolate, green-brown to brown; soralia ± discrete, <0.4 mm diam., at first brown, later abrading ochraceous-yellow; on bark of *Alnus, Betula, Sorbus* and *Larix*; Scottish Highlands ..... ***Japewia subaurifera***
Thallus superficial, orange-yellow, granular or areolate-squamulose 15

15(14) Thallus with soredia ..... ***Candelariella reflexa***
Thallus without soredia, corticate 16

16(15) Thallus consisting of numerous corticate granules to *c*. 0.1 mm diam. 17
Thallus consisting of larger, often flattened granules that may become subsquamulose 18

17(16) Granules yellow (pulvinic acid derivatives) ..... ***Candelariella xanthostigma***
Granules vivid green (rhizocarpic acid) ..... ***Calicium viride***

18(16) Thallus of irregular granules, usually becoming nodulose ..... ***Chaenotheca chrysocephala***
Thallus of well-developed flat to convex subsquamulose areoles, often with a differentiated margin ..... ***Candelariella vitellina***

19(13) Thallus leprose, yellow (usually calycin) ..... ***Chrysothrix candelaris***
Thallus leprose or not, vivid green (rhizocarpic or vulpinic acid) 20

20(19) Thallus a bit corticate, granular, often with black pycnidia, algae trebouxioid ..... ***Calicium viride***
Thallus not corticate at all, without pycnidia 21

21(20) Algae ellipsoid (*Stichococcus*), always in chains ..... ***Chaenotheca furfuracea***
Algae round (trebouxioid) or rarely ellipsoid (*Stichococcus*) but never in chains 22

22(21) Thallus generally thick, covering the substratum; under overhangs, e.g. roots ... ***Psilolechia lucida***
Thallus thin, not fully covering the substratum, on more exposed places .. ***Chrysothrix flavovirens***

Sterile Crustose Key 7b - Corticolous and Lignicolous Lichens: thallus sorediate/blastidiate/leprose with at least some positive spot test reactions.

Synopsis

1 Thallus C+ orange (persisting), containing xanthones 2
Thallus C± red, orange-pink, carmine red or yellow (not persisting) 14
14(1) Thallus C+ red, orange-pink or carmine-red 15
Thallus C± yellow 36
36(14) Thallus Pd+ red, orange or distinctly yellow 37
Thallus Pd± faintly yellow (due to atranorin) 61

1 Thallus C+ orange (persisting), containing xanthones 2
Thallus C± red, orange-pink, carmine red or yellow (not persisting) 14

2(1) Thallus completely sorediate, or covered with goniocysts 3
Thallus with delimited or irregularly delimited soralia; soredia not completely covering thallus .. 8

3(2) Photobiont micareoid, cells *c*. 4-8 µm diam, thallus with goniocysts, with or without soredia 4
Photobiont chlorococcoid, cells *c*. 6-15 µm diam., thallus lacking goniocysts, sorediate 5

4(3) Thallus dissolved into goniocysts, C+ orange; xanthones ..... ***Micarea xanthonica***
Thallus with goniocysts that cluster to form soralia, C+ red in section, but whole thallus often reacting C+ orange due to rapid hydration of the green photobiont; gyrophoric acid ..... ***Micarea viridileprosa***

5(3) Soredia brownish green, finely granular; thallus often rather thick, continuous; isoarthothelin and thiophanic acid ..... ***Pyrrhospora quernea***
Soredia farinose 6

6(5) Soredia pale yellow-green; thallus thin, evanescent; thiophanic, usnic acids, zeorin and 'expallens unknown' ..... ***Lecanora expallens***
Soredia yellowish white to yellowish grey to mustard yellow; usnic acid absent 7

7(6) Soredia mustard yellow; on exposed tree bark; arthothelin and granulosin ..... ***Lecidella flavosorediata***
Soredia yellowish white to yellowish grey; unidentified xanthone; on wood, extinct in the British Isles ..... ***Lecidella pulveracea***

8(2) Soredia mustard yellow; on exposed tree bark; arthothelin and granulosin ..... ***Lecidella flavosorediata***
Soredia not mustard yellow, generally paler 9

9(8) Thallus thin, bluish grey to pellucid or varnish-like, often evanescent 10
Thallus distinct and thicker 11

10(9) Thallus often with bluish black prothallus; soralia becoming confluent; soredia farinose, pale yellow; thiophanic, usnic acids, zeorin and 'expallens unknown' ..... ***Lecanora expallens***
Thallus without prothallus; atranorin and thiophanic acid (major); arthothelin and 'expallens unknown' (minor) ..... ***Lecidella subviridis***

11(9) Thallus of scattered areoles, most areoles dissolving into soralia; arthothelin and thiophanic acid ..... ***Rinodina flavosoralifera***
Thallus continuous 12

12(11) On smooth bark of trees and shrubs; thallus thin and even; soralia pale yellow-grey, efflorescent, UV+ orange; arthothelin, granulosin and lichexanthone ..... ***Lecidella elaeochroma*** f. ***soralifera***
On rough bark, rotting bark or wood; thallus minutely granular-verrucose; soralia pale yellow or green; various lichen products present 13

13(12) Thallus yellowish; soralia round, convex, discrete or becoming confluent, pale yellow; soredia farinose; in woodland on acid bark; arthothelin, thiophaninic acid and atranorin ..... ***Lecanora alboflavida***
Thallus grey; soralia irregular, yellow-green, often inconspicuous and best revealed by rubbing thallus with finger, coarsely granular; in open habitats on wood or enriched bark; atranorin, arthothelin and ± thuringione ..... ***Lecidella scabra***

14(1) Thallus C+ red, orange-pink or carmine-red 15
Thallus C± yellow 36

15(14) Photobiont *Trentepohlia*; thallus Pd– 16
Photobiont *Trebouxia* or chlorococcoid; thallus Pd± 21

16(15) Thallus without true soredia 17
Thallus with true soredia 18

17(16) Thallus with pale creamy yellow soralia-like sporodochia producing hyaline 1-septate conidia ..... ***Blarneya hibernica***
Thallus often with pruinose apothecia resembling eroded soralia ..... ***Arthonia pruinata***

18(16) Thallus cretaceous, pinkish brown to white and usually rather thick (over 0.5 mm); erythrin ..... ***Dirina massiliensis*** f. ***sorediata***
Thallus thin, not cretaceous; gyrophoric acid 19

19(18) Soralia pale fawn, mottled brown, never orange even when fresh ..... ***Opegrapha fumosa***
Soralia with yellow or orange tinge at least when fresh 20

20(19) Soralia yellow-grey often confluent on a dark brown thallus; dark prothallus often present; on hard, smooth bark; gyrophoric and schizopeltic acids ..... ***Opegrapha gyrocarpa***
Soralia pale yellow to buff, small and ± discrete, on an olive to grey-brown thallus; dark prothallus sometimes present, on smooth or rough bark; gyrophoric acid ..... ***Opegrapha sorediifera***

21(15) Thallus Pd+ yellow-orange (alectorialic acid) or Pd+ red (argopsin); on acidic substrata 22
Thallus Pd– (alectorialic acid absent); substratum various 25

22(21) Thallus Pd+ red (argopsin); photobiont micareoid, cells *c*. 4-8 µm diam. ..... ***Micarea leprosula***
Thallus Pd+ yellow-orange (alectorialic acid); photobiont chlorococcoid, cells *c*. 6-15 µm diam. 23

23(22) Thallus of discrete areoles or small squamules ..... ***Pycnora leucococca***
Thallus scurfy granular or with indistinct areoles 24

24(23) Thallus dull grey-green to dark brown-grey, with irregular patches of soredia ... ***Buellia pulverea***
Thallus white of ± immersed areoles and delimited to confluent, white-grey to yellow-brown soralia flecked with dark grey ..... ***Pycnora sorophora***

25(21) Thallus at least partly of ± ascending, convex, often imbricate squamules; soredia on lower surface of squamules in lip-shaped soralia ..... ***Hypocenomyce scalaris***
Thallus without squamules 26

26(25) Thallus with a conspicuous white prothallus; soralia blue-grey-white, ± hemispherical, C+ carmine red (lecanoric acid) ..... ***Pertusaria hemisphaerica***
Thallus without a conspicuous white prothallus; soralia yellow, green or grey-white or brown, often flat or irregular; soralia C+ orange-red (gyrophoric acid) 27

27(26) Photobiont micareoid, cells *c*. 4-8 µm diam. 28
Photobiont chlorococcoid, cells *c*. 6-15 µm diam. 29

28(27) Thallus with goniocysts coalescing into soredia ..... ***Micarea viridileprosa***
Thallus without goniocysts, soredia starting punctiform ..... ***Micarea coppinsii***

29(27) Thallus fully dissolved into soredia, variable in colour, but colour variation related to the degree of exposure to light ..... ***Placynthiella dasaea***
Thallus with sorediate and non-sorediate areas 30

30(29) Thallus thick, corticate, white-grey, often granular or irregularly warted 31
Thallus rather thin, grey, grey-green, olivaceous or brown, inconspicuously areolate or verrucose-granular 33

31(30) Soredia roughly granular, indeterminate ..... ***Ochrolechia subviridis***
Soredia granular, in delimited soralia 32

32(31) Thallus UV– ..... ***Ochrolechia androgyna***
Thallus UV+ yellow ..... ***Ochrolechia arborea***

33(30) Photobiont *Chlorella*-type, at least partly in clusters of 2-4 daughter cells resulting from binary fission, often not round but asymmetrical with one flattened side ..... see ***Trapelia*** Key
Photobiont trebouxioid, essentially round 34

34(33) Soralia brownish, punctiform, eroding and green when abraded; thallus areolate ..... ***Schaereria corticola***
Soralia without brownish tinge 35

35(34) Thallus scurfy, dark green, thick (over 0.3 mm); C–reaction fleeting; on exposed twigs ..... ***Scoliciosporum sarothamni***
Thallus granular, thin; C–reaction strong; over mosses on old trees in forests **.** ***Biatora chrysantha***

36(14) Thallus Pd+ red, orange or distinctly yellow 37
Thallus Pd± faintly yellow (due to atranorin) 61

37(36) Thallus entirely leprose-granular 38
Thallus not leprose, with sorediate areas 39

38(37) Photobiont trebouxioid ..... ***Lepraria***
Photobiont cells ellipsoid (*Stichococcus*) ..... ***Chaenotheca stemonea***

39(37) Thallus K+ yellow soon turning bright red (crystals - norstictic acid) 40
Thallus K–, K + yellow or K+ brown-red (crystals absent - norstictic acid absent) 43

40(39) 'Soralia' being the sorediate surface of apothecia within delimited verrucae ..... ***Phlyctis agelaea***
Soralia not part of ascoma 41

41(40) Soralia dark brown ..... ***Rimularia fuscosora***
Soralia pale-coloured or bluish 42

42(41) Soralia diffuse and erose; thallus thick ..... ***Phlyctis argena***
Soralia delimited and excavate; thallus thin or immersed ..... ***Buellia griseovirens***

43(39) Thallus Pd+ yellow-orange (psoromic, stictic or thamnolic acids) 44
Thallus Pd+ red or dull orange (without psoromic, stictic or thamnolic acids) 47

44(43) Thallus K– (psoromic acid); photobiont *Trentepohlia* ..... ***Schismatomma niveum***
Thallus K+ yellow; photobiont trebouxioid or chlorococcoid 45

45(44) Thallus with firm medulla below soredia ..... ***Cladonia macilenta***
(poorly developed material)
Thallus with soft medulla 46

46(45) Thallus grey-green, superficial; soralia convex to globular; K+ bright yellow (thamnolic acid); mainly on bark ..... ***Loxospora elatina***
Thallus white to pale grey, immersed; soralia ± flat, K+ pale yellow (stictic acid); on wood ..... ***Xylographa vitiligo***

47(43) Thallus KC+ violet (picrolichenic and protocetraric acid); tasting bitter ..... ***Pertusaria amara***
Thallus KC– (picrolichenic acid absent); not tasting bitter 48

48(47) 'Soralia' being the sorediate surface of apothecia within delimited verrucae ..... ***Pertusaria multipuncta***
Soralia discrete, not part of ascoma 49

49(48) Photobiont *Trentepohlia* 50
Photobiont *Trebouxia* 51

50(49) Thallus superficial, cracked-areolate; soralia discrete, or as lines along cracks in the thallus; soredia farinose, *c*. 15-30 µm diam.; protocetraric acid ..... ***Enterographa sorediata***
Thallus mainly immersed, not distinctly cracked; soralia discrete, rounded; soredia finely granular, *c*. 30-70 um diam.; fumarprotocetraric acid ..... ***Schismatomma quercicola***

51(49) Thallus and/or soralia K+ yellow (atranorin present) 52
Thallus K–, sometimes K+ dirty red-brown (atranorin absent) 53

52(51) Thallus a warty crust, often delimited by a black hypothallus; zeorin absent ..... ***Mycoblastus fucatus***
Thallus not delimited by a black hypothallus, becoming obscured by scattered or contiguous, coarsely granular, efflorescent soralia; zeorin present ..... ***Megalaria pulverea***

53(51) Soredia forming discrete, delimited soralia 54
Soredia diffuse or forming irregular soralia 57

54(53) Thallus whitish grey 55
Thallus some shade of green or brown 56

55(54) Thallus thin; soralia up to 0.5 mm diam. ..... ***Pertusaria pupillaris***
Thallus thick (over 0.3 mm); soralia up to 1.5(-3) mm diam. ..... ***Pertusaria borealis***

56(54) Soralia pale green, irregularly rounded, soon confluent; argopsin ..... ***Biatora britannica* & *B. efflorescens***
Soralia often confluent and coalescing towards centre; thallus grey to brown-green, when young often delimited by grey-brown hypothallus; fumarprotocetraric acid; on bark and wood of *Pinus*, rarely *Betula* and *Populus*, Scottish Highlands ..... ***Fuscidea arboricola***

57(53) Thallus completely granular sorediate; fumarprotocetraric acid 58
Thallus not completely sorediate; argopsin or pannarin 59

58(57) Soredia granular, often in consoredia; ubiquitous in areas receiving SO_2 air pollution ..... ***Lecanora conizaeoides***
Soredia farinose; mature exposed trees ..... ***Cliostomum flavidulum***

59(57) Soredia isidioid; argopsin ..... ***Phyllopsora rosei***
Soredia distinct 60

60(59) Soralia fragile, most conspicuous when wet, not much differing in colour from the thallus; argopsin ..... ***Halecania viridescens***
Soralia yellow-brown, scattered, not coalescing towards centre; thallus dark green-grey, hypothallus absent; pannarin; on young trees or branches in moist woodlands and *Salix* carrs, often overgrowing parmelioid lichens ..... ***Rinodina efflorescens***

61(36) Thallus C+ yellow (variolaric acid) 62
Thallus C– (variolaric acid absent) 63

62(61) Thallus often in rounded patches; variolaric acid only; on base-rich bark ..... ***Ochrolechia turneri***
Thallus in streaks or wide-spreading; variolaric and lichesterinic acids; on acidic bark or wood ..... ***Ochrolechia microstictoides***

63(61) Thallus and soralia KC+ violet, tasting bitter; picrolichenic acid 64
Thallus and soralia KC–, not tasting bitter; picrolichenic acid absent 65

64(63) 'Soralia' being the sorediate surface of apothecia within delimited verrucae ..... ***Pertusaria ophthalmiza***
Soralia mostly discrete, not part of ascoma ..... ***Pertusaria amara***

65(63) Soralia dark brown ..... ***Rimularia fuscosora***
Soralia not dark brown 66

66(65) Photobiont *Trentepohlia*; thallus and soredia pure white; ?lepraric acid; on dry bark of wayside trees ..... ***Schismatomma cretaceum***
Photobiont trebouxioid 67

67(66) Thallus of scattered areoles, most areoles dissolving into soralia; atranorin and zeorin ..... ***Rinodina degeliana***
Thallus continuous 68

68(67) Soredia white, grey-white, bluish, pale fawn 69
Soredia yellow-green (check both options if in doubt) 75

69(68) Soredia bluish; on worked timber; atranorin and unidentified substance ..... ***Tephromela grumosa***
Soredia not bluish 70

70(69) Soredia forming discrete, delimited soralia 71
Soredia diffuse or forming irregular soralia 73

71(70) Thallus with initially discrete soralia, becoming confluent; atranorin and zeorin ..... ***Lecanora barkmaniana***
Thallus entirely sorediate from the first 72

72(71) Soredia white to green-grey, granular, 40-100 µm diam.; atranorin and zeorin ..... ***Megalaria pulverea***
Soredia creamy white to pale fawn, farinose to finely granular, 20-50 µm diam.; atranorin and roccellic acid ..... ***Lecanora farinaria***

73(70) Thallus corticate, glossy, with irregular soralia often confined to a few areas on the thallus; atranorin and caperatic acid ..... ***Mycoblastus sanguinarius*** f. ***leprosus***
Thallus matt, more or less completely sorediate, but soredia sometimes lacking near the margin 74

74(73) Marginal prothallus usually conspicuous, white cottony; atranorin, zeorin and porphyrilic acid ..... ***Haematomma ochroleucum*** var. ***porphyrium***
Marginal prothallus absent; atranorin and caperatic acid ..... ***Cliostomum leprosum***

75(68) Soredia diffuse or forming irregular soralia, at times virtually completely covering the thallus . 76
Soredia forming scattered, delimited, round soralia to 1 mm diam. 78

76(75) Marginal prothallus usually conspicuous, white cottony; zeorin, usnic and porphyrilic acids ..... ***Haematomma ochroleucum*** var. ***ochroleucum***
Marginal prothallus absent or black 77

77(76) Thallus pale grey, verrucose, with contrasting yellowish soralia; on bark and wood of old *Pinus*, Scottish Highlands; atranorin, usnic and planaic acids ..... ***Mycoblastus alpinus***
Thallus uniform in colour, powdery-granular with a smooth, pale, continuous prothallus; on mossy bark of deciduous trees in old woodlands; usnic acid, zeorin and terpene(s) or sterol(s) ..... ***Megalospora tuberculosa***

78(75) Thallus rimose, rather thick; atranorin and placodiolic acid ..... ***Haematomma sorediatum***
Thallus granular, thin to nearly absent; atranorin and gangaleoidin ..... ***Lecanora jamesii***

Sterile Crustose Key 7c - Corticolous and Lignicolous Lichens: thallus sorediate/blastidiate/leprose with negative spot test reactions.

Synopsis

1 Photobiont *Trentepohlia* 2
Photobiont chlorococcoid 6
6(1) Soredia forming delimited, round or elongate soralia 7
Soredia diffuse or forming irregular soralia, or leprose or consisting of goniocysts 28
28(6) Thallus UV+ white or orange 29
Thallus UV– 36

1 Photobiont *Trentepohlia* 2
Photobiont chlorococcoid 6

2(1) Thallus conspicuous, pale grey to chalky-white, often wide-spreading, not distinctly mosaic-forming; 'soralia' (? ascomatal initials) pale brown, fleck-like, to 0.5 mm diam., ± scattered; on dry trunks of *Quercus* in old woodlands and parklands ..... ***Lecanactis amylacea***
Thallus inconspicuous, grey to purple-grey, mauve or dark brown, individual thalli often small, sometimes mosaic-forming; soralia and ecology various 3

3(2) Soredia grey, pink-, mauve- or lilac-grey 4
Soredia with a pronounced yellow, yellow-ochre or orange tinge 5

4(3) Thallus lilac- to pink-grey; soralia at first punctiform, becoming confluent; dry sides of old trees ..... ***Schismatomma decolorans***
Thallus dark brown, often tinged mauve and delimited by a dark prothallus; soralia punctiform; on smooth bark, usually near streams; confluentic acid ..... ***Opegrapha zonata***

5(3) Soralia pale fawn to ochraceous, at first 0.2-0.7 mm diam., becoming confluent and to 2-3 mm wide; old trees in open and woodland situations ..... ***Opegrapha corticola***
Soralia bright orange (quickly fading in herbarium) 0.1-0.3 mm diam., sometimes becoming confluent; on exposed twigs and branches of trees and shrubs in boggy places, sometimes on shaded tree trunks ..... ***Opegrapha multipuncta***

6(1) Soredia forming delimited, round or elongate soralia 7
Soredia diffuse or forming irregular soralia, or leprose or consisting of goniocysts 28

7(6) Soralia nearly black 8
Soralia not blackish 9

8(7) Thallus ± immersed; medulla I–; on *Populus* bark ..... ***Caloplaca ahtii***
Thallus superficial, irregularly warted; medulla I+ blue; on wooden fencing ..... ***Thelomma ocellatum***

9(7) Soredia and thallus thick, mostly white 10
Soredia and/or thallus coloured 11

10(9) Soralia genuine, not part of ascoma, round, >1 mm diam., white; thallus well developed with a zoned thalline margin; on bark ..... ***Pertusaria albescens***
'Soralia' being the sorediate surface of apothecia within verrucae; on acid bark in humid sites, N.W. Scotland ..... ***Pertusaria ophthalmiza***

11(9) Soralia developing from thallus pustules that split open so that a resultant concave soralium is delimited by a reflexed ring of thallus 12
Soralia not developing from thallus pustules 13

12(11) Thallus white, without blue tinge; soralia pale yellow-green or green-white, hyphae of exposed soredia never pigmented; on trunks of mature parkland and wayside trees ..... ***Caloplaca ulcerosa***
Thallus pale grey often with blue tinge; soralia pale green, hyphae of exposed soredia with greyish pigment; on nutrient-enriched bark of tree trunks and branches .. ***Caloplaca obscurella***

13(11) Non-abraded soralia on the upper surface with a markedly darker colour (usually brown or bluish) than internally 14
Soralia without darker colour at the surface 21

14(13) Medulla UV+ white 15
Medulla UV– 18

15(14) Prothallus dark blue-grey 16
Prothallus absent or brown 17

16(15) Thallus superficial, dark blue-grey; areoles becoming verrucose and bursting to form pale grey, irregular soralia; perlatolic acid ..... ***Mycoblastus caesius***
Thallus immersed or superficial and pale green-grey; soralia 0.2-0.6 mm diam.; t.l.c. required for identification; on bark of *Betula, Juniperus* and *Pinus* in C. & E. Scottish Highlands ..... ***Lecidea nylanderi*** (divaricatic acid) & ***L. pullata*** (sphaerophorin)

17(15) Perlatolic acid present; thalli often wide spreading; mainly on wood, especially of *Pinus* in Scottish pine forests, less often on bark in C. & E. Scottish Highlands ..... ***Hertelidea botryosa***
Divaricatic acid present; thalli delimited, usually round; on smooth bark of deciduous trees ..... ***Fuscidea recensa***

18(14) Thallus continuous, grey or bluish, smooth 19
Thallus brownish or not smooth but areolate 20

19(18) Atranorin and sometimes traces of norstictic present; on wood and bark, also branches ..... ***Buellia griseovirens***
Atranorin and placodiolic acid present; on wood and bark ..... ***Buellia arborea***

20(18) Thallus areolate, grey or bluish; on ± base-rich bark ..... ***Rinodina griseosoralifera***
Thallus often areolate, brownish; on smooth bark ..... ***Japewia subaurifera***

21(13) Medulla and soralia UV+ white (divaricatic acid) ..... ***Fuscidea lightfootii***
Thallus UV– 22

22(21) Thallus continuous 23
Thallus consisting of scattered areoles 25

23(22) Thallus whitish, soredia creamy white to pale fawn, farinose to finely granular, 20-50 µm diam.; atranorin and roccellic acid ..... ***Lecanora farinaria***
Thallus and/or soralia yellowish, with usnic acid 24

24(23) Soralia pale yellow or green-yellow, scattered, UV– ; thallus thin, pale grey ..... ***Lecanora jamesii***
Soralia along cracks in the thallus; thallus yellowish ..... ***Lecanora orosthea***

25(22) Thallus yellowish, with usnic acid ..... ***Lecanora soralifera***
Thallus greenish to brownish or grey, without usnic acid 26

26(25) Thallus with globose soralia arising from often hidden squamules; on moist, rotting wood, often on *Placynthiella icmalea* ..... ***Trapeliopsis percrenata***
Soralia not strongly convex; mostly on exposed trees 27

27(26) Thallus with soredia, without pigments; upper cortex parenchymatous ..... ***Hyperphyscia adglutinata***
Thallus with soredia that start as blastidia, sometimes with orange, K+ purple pigments; upper cortex unclear ..... ***Rinodina colobinoides***

28(6) Thallus UV+ white or orange 29
Thallus UV– 36

29(28) Thallus and soralia UV± orange (xanthones); on dry, shaded bark in woodlands ..... ***Bacidia viridifarinosa***
Thallus and soralia UV+ white (divaricatic, lobaric or perlatolic acid, or sphaerophorin) 30

30(29) Prothallus dark blue-grey 31
Prothallus absent or brown 32

31(30) Thallus superficial, dark blue-grey; areoles becoming verrucose and bursting to form pale grey, irregular soralia; perlatolic acid ..... ***Mycoblastus caesius***
Thallus immersed or superficial and pale green-grey; soralia 0.2-0.6 mm diam.; t.l.c. required for identification; on bark of *Betula, Juniperus* and *Pinus* in C. & E. Scottish Highlands ..... ***Lecidea nylanderi*** (divaricatic acid) & ***L. pullata*** (sphaerophorin)

32(30) Thalli delimited, often by brown prothallus, usually round; mainly on smoothish bark of deciduous trees 33
Thalli wide-spreading 34

33(32) Perlatolic acid present ..... ***Ropalospora viridis***
Divaricatic acid present ..... ***Fuscidea lightfootii***

34(32) Thallus leprose ..... ***Lepraria incana***
Thallus sorediate; mainly on wood of old *Pinus* 35

35(34) Lobaric acid present ..... ***Lecidea porphyrospoda***
Perlatolic acid present ..... ***Hertelidea botryosa***

36(28) Thallus ± leprose 37
Thallus sorediate 39

37(36) Thallus consisting of a primary leprose thallus from which simple or sparingly branched, granular pseudopodetia develop ..... ***Leprocaulon microscopicum***
Thallus without pseudopodetia 38

38(37) Thallus leprose, with trebouxioid algae ..... ***Lepraria***
Thallus ± leprose, with ellipsoid algae (*Stichococcus*) ..... ***Chaenotheca trichialis***

39(36) Thallus well delimited, often rather thick, white to yellow green 40
Thallus less delimited, thin, greyish to green 45

40(39) Thallus bright or pale yellow-green 41
Thallus yellow-white to yellow-grey 43

41(40) Thallus delimited by a white, fibrous prothallus; zeorin, porphyrilic and usnic acids ..... ***Haematomma ochroleucum*** var. ***ochroleucum***
Fibrous prothallus absent 42

42(41) Thallus green-white, thin; soredia yellow-green, with white medulla beneath; usnic acid and zeorin; in exposed places ..... ***Lecanora compallens***
Thallus powdery granular with a smooth, pale, continuous prothallus; thalline granules aggregated, pale green, tinged yellow-green, often partly eroded and then paler; atranorin, usnic acid, zeorin, ?diterpene(s), sterol(s); in ancient woodland ..... ***Megalospora tuberculosa***

43(40) Thallus delimited by a white, fibrous prothallus; atranorin, zeorin and porphyrilic acid ..... ***Haematomma ochroleucum*** var. ***porphyrium***
Fibrous prothallus absent 44

44(43) Thallus often in rounded patches; variolaric acid only; on base-rich bark ..... ***Ochrolechia turneri***
Thallus in streaks or wide-spreading; variolaric and lichesterinic acids; on acidic bark or wood ..... ***Ochrolechia microstictoides***

45(39) Thallus bluish grey to greyish white 46
Thallus some shade of green 52

46(45) Soredia granular (generally over 50 µm diam.) 47
Soredia farinose 50

47(46) Thallus consisting of partly cylindrical granules; bluish pigment K+ green intensifying, N+ purple; on trees in oceanic ancient woodland ..... ***Bacidia caesiovirens***
Thallus of more rounded granules; pigment different; in open, low rainfall areas 48

48(47) Thallus thick, totally covering bark; soredia with K+ violet pigment ..... ***Caloplaca virescens*** (cf. also morphs of ***C. citrina***)
Thallus thin, bark well recognisable below 49

49(48) Thallus rough, granular to areolate, soredia concolorous; soredia with K+ violet pigment ..... ***Rinodina pityrea***
Thallus finely granular, with green-grey-brown soredia ..... ***Lecania erysibe***

50(46) Thallus pale bluish grey; usnic acid, zeorin and asemone ..... ***Fellhanera bouteillei***
Thallus with violaceous soredia or whitish 51

51(50) Thallus whitish with darker, violaceous soredia; on rough bark of trees in ancient woodland; no substances ..... ***Buellia violaceofusca***
Thallus uniformly whitish; on bark of old *Pinus* in native pine woods; pseudoplacodiolic acid ..... ***Lecidea leprarioides***

52(45) Photobiont micareoid, cells *c*. 4-8 µm diam; t.l.c. required for identification ..... ***Micarea prasina*** agg. 53
Photobiont chlorococcoid, cells *c*. 6-15 µm diam. 55

53(52) Thallus with micareic acid; usually on wood of stumps of old trees ..... ***Micarea prasina***
Thallus without micareic acid 54

54(53) Thallus with methoxymicareic acid, without bluish tinge; common ..... ***Micarea micrococca***
Thallus with prasinic acid, often with a bluish tinge; rare on trees ..... ***Micarea subviridescens***

55(52) Thallus smooth to rimose between the soredia, soredia of the same grey-green colour; soralia usually markedly, vertically raised, with steep sides; roccellic acid present ..... ***Fellhanera viridisorediata***
Thallus different; no substances detected by t.l.c. 56

56(55) Thallus with rather irregular ± granular soredia; on ancient trees in forest or pasture woodland 57
Thallus with either farinose soredia or regular granular soredia; also in exposed habitats 58

57(56) Thallus diffuse; soredia isidiose, often with brownish tips. ..... ***Bacidia biatorina***
Thallus often clearly delimited; soredia relatively sparse ..... ***Mycobilimbia epixanthoides***

58(56) Soredia granular, regular ..... ***Bacidia sulphurella***
Soredia farinose 59

59(58) Thallus consisting mainly of goniocysts ..... ***Bacidia delicata***
Thallus different 60

60(59) Thallus pale yellow-green; soredia generally effuse ..... ***Bacidia adastra***
Thallus green; soredia often rather discrete, of paler colour ..... ***Bacidia caligans***

Sterile Crustose Key 7d - Corticolous and Lignicolous Lichens: thallus with isidia, hyphophores or papillae, in some species becoming sorediate or appearing minutely squamulose.

Synopsis

1 Thallus C+ bright orange or orange-red 2
Thallus C– 4
4(1) Thallus KC+ violet; tasting bitter; upper surface warted-papillate, the apices and ridges breaking down into small punctiform soralia ..... ***Pertusaria amara***
Thallus KC± yellow (may be K+ red); not tasting bitter 5
5(4) Thallus K+ yellow or red (stictic, norstictic or thamnolic acids) 6
Thallus K–, at times with orange, K+ purple pigments (anthraquinones) 8
8(5) Photobiont *Trentepohlia*; on tree bark in old woodlands and parklands 9
Photobiont trebouxioid; ecology varied 11

1 Thallus C+ bright orange or orange-red 2
Thallus C– 4

2(1) Thallus yellow-green, upper surface coarsely warted with numerous, ± globose isidia; sunny sides of wayside trees; C+ persistent orange; xanthones (cf. also *Pyrrhospora quernea*, which has regular, rather large, granular soredia) ..... ***Pertusaria flavida***
Thallus grey-white to pale fawn, blastidia or coralloid isidia present; ecology varied; C+ persistent orange or fleetingly orange-red 3

3(2) Thallus grey-white; isidia small, cylindrical-coralloid, usually branched, forming a continuous crust in centre; on nutrient-enriched bark; C+ orange-red, not persistent; gyrophoric acid ..... ***Ochrolechia subviridis***
Thallus pale fawn brown; of small granules (blastidia), forming a thick, granular-areolate crust; rare on exposed, decorticated coastal wood; C+ persistent orange; xanthones ..... ***Lecidella meiococca***

4(1) Thallus KC+ violet; tasting bitter; upper surface warted-papillate, the apices and ridges breaking down into small punctiform soralia ..... ***Pertusaria amara***
Thallus KC± yellow 5

5(4) Thallus K+ distinctly yellow or red (stictic, norstictic or thamnolic acids) 6
Thallus K± slightly yellow (atranorin), at times with orange, K+ purple pigments (anthraquinones) 8

6(5) Thallus K+ yellow to red (crystals - norstictic acid), UV–; ..... ***Pertusaria coccodes***
Thallus K+ yellow (crystals absent) 7

7(6) Thallus white, UV–; thamnolic acid ..... ***Pertusaria corallina***
Thallus greenish, UV+ orange; coronaton, stictic and constictic acids ..... ***Pertusaria coronata***

8(5) Photobiont *Trentepohlia*; on tree bark in old woodlands and parklands 9
Photobiont chlorococcoid or trebouxioid; ecology various 11

9(8) Thallus dull grey, often with a blue or purple tinge when fresh; surface thinly to thickly minutely isidiate ..... ***Porina coralloidea***
Thallus sandy brown or dull orange to pale green-brown or yellow-green; surface thickly isidiate and obscured by dispersed or a generally confluent crust of simple or frequently coralloid-branched isidia 10

10(9) Thallus sandy brown to pale green-brown, ± continuously isidiate; isidia lacking cortex or when present very narrow and ill-defined; *Trentepohlia* cells 7-12 µm diam. .. ***Porina hibernica***
Thallus pale green-yellow; isidia forming ± distinct, minutely branched, shrub-like aggregations; isidia with a wide well-defined algal free cortex; *Trentepohlia* cells 9-17 µm diam. (cf. *P. atlantica* which can have moniliform isidia) ..... ***Porina rosei***

11(8) Thallus squashes C+ red (gyrophoric acid); thallus black to dark brown, rarely pale green-brown (shade forms) of isidiose to minutely coralloid granules 25-150(-200) × 25-50 µm; on acid bark and wood ..... ***Placynthiella icmalea***
Thallus squashes C– (gyrophoric acid absent); thallus paler; isidia morphology and ecology various 12

12(11) Thallus appearing minutely squamulose, of ± cylindrical or nodular, branched, at times digitiform, isidia or filaments 13
Thallus not appearing squamulose or filamentous 18

13(12) Thallus whitish grey, of scattered, branched, finger-like, cylindrical or compressed isidia, K+ yellow (atranorin); external cells of upper cortex without conical papillae; photobiont cells mostly globose, (7-)9-14(-16.5) µm; on trunks of mature *Quercus* in old woodlands ..... ***Rinodina isidioides***
Thallus pale grey to brown-green, bright green when wet, K– (atranorin absent); photobiont cells often smaller, rarely exceeding 12 µm diam.; habitat ecology various 14

14(13) Thallus of green, flattened micro-squamules or branched green isidia; cortical cells without papillae; photobiont cells 5-12 µm diam. 15
Thallus various; cortical cells with microscopic papillae; photobiont cells globose, broadly oblong or ovoid-pyriform, 4.5-9(-10) × 4.5-7 µm 16

15(14) Thallus of green, flattened microsquamules, usually somewhat incised and overlapping, dull; open habitats in low rainfall areas ..... ***Bacidia neosquamulosa***
Thallus of pale yellowish green deeply dissected squamules resembling richly branched coralloid isidia, shiny; in oceanic woodland ..... ***Bacidia squamellosa***

16(14) Thallus of densely branched, pale green filaments, 12-35 µm wide; branches sometimes breaking down into soredia-like granules; on water-retentive bark, especially *Sambucus* ..... ***Psoroglaena stigonemoides***
Thallus of cylindrical to flattened squamules >50 µm wide 17

17(16) Squamules to 0.5 mm wide, ± contiguous, often ascending, nodulose and subgranular, rarely dispersed and elongate, digitiform; on base-rich or nutrient-enriched bark, usually amongst bryophytes or overgrowing cyanophilous lichens ..... ***Agonimia tristicula***
Squamules 0.05-0.1 × 0.05-0.25 mm, often dispersed, rarely contiguous and compacted into elongate, adpressed, simple, branched, or trilobed-digitiform clusters, amongst mosses on trunks of *Quercus* in relict woodlands ..... ***Agonimia octospora***

18(12) Apices of isidia and pycnidia orange, K+ purple; on acid bark in well-lit woodlands and parklands ..... ***Caloplaca herbidella***
Apices of isidia and pycnidia (if present) not orange, K–; ecology various 19

19(18) Thallus slate blue-grey to blue black, scurfy-isidiate, cracked-areolate; on nutrient-enriched trees (cf. *Caloplaca virescens* which has fine, cylindrical, granular soredia) ..... ***Caloplaca chlorina***
Thallus white grey, grey-green or olivaceous brown to yellow-green or nearly black; film-like or continuously isidiate 20

20(19) Thallus whitish, isidia in black, soralia-like clusters; medulla I+ blue ..... ***Thelomma ocellatum***
Isidia scattered or forming a continuous crust; medulla I– 21

21(20) Thallus thin, wax- or skin-like, with rather inconspicuous, black or green 'isidia' (hyphophores) . 22
Thallus conspicuously isidiate-granular 23

22(21) Hyphophores green-grey, ± translucent, very slender, *c*. 0.02 mm diam., with paler, pointed apices; on horizontal boughs of *Salix* and smooth-barked, young trees in damp sites, even in polluted habitats ..... ***Jamesiella anastomosans***
Hyphophores dark brown, bent over above with a flattened, expanded apex with a spiked margin; on pleurocarpous mosses, W. British Isles ..... ***Gyalideopsis muscicola***

23(21) Thallus thick, white-grey, usually with conspicuous prothalline margin, coarsely verrucose or papillose to granular-isidiate, at times breaking down to form sorediate areas 24
Thallus thin, grey-green to yellow-green or olivaceous brown to nearly black, without a prothalline margin, granular-isidiate; granules 60-120 µm, rounded, or ± elongate, never becoming sorediate 26

24(23) Isidia coarse and irregular; thallus grey as compared to the isidia (cf. also *Pertusaria polythecia* which only differs in fatty acids) ..... ***Pertusaria albescens*** var. ***corallina***
Isidia finer, ± sorediose; thallus whitish 25

25(24) Thallus often in rounded patches; variolaric acid only; on base-rich bark ..... ***Ochrolechia turneri***
Thallus in streaks or wide-spreading; variolaric and lichesterinic acids; on acidic bark or wood ..... ***Ochrolechia microstictoides***

26(23) Thallus olivaceous brown to nearly black, dull; on wood ..... ***Protoparmelia oleagina***
Thallus bluish grey to grey-green or yellow-green 27

27(26) On trunks of mature, base-rich-barked trees in parklands, wayside situations and woodlands; granules never dark-coloured on upper surface ..... ***Bacidia rubella***
On trunks of mature, acid-barked trees, especially *Quercus* in ancient parklands and woodlands; granules brown or violaceous on upper surface 28

28(27) Granules violaceous (N+ red) on upper surface ..... ***Bacidia caesiovirens***
Granules brown (N-) on upper surface ..... ***Bacidia biatorina***

Sterile Crustose Key 7e - Corticolous and Lignicolous Lichens: thallus without soredia, isidia, hyphophores, or papillae, but with pycnidia or sporodochia.

Only the most characteristic species occurring in this condition are included. Many other normally fertile (i.e. with ascomata) species occasionally occur sterile, but with pycnidia. Included are 'pycnidial morphs' of weakly lichenized species occurring on smooth bark e.g. species in *Arthonia, Arthopyrenia, Eopyrenula* and *Mycomicrothelia.*

Synopsis

1 Photobiont *Trentepohlia* or algae apparently absent 2
Photobiont micareoid or chlorococcoid 30
30(1) Photobiont micareoid, cells 4-7 µm, ± globose, thin-walled 31
Photobiont chlorococcoid, cells mostly >8 µm diam. 41

1 Photobiont *Trentepohlia* or algae apparently absent 2
Photobiont micareoid or chlorococcoid 30

2(1) Conidiomata sporodochia, without wall 3
Conidiomata pycnidia, with wall 4

3(2) Thallus lichenicolous, on *Enterographa* and *Lecanactis*, pale pink with scattered, ± regular hemispherical warts (sporodochia), 0.3-1 mm diam., which develop over moribund apothecia or pycnidia of the host; sporodochia pale to creamy, composed of ± vertically orientated hyphae, forming 1-septate, ellipsoid conidia in chains; thallus and sporodochia C+ red (lecanoric and schizopeltic acids) ..... ***Blarneya hibernica***
Thallus probably often lichenicolous, e.g. on *Enterographa*, *Lecanographa* and *Schismatomma*; sporodochia black; conidia irregularly subglobose to ellipsoid multicellular-appearing, 6-17(-20) × 5-10 µm, with black thickenings in the wall ..... ***Milospium graphideorum*** (not treated)

4(2) Pycnidia dull yellow; pycnidial wall ± colourless 5
Pycnidia brown to black, but sometimes pruinose; pycnidial wall dark-coloured 6

5(4) Conidia ellipsoid, 3-4(-5) × 1.3-1.8 µm ..... ***Dimerella lutea***
Conidia oblong, ± with a median constriction, 6-7(-8) × 1.8-2.6 µm ..... ***Dimerella pineti***

6(4) Pycnidia thickly white to dull yellow- or white-pruinose 7
Pycnidia brown to black, not or only thinly pruinose 10

7(6) Apices of pycnidia C+ red (lecanoric acid), thallus C– (schizopeltic acid); conidia 12-17 × 2-3 µm long ..... ***Lecanactis abietina***
Apices of pycnidia and thallus C–; conidia <10 µm long; no substances 8

8(7) Pycnidia with a white, yellow or green pruina; conidia ellipsoid to dumb-bell-shaped, 3-5 × 0.5-1(-2) µm ..... ***Opegrapha varia***
Pycnidia black; conidia not dumb-bell-shaped 9

9(8) Conidia 3.7-5 × 1.2-1.7 µm; pycnidia with a dark brown-black wall, K+ olive-black; pruina of pycnidia K+ yellow, KC–, C–, Pd– ; thallus contains confluentic acid and accessory and lepraric acid; on predominantly acid substrata in old woodlands ..... ***Lecanactis subabietina***
Conidia 4.5-6.7 × 1-1.4 µm; pycnidia with a brown wall, K–; pruina of pycnidia K–, KC–, C-, Pd–; thallus contains two unidentified pigments; on trees with a base-rich or nutrient-rich bark in parklands and woodlands ..... ***Opegrapha vermicellifera***

10(6) Conidia curved 11
Conidia globose, ellipsoid or oblong, not curved 14

11(10) Thallus semi-glossy, with conspicuous pseudocyphellae; conidia 10-16 × 0.8-1 µm ..... ***Pyrenula*** (mainly *P. chlorospila* & *P. macrospora*)
Thallus dull, without clear pseudocyphellae 12

12(11) Conidia sickle-shaped, of two types: 9-15 × l-1.3 µm or 9-14(-17) × 0.5-0.7 µm; thallus pale grey to dull olive or brown ..... ***Opegrapha vulgata***
Conidia short and curved, <9 µm; colour various 13

13(12) Conidia 5-8 × 1-2 µm; thallus dull olive to red-brown ..... ***Opegrapha rufescens***
Conidia of two types: 4-7 × 1-1.5 µm or 7-9 × 0.7 µm; thallus dull grey-olive ..... ***Opegrapha niveoatra***

14(10) Conidia brown 15
Conidia hyaline 16

15(14) Conidia with wall thickened only near the septum; on *Betula* ..... ***Mycomicrothelia wallrothii***
Conidia with more regular thickenings, 1- to 7-septate; rarely on *Betula* ..... ***Eopyrenula***

16(14) Conidia septate 17
Conidia simple 20

17(16) Conidia filiform, multiseptate, over 50 µm long ..... ***Celothelium ischnobelum***
Conidia 1- to 9-septate, under 30 µm long 18

18(17) Conidia filiform, curved, 1-septate, 20-25 × 1.5 µm ..... ***Leptorhaphis maggiana***
Conidia oblong, ellipsoid, fusiform to clavate, straight, 1- to 9-septate 19

19(18) Pycnidial wall K+ green; conidia oblong, 3-septate, 11-13 × 2-2.5 µm; not lichenized ..... ***Arthopyrenia cerasi***
Pycnidial wall K–; conidia ellipsoid, fusiform to clavate, 1- to 9-septate; lichenized ..... ***Strigula***

20(16) Pycnidia conical with elongated neck; conidia released in chains of cylindrical packets 21
Pycnidia ± globose or flattened; conidia free 22

21(20) Conidia 3.5-4.5 × 1.8-3 µm; pycnidia 0.08-0.15 mm diam. ..... ***Anisomeridium polypori***
Conidia 4.5-6 × 2.5-3 µm; pycnidia 0.2-0.58 mm diam. ..... ***Anisomeridium robustum***

22(20) Pycnidial wall K+ purple 23
Pycnidial wall K+ green or K– 24

23(22) Pycnidia dull red-brown, wall K+ pale purple, 80-100 µm diam; conidia 3-4.5 × 0.5-1 µm ..... ***Arthonia spadicea***
Pycnidia orange/yellow, wall K+ strongly purple, 40-60 µm diam; conidia 4-6 × 1 µm ..... ***Arthonia vinosa***

24(22) Conidia >7 µm long 25
Conidia <5 µm long 27

25(24) Thallus not lichenized, conidia 8-11 × 1.8-2.2 µm ..... ***Arthopyrenia cinereopruinosa***
Thallus lichenized 26

26(25) Conidia rather broad, 7.6-10(-12) × 3.5-4.5 µm ..... ***Anisomeridium ranunculosporum***
Conidia more slender, 9-10.5 × 2-2.5 µm ..... ***Anisomeridium viridescens***

27(24) Conidia subglobose to broadly ellipsoid, 2.3-4 × 1.8-2.7 µm ..... ***Anisomeridium biforme***
Conidia ellipsoid to bacilliform, generally under 1.8 µm wide 28

28(27) Pycnidia ± immersed, ostiole often gaping and torn; conidia 3.5-4 × 1-1.5 µm ..... ***Bactrospora corticola***
Pycnidia emergent to sessile, ostiole not gaping 29

29(28) Pycnidia *c*. 0.1 mm diam.; conidia 3-5 × 0.5-1(-2) µm ..... ***Opegrapha varia***
Pycnidia 0.1-0.4 mm diam.; conidia 3-5 × (1-)1.2-1.5(-1.7) µm ..... ***Opegrapha areniseda***

30(1) Photobiont micareoid, cells 4-7 µm, ± globose, thin-walled 31
Photobiont chlorococcoid, cells mostly >8 µm diam. 41

31(30) With stalked or sessile pycnidia containing mesoconidia (smaller, ± immersed pycnidia containing microconidia sometimes present); never with curved or flexuose macroconidia ... 32
Pycnidia innate sometimes becoming emergent with gaping ostioles, or with small, sessile, apothecia-like sporodochia; pycnidia sometimes containing curved or flexuose macroconidia .. 37

32(31) Pycnidia black 33
Pycnidia white to red-brown, never black 35

33(32) Pycnidial wall olivaceous brown, K+ violet; mesoconidia 3.5-5 × 1-1.5(-1.7) µm **..** ***Micarea misella***
Pycnidial wall K± olivaceous 34

34(33) Pycnidial wall and stalk dark purple-brown, K+ dark green; mesoconidia 3.4-4.3 × 1.2-1.6 µm ..... ***Micarea nigella***
Pycnidial wall dark olivaceous, K– ; stalk fuscous or red-brown, K– ; mesoconidia 3.5-4.8 × 1-1.5 µm ..... ***Micarea botryoides***

35(32) Thallus of pale to dark green goniocysts. 12-40 µm diam.; goniocysts containing purple, oily substance in K; pycnidia brown with white tomentum; mesoconidia (4-)4.5(-6) × 1.3-1.7 µm ..... ***Micarea hedlundii***
Thallus indistinctly areolate or rimose, or endoxylic, without goniocysts, K– ; pycnidia white without tomentum 36

36(35) Pycnidia C+ red (gyrophoric acid), simple; mesoconidia 4-6 × 1-1.5 µm **.** ***Micarea pycnidiophora***
Pycnidia C–, often branched; mesoconidia 6-8 × 1-1.8 µm ..... ***Micarea stipitata***

37(31) With white, cushion-like, apothecia-like sporodochia *c*. 0.1-0.25 mm diam. bearing oblong-ellipsoid macroconidia 6-10 × 2-3 µm; immersed, inconspicuous pycnidia containing mesoconidia 4-5.3 × 1.2-1.5 µm may also be present; all parts C–; no substances ..... ***Micarea adnata***
Sporodochia absent; thallus and/or pycnidia C+ red (gyrophoric acid) or C– 38

38(37) Thallus of pale to dark green (sometimes K+ violet) goniocysts 12-60 µm; pycnidia, if present, 30-80 µm diam. containing either (5-)5.5-8 × 0.7-1 µm microconidia, or (3.5-)4-6 × 1.2-1.7 µm mesoconidia; all parts C–; prasinic, micareic or methoxymicareic acid ..... ***Micarea prasina*** agg.
Thallus areolate, or scurfy (invaded by dematiaceous hyphae and foreign photobionts), or ± endoxylic; sometimes with curved or flexuose macroconidia; thallus and/or pycnidia usually C+ red (gyrophoric acid) 39

39(38) With numerous pycnidia containing mesoconidia, 3.5-4.5 × 1.3-2 µm, often extruded as conspicuous white blobs; in addition, pycnidia containing microconidia (4-)4.5-6(-6.5) × 0.7-1 µm, or curved macroconidia 12-21 × 1 µm, sometimes present: pycnidial walls with pale olivaceous pigment, K+ violet; usually on wood, commonly on worked timber (cf. also *M. nitschkeana*) ..... ***Micarea denigrata***
Pycnidia usually with longer, curved or flexuose macroconidia; smaller pycnidia with microconidia sometimes present; mesoconidia unknown; pycnidial walls colourless or green, K– ; on various substrata, rarely on worked timber 40

40(39) Macroconidia curved or hamate, 21-40 × 1-1.5 µm; microconidia (5-)6-7(-7.7) × 0.4-0.7 µm; on bark of old trees (especially *Quercus*) in old woodlands ..... ***Micarea peliocarpa***
Macroconidia flexuose, 50-110 × 1 µm; microconidia (3.8-)4.5 × 0.5-0.7 µm; on shaded wood in woodlands ..... ***Micarea cinerea***

41(30) Conidiomata sporodochia, without wall ..... ***Psammina palmata***
Conidiomata pycnidia, with wall 42

42(41) Pycnidia green-black or blue-black 43
Pycnidia white, pink-brown or grey 50

43(42) Pycnidia stalked, blue-black, to 0.2 mm diam., often with a globose white spore mass extruded from ostiole; conidia *c*. 3.7-4 × 1.5-1.7 µm, simple; thallus grey, leprose-granular; on acid bark and wood of old trees ..... ***Lecidea doliiformis***
Pycnidia sessile or immersed 44

44(43) Conidia long and curved, 20-45 × 1-1.5 µm ..... ***Fellhaneropsis myrtillicola***
Conidia shorter 45

45(44) Conidia subglobose 46
Conidia short to long ellipsoid to bacilliform 47

46(45) Thallus inapparent, C–; conidia *c*. 2-3 µm diam. (often found only with pycnidia and mistaken for an autonomous lichen) ..... ***Microcalicium disseminatum***
Thallus well-developed, C+ red; conidia 2.5-4 × 1.5-3 µm ..... ***Pycnora xanthococca***

47(45) Conidia bacilliform, curved or not, >5 µm long 48
Conidia ellipsoid, not curved, <5 µm long 49

48(47) Conidia curved, 10-14 × 1 µm; thallus grey ..... ***Lecanora chlarotera***
Conidia not curved, 0- to 1-septate, 5-9 × 2-2.5 µm; thallus dull green ..... ***Bacidia incompta***

49(47) Pycnidia 0.2-0.6 mm diam.; thallus of pale brown or yellow-brown, warted granules, or disappearing; conidia 2-4 × 1-1.7 µm; on wood, especially near the sea, mainly E. England ..... ***Cliostomum corrugatum***
Pycnidia 0.1-0.3 mm diam.; thallus white-grey, usually irregular with ± smooth, areolate areas, sometimes becoming warted; conidia 3-5 × 1.5-2 µm; on ± acid bark and wood, widespread ..... ***Cliostomum griffithii***

50(42) Pycnidia stalked, white-pruinose, 0.08-0.12 mm diam., to 0.15 mm high; conidia 2.8-3.8 × 0.8-1.2 µm ..... ***Catillaria alba***
Pycnidia immersed to sessile 51

51(50) Conidia pyriform or ellipsoid 52
Conidia curved, filiform 56

52(51) Pycnidia bluish grey; conidia ellipsoid, 3-4 × 1.2-2 µm; on leaves ..... ***Byssoloma diederichii***
Conidia pyriform 53

53(52) Pycnidial wall green; conidia 3.7-4.5 × 1.3-1.7 µm ..... ***Byssoloma marginatum***
Pycnidial wall pale orange or bluish grey 54

54(53) Pycnidia partly orange-, partly blue-pigmented; conidia 4-6 µm long ..... ***Fellhanera ochracea***
Pycnidia pale; conidia 3-5 µm long 55

55(54) Thallus green; no substances ..... ***Fellhanera subtilis***
Thallus bluish; zeorin, asemone & usnic acid ..... ***Fellhanera bouteillei***

56(51) Conidia 10-15(-18) × 1.5-2 µm ..... ***Lecania cyrtellina***
Conidia >20 µm long 57

57(56) Thallus smooth to slightly verrucose, not consisting of goniocysts or micro-squamules 58
Thallus granular, consisting of goniocysts or micro-squamules 59

58(57) Pycnidia pink to brown, sessile ..... ***Fellhaneropsis vezdae***
Pycnidia white, immersed ..... ***Bacidia chloroticula***

59(57) Thallus micro-squamulose ..... ***Bacidia neosquamulosa***
Thallus consisting of goniocysts 60

60(59) Conidia strongly curved, walking-stick-like hooked ..... ***Bacidia sulphurella***
Conidia curved but not hooked ..... ***Bacidia delicata***

Sterile Crustose Key 7f - Corticolous and Lignicolous Lichens: without pycnidia, sporodochia, soredia or isidia.

Only the most characteristic species occurring in this condition are included. Sterile thalli (without ascomata, conidiomata, or distinctive vegetative dispersal structures) of many other species may be encountered, these being either juvenile or stunted or arrested in their development by environmental stress.

1 Thallus white-grey to pale grey- or glaucous green 2
Thallus green, pale grey mottled orange-brown or fawn to deep brown 6

2(1) Photobiont *Trentepohlia*; thallus UV+ white 3
Photobiont chlorococcoid (the lichenicolous basidiomycete *Athelia* keys out here; it forms white concentric rings, sometimes with white to creamy sclerotia, on algae and lichens and may resemble a lichen) 4

3(2) Thallus pale grey to chalky white with pale brown flecks (? ascomatal initials); unidentified acids ..... ***Lecanographa amylacea***
Thallus whitish without brown flecks; confluentic and 2′-*O*-methylmicrophyllinic acids ..... ***Lecanographa lyncea***

4(2) Thallus Pd– ; forming superficial, granular verrucae; granules *c*. 80-120 µm diam., but granules never loose and soralia-like; forming large patches on mossy trunks in old woodlands, Lake District, N.E. England, Scottish Highlands ..... ***Biatora vernalis***
Thallus Pd+ orange-red; minutely granular-squamulose or smooth, continuous 5

5(4) Thallus smooth, ± continuous, very thin, often with erose patches; prothallus absent; K+ red (crystals - norstictic acid); widespread ..... ***Phlyctis argena***
Thallus of minute, flattened to granular, pale blue-grey, faintly white pubescent, squamules, often delimited by a ± arachnoid prothallus; K– or faint yellow (argopsin); overgrowing mosses on mature tree trunks in old woodlands, W. & S. British Isles ..... ***Phyllopsora rosei***

6(1) Thallus green, granules 0.1–0.2 mm diam., with colourless pseudoparenchymatous surface layer; photobiont *Coccomyxa* ..... ***Lichenomphalia umbellifera* & *L. velutina***
Thallus grey mottled orange-brown or fawn to deep brown; photobiont trebouxioid (the free-living alga *Trentepohlia*, consisting of often moniliform filaments of one cell wide keys out here) 7

7(6) Thallus grey, mottled orange-brown, the orange patches reacting K+ purple; on dry, acid bark ..... ***Chaenotheca ferruginea***
Thallus fawn to deep brown, K– 8

8(7) Thallus squamulose; squamules 1(-1.5) mm diam., round or irregular, often crowded, bullate or irregularly ascending, margin ± crenulate; upper surface grey-green to dark brown, dull; on bark and wood, tolerating atmospheric pollution ..... ***Hypocenomyce caradocensis***
Thallus granular-squamulose; granules *c*. 0.1 mm diam. 9

9(8) Granules matt, brown with paler, often white margins; on mossy, acid-barked trees, especially *Quercus*, often over bryophytes ..... ***Lopadium disciforme***
Granules shiny brown, uniform; mainly on *Betula* and conifer trunks, Scottish Highlands ..... ***Protoparmelia ochrococca***

GENERIC KEY 8
Sterile crustose lichens growing on rock, soil, detritus, glass, iron, rubber etc.

1 Thallus completely non-corticate or leprose ..... **Sterile Crustose Key 8a**
Thallus with at least some corticate areas 2
(NB: if in doubt go to **42)**

2(1) Thallus and/or soredia or pycnidia C+ (or KC+) red, orange or yellow .. **Sterile Crustose Key 8b**
Thallus and soredia C–, KC– (may be K+) 3

3(2) Thallus with soredia or blastidia 4
Thallus with neither soredia nor blastidia 5

4(3) Thallus and/or soredia either K+ and/or Pd+ ..... **Sterile Crustose Key 8c**
Thallus and soredia with all spot test reactions negative ..... **Sterile Crustose Key 8d**

5(3) Thallus either K+ and/or Pd+ ..... **Sterile Crustose Key 8e**
Thallus with all spot test reactions negative ..... **Sterile Crustose Key 8f**

Sterile Crustose Key 8a - Saxicolous and Terricolous Lichens: thallus non-corticate or leprose.

Synopsis

1 Thallus C+ red (or at least KC+ red-orange) or C+ persistent orange 2
Thallus C– 13
13(1) Photobiont cyanobacteria (blue-green, *Nostoc*); no substances 14
Photobiont green 17
17(13) Photobiont *Coccomyxa*; thallus green, granules partly hyaline; no substances ..... ***Lichenomphalia umbellifera***
Photobiont not *Coccomyxa* 18
18(17) Photobiont with orange pigment (*Trentepohlia*) 19
Photobiont without orange pigment 21
21(18) Thallus yellow, yellow-green or green 22
Thallus grey, brown or black 42

1 Thallus C+ red (or at least KC+ red-orange) or C+ persistent orange 2
Thallus C– 13

2(1) Thallus green, C+ red in section but seemingly C+ orange due to rapid hydration of micareoid photobiont (cells *c*. 4-8 µm diam.); gyrophoric acid ..... ***Micarea viridileprosa***
Thallus white, grey, brown, green-brown or black; photobiont chlorococcoid 3

3(2) C+ persistent orange (xanthones present); thallus yellow-green to green (occasionally straw coloured) when fresh 4
Thallus C+ or KC+ red, often fleeting (xanthones absent); thallus grey or brown (rarely green-brown) 7

4(3) Thallus of farinose soredia, 20-30(-50) µm diam. 5
Thallus of finely-granular to granular blastidia or soredia, often >40 µm diam., with yellow-brown or grey-ochre tinge 6

5(4) Thallus green-grey to straw coloured; surface soredia often brown, grey-flecked blue-grey; atranorin, arthothelin and ± thuringione ..... ***Lecidella scabra***
Thallus composed of yellow-green soredia; thiophanic, usnic acids, zeorin and 'expallens unknown' ..... ***Lecanora expallens***

6(4) Thallus of granular blastidia, 65-80 µm diam.; atranorin, isoarthothelin, thiophanic acid and other xanthones ..... ***Lecidella meiococca***
Thallus of finely granular soredia, 20-60 µm diam.; isoarthothelin and thiophanic acid ..... ***Pyrrhospora quernea***

7(3) Thallus leprose, held together by a white medulla, thallus easily removed as a coherent patch; C+ red reaction best observed on underside; divaricatic and nordivaricatic acids and zeorin ..... ***Lepraria crassissima***
Thallus granular, sorediate or isidiate 8

8(7) Thallus of ± smooth, grey granules, forming irregular rosettes; granules >100 µm diam.; Pd+ yellow; usually in exposed situations; alectorialic and angardianic acids . ***Lepraria neglecta***
Thallus sorediate or isidiate; if granular then not grey; Pd–; gyrophoric acid 9

9(8) Thallus leprose, grey to blue-grey, continuous to rimose; on vertical, usually copper-rich, rocks ..... ***Psilolechia leprosa***
Thallus isidiate or sorediate, rarely leprose or granular; brown or green-brown, never grey 10

10(9) Thallus dark brown to black, the surface minutely isidioid or granular 11
Thallus brown or green-brown, composed of soft, sorediose granules 12

11(10) Isidia simple, photobiont cells 6-12 µm diam.; on exposed siliceous rocks ..... ***Rimularia furvella***
Isidia ± branched. Photobiont cells 5-9 µm diam.; on damp, shaded rocks or soil ..... ***Placynthiella icmalea***

12(10) Thallus usually with some areoles; on damp siliceous rocks and stones ..... ***Trapelia obtegens***
Thallus of soft sorediose granules; on soil, bryophytes, plant debris, etc. .... ***Placynthiella dasaea***

13(1) Photobiont cyanobacteria (blue-green, *Nostoc*); no substances 14
Photobiont green 17

14(13) Thallus, when dry, blue-grey 15
Thallus, when dry, olivaceous, dark grey or dark grey-brown 16

15(14) Thallus granules pulverulent or fluffy, weakly corticated, not parenchymatous within ..... ***Moelleropsis nebulosa***
Thallus granules smooth, corticate, parenchymatous throughout ..... ***Epiphloea byssina***

16(14) Thallus bluish grey when wet; granules (goniocysts) 0.03-0.06 mm diam. ..... ***Gregorella humida***
Thallus olivaceous or dark grey when wet; granules often larger ..... ***Vahliella atlantica***

17(13) Photobiont *Coccomyxa*; thallus green, granules 0.1–0.2 mm diam., with colourless pseudoparenchymatous surface layer; no substances ..... ***Lichenomphalia umbellifera*** & ***L. velutina***
Photobiont not *Coccomyxa* 18

18(17) Photobiont with orange pigment when fresh (*Trentepohlia*) 19
Photobiont without orange pigment 21

19(18) Thallus whitish, with grey-mauve mounds (sporodochia) of superficial, 1-septate conidia; no substances ..... ***Sclerococcum griseisporodochium***
Thallus pinkish, without superficial conidia 20

20(19) Thallus widely spreading or of orbicular patches, thin, pink; UV–; on calcareous rocks, (N+ effervescence); no substances ..... ***Belonia nidarosiensis***
Thallus grey-white, tinged pink, forming small, thick cushions; UV+ ice-blue; on acidic rocks (N–); lepraric acid ..... ***Lecanactis latebrarum***

21(18) Thallus yellow, yellow-green or green 22
Thallus grey, brown or black 42

22(21) Thallus K+ purple 23
Thallus K± yellow 26

23(22) Thallus with distinct, shallow marginal lobes and white medulla ..... ***Caloplaca xantholyta***
Thallus without marginal lobes 24

24(23) On siliceous rocks; blue-grey patches, K–, UV+ white; divaricatic acid ..... ***Lepraria incana***
On calcareous rocks or over bryophytes; completely yellow or yellow-brown 25

25(24) Thallus brown-yellow; often over bryophytes ..... ***Caloplaca chrysodeta***
Thallus yellow or green-yellow; usually directly on rocks ..... ***Caloplaca citrina***

26(22) Thallus an indistinct crust, several mm thick, with branched medullary strands, surface leprose; atranorin, rangiformic, usnic and fatty acids and unidentified substances ..... ***Leprocaulon microscopicum***
Thallus lacking medullary strands 27

27(26) Thallus K+ yellow (atranorin) 28
Thallus K– (atranorin absent) 29

28(27) White, arachnoid prothallus usually present, centre of thallus completely leprose; soredia uniformly yellow; atranorin, porphyrilic and usnic acids ..... ***Haematomma ochroleucum*** var. ***ochroleucum***
Prothallus absent. Thallus non-corticate with ± discrete, blue-grey flecked soredia; usually coastal; atranorin, gangaleoidin and unidentified substances ..... ***Lecania baeomma***

29(27) Thallus leprose ..... ***Lepraria***
Thallus not leprose 30

30(29) Photobiont micareoid, cells 4-7 µm, ± globose, thin-walled 31
Photobiont chlorococcoid, partly ellipsoid, cells mostly >8 µm diam. 35

31(30) With stalked or sessile pycnidia; pycnidial wall dark olivaceous, K–; stalk fuscous or red-brown, K– ; mesoconidia 3.5-4.8 × 1-1.5 µm; no substances ..... ***Micarea botryoides***
Pycnidia innate, sometimes becoming emergent with gaping ostioles, or with small, sessile, apothecia-like sporodochia or absent 32

32(31) With white, cushion-like, apothecia-like sporodochia *c*. 0.1-0.25 mm diam. bearing oblong-ellipsoid macroconidia 6-10 × 2-3 µm (immersed, inconspicuous pycnidia containing mesoconidia 4-5.3 × 1.2-1.5 µm may also be present); no substances ..... ***Micarea adnata***
Sporodochia absent 33

33(32) Pycnidia absent; thallus without any pigmentation; no substances ..... ***Micarea farinosa***
Pycnidia, if present, 30-80 µm diam. containing either microconidia, or mesoconidia; thallus with some K+ violet pigment on the hyphae ..... (***Micarea prasina*** agg.) 34

34(33) Thallus with methoxymicareic acid, without bluish tinge; common ..... ***Micarea micrococca***
Thallus with prasinic acid, often with a bluish tinge; rare ..... ***Micarea subviridescens***

35(30) Thallus bright, citrine yellow 36
Thallus yellow-green 38

36(35) Thallus rarely more than 1-2 cm diam., composed of small areoles which break down into granular soredia; rhizocarpic acid ..... ***Arthrorhaphis citrinella***
Thallus more widely spreading 37

37(36) Thallus thick, <1 mm; granules 0.1-0.2 mm; calycin and vulpinic acid ..... ***Chrysothrix chlorina***
Thallus thin <0.5 mm; granules 0.01-0.1 mm; calycin or pinastric acid ... ***Chrysothrix candelaris***

38(35) Thallus green; no substances 39
Thallus yellow to yellow-green; usnic or pulvinic acid derivatives 40

39(38) Thallus of angular granules with papillae or spines, easily fragmenting when touched .... ***Vezdaea***
Thallus of small granules ..... ***Sarcosagium campestre***

40(38) Thallus pale yellow; usnic acid ..... ***Pyrrhospora rubiginans***
Thallus more brightly coloured, yellow-green; pulvinic or vulpinic acids 41

41(40) Photobiont usually trebouxioid; rhizocarpic acid; thallus granules <0.1 mm .... ***Psilolechia lucida***
Photobiont usually *Stichococcus*; pulvinic and vulpinic acids ..... ***Chaenotheca furfuracea***

42(21) Thallus brown, covered with minute, fragile blastidia; usually on copper-rich rocks; stictic acid ..... ***Rhizocarpon furfurosum***
Thallus cream to grey 43

43(42) Thallus leprose, or of ± smooth, grey granules forming rosettes in exposed situations ... ***Lepraria***
Thallus not leprose; sorediate or finely granular 44

44(43) Thallus fine-granular, prothallus absent; usnic acid, zeorin and asemone ..... ***Fellhanera bouteillei***
Thallus sorediate, usually with a prothallus 45

45(44) Surface of the soredia blue-grey 46
Soredia white to pale grey throughout 47

46(45) Soredia farinose, <40 µm diam.; on sheltered rocks; atranorin, gangaleoidin and unidentified substances ..... ***Lecania baeomma***
Soredia granular, *c*. 50-100 µm diam.; on exposed rocks; atranorin and unidentified substance ..... ***Tephromela grumosa***

47(45) Thallus coarsely granular; granules *c*. 100-300 µm diam.; terricolous ... ***Icmadophila ericetorum***
Thallus farinose to granular; granules mostly <100 µm diam.; saxicolous (sometimes over bryophytes) 48

48(47) Thallus generally rather thick and. areolate but obscured by farinose soredia, mostly 20-50 µm diam.; thallus usually delimited by a conspicuous white, arachnoid prothallus; Pd± faint yellow; atranorin and porphyrilic acid; usually directly on rock ..... ***Haematomma ochroleucum*** var. ***porphyrium***
Thallus not or scarcely areolate, mostly formed of granular soredia, 40-100 µm diam.; thallus not or only rarely delimited by a distinct white prothallus; Pd+ red, occasionally Pd± faint yellow; atranorin, zeorin, ± fumarprotocetraric acid; usually overgrowing bryophytes ..... ***Megalaria pulverea***

Sterile Crustose Key 8b - Saxicolous and Terricolous Lichens: with C+ spot test reaction.

Synopsis

1 Thallus and/or soredia C+ persistent orange (xanthones) 2
Thallus and/or soredia C+ yellow, pink or red; reactions quickly fading 8
8(1) Photobiont with orange pigment (*Trentepohlia*) 9
Photobiont without orange pi gment 14
14(8) Thallus without soralia; but isidia, spines, papillae, pycnidia or apothecia initials often present 15
Thallus with soralia or sorediose patches 33

1 Thallus and/or soredia C+ persistent orange (xanthones) 2
Thallus and/or soredia C+ yellow, pink or fleetingly red 8

2(1) Thallus with isidia; thiophaninic acid ..... ***Pertusaria flavocorallina***
Thallus with soredia or proliferating granules 3

3(2) Thallus Pd+ orange; on ± base-rich rocks; thiophaninic, stictic, menegazziaic and ± norstictic acids and *O*-methylmonochlornorlichexanthone ..... ***Pertusaria amarescens***
Thallus Pd– 4

4(3) Soredia granular (>40 µm diam.) 5
Soredia farinose (<40 µm diam.) 7

5(4) Thallus composed of soredia-like granules (blastidia), 65-80 µm diam.; atranorin, isoarthothelin, thiophanic acid and other xanthones ..... ***Lecidella meiococca***
Thallus continuous or areolate; soredia smaller, in ± discrete soralia 6

6(5) Thallus cream to brown-yellow, continuous-areolate; soredia 40-55 µm diam.; arthothelin, thiophaninic acid and atranorin ..... ***Lecanora alboflavida***
Thallus yellow-green, smooth and cracked to coarsely warted; usually glossy; soredia 40-100 µm diam.; thiophaninic acid and ± *O*-methylmonochlornorlichexanthone) ..... ***Pertusaria flavicans***

7(4) Thallus grey-green, thin to granular-tuberculate; surface soredia often brown, grey or flecked blue-grey; atranorin, arthothelin and ± thuringione ..... ***Lecidella scabra***
Thallus yellow-green; effuse, granular, rarely cracked areolate; soralia concolorous, excavate or diffuse; thiophanic, usnic acids, zeorin and ‘expallens unknown’ ..... ***Lecanora expallens***

8(1) Photobiont with orange pigment (*Trentepohlia*) 9
Photobiont without orange pigment 14

9(8) Thallus C–; with numerous stalked, white-pruinose pycnidia the tips of which are C+ red; over bryophytes; lecanoric and schizopeltic acids ..... ***Lecanactis abietina***
Thallus C+ red; without stalked pycnidia; directly on rock 10

10(9) Thallus thin, brown; gyrophoric acid ..... ***Opegrapha gyrocarpa***
Thallus usually thick, white-grey 11

11(10) Thallus not sorediate, often with pruinose apothecia resembling eroded soralia; gyrophoric acid ..... ***Arthonia pruinata***
Thallus sorediate 12

12(11) Thallus tartareous, often with bullate ridges or lobe-like proliferations; soredia 50-100 µm diam.; medulla UV–; lecanoric acid ..... ***Arthonia endlicheri***
Thallus thin to thick, not ridged; soredia 30-50 µm diam.; medulla UV+ glaucous or (rarely) yellow; lecanoric acid and erythrin 13

13(12) Thallus thick, 0.6-1.6 mm, pale brown grey, often with a violet tinge ..... ***Dirina massiliensis*** f. ***sorediata***
Thallus thin, 0.25-0.3 mm, pale creamy white, with pink tinge when fresh .. ***Llimonaea sorediata***

14(8) Thallus without soralia; but isidia, spines, papillae, pycnidia or apothecia initials often present 15
Thallus with soralia or sorediose patches 33

15(14) Thallus C+ yellow, creamy white, often with round apothecium initials; variolaric acid ..... ***Ochrolechia parella***
Thallus or apothecium initials C+ pink or red 16

16(15) Thallus developing thin, spine-like extensions; usually montane; gyrophoric acid and ± lecanoric acid ..... ***Ochrolechia frigida***
Thallus otherwise 17

17(16) Thallus ± completely isidiate, isidia obscuring the thallus 18
Thallus not isidiate, sometimes with scattered papillae, pycnidia or apothecia initials 20

18(17) Thallus indistinct; isidia white to pale grey, often darkened at the apices, not eroding; Pd+ red; gyrophoric and fumarprotocetraric acids ..... ***Pertusaria oculata***
Thallus and isidia brown (occasionally green); gyrophoric acid 19

19(18) Isidia simple; photobiont cells 6-12 µm diam.; only on exposed siliceous rocks ..... ***Rimularia furvella***
Isidia branched; photobiont cells 5-9 µm diam. ..... ***Placynthiella icmalea***

20(17) Thallus with papillae; saxicolous; gyrophoric acid 21
Thallus without papillae 22

21(20) Thallus thin, grey to pink-brown; papillae 0.05-0.15 µm diam. ..... ***Rimularia intercedens***
Thallus thick and tartareous (up to 3 mm), pale to dark grey; papillae larger ..... ***Ochrolechia tartarea***

22(20) Thallus C–, of convex orange areoles, C+ red apothecia initials or pycnidia present; gyrophoric acid ..... ***Ainoa mooreana***
Thallus C+ red; gyrophoric acid 23

23(22) Cephalodia present ..... ***Amygdalaria pelobotryon***
Cephalodia absent 24

24(23) Photobiont micareoid, cells 4-7 µm, ± globose, thin-walled 25
Photobiont chlorococcoid, cell mostly >8 diam. 27

25(24) Pycnidial wall K+ violet; conidia various ..... ***Micarea denigrata***
Pycnidial wall K–; conidia longer than 20 µm 26

26(25) Conidia flexuose, 50-110 µm long ..... ***Micarea cinerea***
Conidia curved or sigmoid, 20-40 µm long ..... ***Micarea peliocarpa***

27(24) Thallus consisting of confluent yellow- to red-brown or dark brown areoles 28
Thallus continuous to rimose, or consisting of grey areoles or minute squamules 30

28(27) Areoles thick, bullate, surface rough ..... ***Schaereria cinereorufa***
Areoles thin, flat to concave, smooth 29

29(28) Areoles often with black margins; conidia ellipsoid-globose ..... ***Acarospora fuscata***
Areoles with concolorous or whitish margins; conidia narrowly bacilliform .... ***Lecidea fuscoatra***

30(27) Thallus thin to nearly immersed, with white dots (apothecial initials) ..... ***Trapelia coarctata***
Thallus generally thick, without white dots 31

31(30) Thallus of dispersed to confluent or imbricate, convex to subsquamulose areoles;
photobiont *Chlorella*-type ..... ***Trapelia glebulosa***
Thallus rimose to areolate; photobiont trebouxioid 32

32(31) Thallus white, grey to grey-brown, surface smooth; conidia 7-10 µm long
..... ***Lecidea fuscoatra* & *L. grisella***
Thallus creamy to pale yellowish, surface rough; conidia 4-6 µm long ... ***Diploschistes scruposus***

33(14) Thallus C+ yellow, KC+ yellow; thin, white-grey, smooth; soralia often excavate and in
lines, becoming crowded and confluent; variolaric and ± lichesterinic acids
..... ***Ochrolechia microstictoides***
Thallus C+ red, KC+ red 34

34(33) Thallus distinctly lobed, placodioid or squamulose 35
Thallus without lobes or squamules 37

35(34) Thallus composed of grey-green, olive-brown to dark brown, ± discrete, ascending
squamules (to 1.2 mm wide), the margins slightly upturned with farinose soredia;
gyrophoric acid ..... ***Hypocenomyce scalaris***
Thallus crustose with marginal lobes, or with squamules that are discrete and never ascending .. 36

36(35) Thallus squamulose or placodioid; squamules or marginal lobes >0-2 mm wide;
cephalodia absent ..... see ***Trapelia*** Key
Placodioid; marginal lobes <0.15 mm wide; cephalodia ± present ..... ***Placopsis***

37(34) Thallus or soredia Pd+ yellow, orange or red 38
Thallus and soredia Pd± faint yellow; gyrophoric acid 44

38(37) Thallus of grey granules 39
Thallus not of grey granules 41

39(38) Thallus or sorediose patches Pd+ red; argopsin and gyrophoric acid ..... ***Micarea leprosula***
Thallus or sorediose patches Pd+ yellow; alectorialic acid 40

40(39) Granules usually forming irregular rosettes, not eroding to form sorediose patches ..... ***Lepraria***
Granules usually forming an effuse crust; granules fragile and often eroding to
form sorediose patches; alectorialic acid ..... ***Micarea submilliaria***

41(38) Growing directly on rock, soredia green to brown 42
Growing on bryophytes or soil; soredia grey-white to cream 43

42(41) Soredia green, K± faintly yellow; alectorialic acid; photobiont *Chlorella*-like ..... ***Fuscidea praeruptorum***
Soredia dark brown, K+ red; norstictic acid, forming acicular crystals (microscope); photobiont trebouxioid ..... ***Rimularia furvella***

43(41) Soralia ± discrete, formed by the apices of papillate granules bursting open; alectorialic and barbatolic acids ..... ***Pertusaria geminipara***
Soredia widely spreading, formed by eroding thallus; gyrophoric acid and unidentified substance ..... ***Ochrolechia inaequatula***

44(37) Thallus without discrete soralia 45
Thallus with discrete soralia 49

45(44) Thallus green, C+ red in section but seemingly C+ orange due to rapid hydration of micareoid photobiont (cells *c*. 4-8 µm diam.) ..... ***Micarea viridileprosa***
Thallus white, grey, brown, green-brown or black; photobiont chlorococcoid 46

46(45) Thallus white to pale grey, well-developed; soralia effuse formed from abrading isidia ..... ***Ochrolechia subviridis***
Thallus black, brown or greenish brown 47

47(46) Thallus dark brown to black, the surface minutely isidioid or granular; on exposed siliceous rocks ..... ***Rimularia furvella***
Thallus brown or green brown, composed of soft, sorediose granules 48

48(47) Thallus usually partly areolate; on damp rocks and stones ..... ***Trapelia obtegens***
Thallus completely non-areolate; on soil, bryophytes, plant debris, etc. ..... ***Placynthiella dasaea***

49(44) Thallus K+ yellow; atranorin; on siliceous pebbles and flints; gyrophoric acid .. ***Rinodina aspersa***
Thallus K–; atranorin absent 50

50(49) Thallus pale grey-green to dark chocolate-brown, soredia pale ochre-yellow to pale yellow-green. UV+ blue-white; gyrophoric acid ..... ***Ropalospora hibernica***
Thallus and soredia otherwise 51

51(50) Soralia black, convex, 0.1-0.4 mm diam; thallus brown to dark grey; gyrophoric acid ..... ***Schaereria fuscocinerea*** var. ***sorediata***
Soralia some shade of green,, white, yellowish or grey 52

52(51) Photobiont *Chlorella*-type, at least partly in clusters of 2-4 daughter cells resulting from binary fission, often not round but asymmetrical with one flattened side; gyrophoric acid ..... see ***Trapelia*** Key
Photobiont trebouxioid, essentially round 53

53(52) Soralia green or blue-green, punctiform, up to 0.2 mm diam; photobiont micareoid; gyrophoric acid ..... ***Micarea coppinsii***
Soralia paler, larger; photobiont chlorococcoid 54

54(53) Thallus grey, soredia cream to grey-green; C+ orange-red; gyrophoric acid ..... ***Ochrolechia androgyna***
Soredia white to blue-white; C+ carmine red; lecanoric acid 55

55(54) Centre of thallus regularly cracked and forming discrete areoles; soralia 0.4-1.2 mm diam., usually tuberculate with a raised thalline rim; soredia (62-)100-160(-220) µm diam. ..... ***Pertusaria lactea***
Centre of thallus irregularly rimose, not forming discrete areoles; soralia 0.4-2.0 mm diam., rarely tuberculate (except when young); soredia 40-100 µm diam. ..... ***Pertusaria hemisphaerica***

Sterile Crustose Key 8c - Saxicolous and Terricolous Lichens: with soralia or blastidia; C– but K+ or Pd+ spot test reactions.

Synopsis

1	Thallus and/or soredia K+ purple (anthraquinone pigments); orange or yellow (**NB**: if placodioid or distinctly squamulose see **Key 2**)	2
	Thallus K+ red or yellow, or K– (anthraquinone pigments absent); not orange, rarely yellow	8
8(1)	Thallus and/or soredia K+ yellow soon becoming red (norstictic acid), acicular crystals formed (microscope)	9
	Thallus and soredia K+ yellow or orange or K–, acicular crystals not formed	14
14(8)	Soralia KC+ violet (use acetone extract onto filter paper)	15
	Soralia KC–	19
19(14)	Thallus distinctly lobed or squamulose	20
	Thallus without lobes, sometimes of dispersed areoles	22
22(19)	Thallus or soredia Pd+ red, orange or distinct yellow	23
	Thallus and soredia Pd– or faintly yellow (when atranorin present)	43

1 Thallus and/or soredia K+ purple (anthraquinone pigments); orange or yellow (**NB**: if placodioid or distinctly squamulose see **Key 2**) 2
Thallus K+ red or yellow, or K– (anthraquinone pigments absent); not orange, rarely yellow 8

2(1) Thallus white-grey, K–; soredia yellow to orange-brown, K+ purple 3
Thallus and soredia yellow to orange, K+ purple 4

3(2) Thallus wide spreading; on siliceous rocks, often below overhangs ..... ***Pyrrhospora rubiginans***
Thallus of scattered areoles; coastal, on *Armeria* tussocks, etc. and rocks .....***Caloplaca sorediella***

4(2) Thallus essentially isidiate but seemingly blastidiate ..... ***Caloplaca dichroa***
Thallus truly sorediate 5

5(4) Thallus with some indication of marginal lobes ..... ***Caloplaca britannica* & *C. arcis***
Thallus essentially crustose 6

6(5) Thallus yellow, of small areoles or squamules with marginal soredia, usually at one side only ..... ***Caloplaca flavocitrina***
Thallus yellow and effuse, or orange and areolate, never squamulose 7

7(6) Thallus with discrete soralia; on ± vertical, acidic or slightly base-rich montane rock faces ..... ***Caloplaca obliterans***
Thallus with effuse soralia; widespread; usually on strongly base-rich rocks and walls ..... ***Caloplaca citrina***

8(1) Thallus and/or soredia K+ yellow soon becoming red (norstictic acid), acicular crystals formed (microscope) 9
Thallus and soredia K+ yellow or orange or K–, acicular crystals not formed 14

9(8) Soredia and isidia absent; thallus of small, peltate squamules, brown to pale yellow-brown ..... ***Acarospora smaragdula***
Soredia and/or isidia present 10

10(9) Thallus with crowded, ± globose, isidia-like papillae which leave eroded, granular-sorediate patches ..... ***Pertusaria lactescens***
Thallus without isidia or papillae; soredia present 11

11(10) Thallus grey; soralia discrete 12
Thallus white or cream, soralia becoming confluent 13

12(11) Soredia concolorous with thallus, granular-isidiate, convex ..... ***Aspicilia grisea***
Soredia greener or more bluish than thallus, ± excavate ..... ***Buellia griseovirens***

13(11) Thallus thick, rimose-cracked to areolate; soralia ± convex, arising from wide, low warts; at first discrete, later becoming confluent; soredia coarsely-granular, cream-grey; saxicolous ..... ***Pertusaria excludens***
Thallus thin, continuous or sparingly cracked; soralia very irregular, shallow, ulcerose to effuse; soredia fine-powdery to coarsely-granular, often green; saxicolous, often over bryophytes ..... ***Phlyctis argena***

14(8) Soralia KC+ violet (use acetone extract onto filter paper) 15
Soralia KC– 19

15(14) Thallus areolate or an indistinct crust, to several mm thick, with corticate and sorediate parts, not continuous, prothallus absent; lobaric acid 16
Thallus continuous, usually surrounded by a distinct prothallus; picrolichenic and protocetraric acids 18

16(15) Thallus areolate, with marginal soredia ..... ***Stereocaulon leucophaeopsis***
Thallus not areolate, forming an indistinct crust, several mm thick, with corticate and sorediate parts 17

17(16) Soredia on convex soralia or on tips of vertically orientated parts ..... ***Stereocaulon pileatum***
Soredia at the margin of areoles ..... ***Stereocaulon nanodes***

18(15) Thallus forming compact cushions of sorediate, warted papillae ..... ***Pertusaria amara*** (including f. ***pulvinata***)
Papillae scattered, only occasionally breaking down to form granular soredia ..... ***Pertusaria melanochlora***

19(14) Thallus distinctly lobed or squamulose 20
Thallus without lobes, sometimes of dispersed areoles 22

20(19) Thallus with radiating lobes; Pd– ..... ***Diploicia canescens***
Thallus without radiating lobes; Pd+ orange or red 21

21(20) Thallus composed of congested squamules; Pd+ orange (stictic, ± norstictic acids) ..... ***Baeomyces rufus***
Thallus of dispersed, narrow lobes; Pd+ red (argopsin) ..... ***Solenopsora vulturiensis***

22(19) Thallus or soredia Pd+ red, orange or distinct yellow 23
Thallus and soredia Pd– or faintly yellow (when atranorin present) 43

23(22) Thallus with discrete soralia, at least in part; sometimes coalescing when older 24
Thallus with effuse soredia, corticate areas confined to the thallus margin 40

24(23) Thallus orange, brown or bright green 25
Thallus white or grey; sometimes becoming yellow or orange due to oxidization if on iron-rich rocks 29

25(24) Thallus green; soredia bright yellow-green; pulvinic acid derivatives 26
Thallus orange or brown; soredia blue-black or brown; stictic acid 27

26(25) Soralia arising from the margins of the flat areoles; Pd+ red; pannarin ..... ***Lecanora subaurea***
Soralia arising from the centre of the strongly convex areoles; Pd+ yellow (psoromic acid) ..... ***Rhizocarpon ridescens***

27(25) Thallus of discrete brown areoles on a powdery black hypothallus that produces thallospores. Soredia brown, abrading cream-coloured ..... ***Protoparmelia nephaea***
Thallus yellow-orange, oxydated; continuous; soredia blue-black 28

28(27) Thallus ochre to yellow-orange; areoles often dispersed, uneven to strongly convex; on metal-rich rocks, often with *Acarospora sinopica* ..... ***Miriquidica atrofulva***
Thallus yellow-orange, cracked-areolate; areoles ± flat; usually on damp siliceous rocks ..... ***Porpidia ochrolemma***

29(24) Thallus Pd± red (fumarprotocetraric and/or protocetraric acids) 30
Thallus Pd+ orange or yellow (fumarprotocetraric and/or protocetraric acids absent) 32

30(29) Thallus pale grey-fawn to dark grey, usually with a strong brown tinge (dove-coloured); soralia 0.4-2.0 mm diam., rounded to convex, pale yellow-brown to green ..... ***Fuscidea cyathoides*** var. ***sorediata***
Thallus pale to dark grey, without brown tinge; soralia to 1.0 mm diam., flat to slightly convex, white 31

31(30) Soralia rather irregular; fumarprotocetraric, ± protocetraric acids ..... ***Pertusaria aspergilla***
Soralia regularly rounded; protocetraric acid ..... ***Pertusaria leucosora***

32(29) Pd+ yellow or yellow-orange; psoromic or thamnolic acids 33
Pd+ orange; stictic acid 34

33(32) Soralia ± tuberculate, punctiform, 0.1-0.2 mm diam., soredia blue-black; on exposed montane rocks; K–; psoromic acid ..... ***Miriquidica nigroleprosa*** f. ***liljenstroemii***
Soralia convex, often becoming confluent, 0.6-2.0 mm diam., soralia pale yellow to yellow-grey; on rocks in woodlands; K+ bright yellow; thamnolic acid ..... ***Loxospora elatina***

34(32) Thallus composed of prostrate, dorsiventral pseudopodetia; upper surface with grey phyllocladia with darker centres ..... ***Stereocaulon vesuvianum*** var. ***symphycheileoides***
Thallus crustose, continuous to areolate 35

35(34) Thallus of flat to convex areoles, often with darker centres; usually cracked with green soralia arising from the cracks; soredia becoming blue-grey or brown when old; atranorin present 36
soredia not arising from cracks in the areoles; white, grey or blue-grey, never green; atranorin absent..... 37

36(35) Areoles usually forming a ± continuous crust ..... ***Stereocaulon tornense***
Areoles usually ± dispersed ..... ***Stereocaulon plicatile***

37(35) Thallus continuous to scurfy and indistinct ..... ***Porpidia soredizodes***
Thallus well-developed 38

38(37) Thallus of convex areoles, white to pale grey; soredia blue-grey; cephalodia absent; on exposed rocks ..... ***Porpidia superba*** f. ***sorediata***
Thallus cracked-areolate to verrucose; soredia cream or grey; cephalodia present or absent 39

39(38) Thallus grey; soredia concolorous and granular; cephalodia absent; on ± exposed rocks and walls ..... ***Aspicilia grisea***
Thallus creamy white; soredia ± concolorous; cephalodia often present; on shaded, often damp rocks ..... ***Coccotrema citrinescens***

40(23) Thallus brown, densely covered with minute, fragile blastidia; stictic acid ..... ***Rhizocarpon furfurosum***
Thallus white, grey or green, without blastidia 41

41(40) Photobiont *Trentepohlia*; thallus Pd+ yellow; psoromic acid ..... ***Peterjamesia sorediata***
Photobiont trebouxioid; thallus Pd+ red; fumarprotocetraric acid 42

42(41) Thallus thin, smooth; grey-white to glaucous; cortex usually visible only at margin; fumarprotocetraric acid, atranorin and zeorin ..... ***Megalaria pulverea***
Thallus thick, warted, dark grey-green; fumarprotocetraric acid only ..... ***Lecanora conizaeoides***

43(22) Thallus with discrete soralia, at least in part; sometimes coalescing when older 44
Thallus with effuse soredia, corticate area confined to the thallus margin 56

44(43) Thallus usually of dispersed areoles, each areole having a dark centre (similar to the phyllocladia of *S. vesuvianum*); blue-green soredia arising from the edge of each areole and remaining discrete; atranorin and lobaric acid ..... ***Stereocaulon leucophaeopsis***
Areoles without darkened centre 45

45(44) Soredia distinctly blue-grey throughout 46
Soredia white-green to yellow, sometimes with blue-grey flecks 49

46(45) Soredia diffuse, formed from the break-down of the thallus surface; appearing almost leprose except for the thallus edge; soredia granular, 50-80 µm diam; atranorin and unidentified substance ..... ***Tephromela grumosa***
Soredia in discrete soralia, sometimes becoming confluent in places 47

47(46) Soralia whitish, convex to hemispherical; thallus ± continuous, granular, of dispersed to aggregated warted areoles; prothallus, when present, white or blue; atranorin, ± fatty acids ..... ***Lecanora caesiosora***
Soralia grey-blue to blue-black 48

48(47) Soredia blue-black 20-35 µm diam.; soralia ± orbicular at first, becoming irregular; atranorin and unidentified substance ..... ***Miriquidica pycnocarpa*** f. ***sorediata***
Soredia grey-blue, 35-50 µm diam.; soralia irregular from the beginning, often forming on the edge of the areoles; atranorin, gangaleoidin, roccellic acid, ± fatty acids ..... ***Lecanora pannonica***

49(45) On limestone (or other base-rich rocks), thallus forming ± circular patches, surface rough to warted; atranorin, zeorin and other terpenoids ..... ***Lecanora campestris*** subsp. ***dolomitica***
On siliceous rocks 50

50(49) Red pigment present in medulla; thallus thick, smooth; soralia cream-yellow; atranorin and caperatic acid ..... ***Mycoblastus sanguinarius*** f. ***leprosus***
Red pigment not present in medulla 51

51(50) Thallus yellow; soralia concolorous, developing from the edges of the areoles, usually forming lines, later becoming confluent; usually on exposed rocks; usnic acid, ± zeorin ..... ***Lecanora orosthea***
Thallus grey; soralia not developing from the edges of the areoles; usually on shaded rocks 52

52(51) Thallus film-like with low grey warts; soralia at first punctiform, bursting from thalline warts, later coalescing; bright yellow; atranorin, usnic and planaic acids .. ***Mycoblastus alpinus***
Soralia not bursting from thalline warts; creamy white to pale yellow 53

53(52) Thallus thin, continuous, smooth to granular, 2-3 cm diam.; prothallus, when present, black; soralia ± circular, convex, up to 1 mm diam.; soredia farinose, pale yellow; atranorin, usnic acid and 2-*O*-methylsulphurellin ..... ***Lecanora jamesii***
Thallus thicker, often of convex granules 54

54(53) Soredia 150-250 µm diam., white blue, hemispherical; atranorin and α-collatolic acid ..... ***Tephromela pertusarioides***
Soredia smaller, occasionally aggregating into granules (consoredia); α-collatolic acid absent .. 55

55(54) Thallus ± continuous, granular, of dispersed to aggregated warted areoles; prothallus when present, white or blue; atranorin, ± fatty acids ..... ***Lecanora caesiosora***
Thallus cracked-areolate often thick and uneven, areoles flat to slightly convex; surface ± smooth; prothallus black; atranorin and roccellic acid ..... ***Lecanora rupicola*** var. ***efflorens***

56(43) Thallus white to grey; soredia blue-grey, darker than thallus 57
Thallus and soredia concolorous 58

57(56) Thallus white to yellow-white, indeterminate; ± completely dissolved into blue-grey speckled, farinose soredia (20-25 µm diam.); atranorin and gangaleoidin; on shaded rocks, predominantly coastal ..... ***Lecania baeomma***
Thallus pale grey, corticate, sometimes with blue-black prothallus. Soredia blue-grey, granular, 50-80 µm diam.; atranorin and unidentified substance; on exposed rocks ..... ***Tephromela grumosa***

58(56) Thallus not or scarcely areolate, mostly formed of granular soredia, 40-100 µm diam. 59
Thallus generally rather thick and areolate but obscured by farinose soredia, mostly 20-50 µm diam.; usually delimited by a white arachnoid prothallus 60

59(58) Thallus uniform in colour, powdery-granular with a smooth, pale, continuous prothallus; on mossy bark of deciduous trees in old woodlands; usnic acid, zeorin and terpene(s) or sterol(s) ..... ***Megalospora tuberculosa***
Prothallus rarely evident; atranorin and zeorin ..... ***Megalaria pulverea***

60(58) Thallus white to pale grey, without yellow tinge; atranorin and porphyrilic acid ..... ***Haematomma ochroleucum*** var. ***porphyrium***
Thallus pale yellow to yellow-green; atranorin, porphyrilic and usnic acids ..... ***Haematomma ochroleucum*** var. ***ochroleucum***

Sterile Crustose Key 8d - Saxicolous and Terricolous Lichens: with soralia or blastidia; all spot test reactions negative.

Synopsis

1 Photobiont *Trentepohlia* 2
Photobiont without orange pigment 6

6(1) Medulla UV+ white (divaricatic or perlatolic acids) 7
Medulla UV– (divaricatic and perlatolic acids absent) or UV+ pink/orange 9

9(6) Photobiont *Chlorella*-type, at least partly in clusters of 2-4 daughter cells resulting from binary fission, often not round but asymmetrical with one flattened side ..... see ***Trapelia*** Key
Photobiont micareoid or trebouxioid, essentially round 10
10(9) Soralia yellow to yellow-green; usnic acid or pulvinic acid derivatives 11
Soralia green, white, grey, brown, black or blue; no usnic acid or pulvinic acid derivatives 15
15(10) Thallus orange or brown to black or bluish to dark green 16
Thallus green or pale grey to white (soredia may be bluish or black) 24
24(15) Thallus continuous, grey to white, forming discrete patches 25
Thallus areolate or granular, not in discrete patches 32

1 Photobiont *Trentepohlia* 2
Photobiont without orange pigments 6

2(1) Thallus whitish, with grey-mauve mounds (sporodochia) of superficial, 1-septate conidia; no substances ..... ***Sclerococcum griseisporodochium***
Thallus darker, without superficial conidia 3

3(2) Corticate areas confined to margin, centre of thallus completely dissolved in thick, creamy soredia; UV+ ice-blue; schizopeltic acid ..... ***Schismatomma umbrinum***
Thallus mostly corticate, soralia ± discrete, scattered over the thallus; UV– 4

4(3) Thallus lilac to pink grey; soralia ± concolorous, discrete to slightly confluent; often covering relatively large areas; fatty acids ..... ***Schismatomma decolorans***
Thallus grey-green to brown with discrete soralia scattered over the thallus 5

5(4) Thallus dark chocolate-brown tinged lilac, soralia dark brown to lilac; usually with a black delimiting prothallus arid often forming mosaics with *Opegrapha gyrocarpa*; confluentic acid and/or 2-*O*-methylmicrophyllinic acid ..... ***Opegrapha zonata***
Thallus grey-green to red-brown, wide-spreading and effuse, soralia bright orange when fresh; no lichen substances ..... ***Opegrapha multipuncta***

6(1) Medulla UV+ white (divaricatic or perlatolic acids) 7
Medulla UV– (divaricatic and perlatolic acids absent) or UV+ pink/orange 9

7(6) Soredia pale green to blue-grey; photobiont trebouxioid; perlatolic acid ..... ***Mycoblastus caesius***
Soredia white to brown; photobiont *Chlorella*-like; divaricatic acid 8

8(7) Thallus of thin, pale grey, ± dispersed areoles on a black hypothallus; soredia ± concolorous ..... ***Fuscidea gothoburgensis***
Thallus continuous, pale grey to brown-grey; soralia soon becoming confluent, cream, often becoming brown ..... ***Fuscidea recensa***

9(6) Photobiont *Chlorella*-type, at least partly in clusters of 2-4 daughter cells resulting from binary fission, often not round but asymmetrical with one flattened side ..... see ***Trapelia*** Key
Photobiont micareoid or trebouxioid, essentially round 10

10(9) Soralia yellow to yellow-green; usnic acid or pulvinic acid derivatives 11
Soralia green, white, grey, brown, black or blue; no usnic acid or pulvinic acid derivatives 15

11(10) Thallus continuous, growing over bryophytes and debris; usnic acid, zeorin and terpene(s) or sterol(s) ..... ***Megalospora tuberculosa***
Thallus areolate, saxicolous 12

12(11) Soralia developing from the edges of the areoles 13
Soralia arising from the centre of each areole 14

13(12) Thallus grey to grey-green, thick, areoles usually convex occasionally flatter and subsquamulose, often dispersed; soredia not forming lines, usually remaining discrete; usnic acid and zeorin ..... ***Lecanora handelii***
Thallus yellow-green, thinner, areoles ± plane, confluent; soredia usually forming lines, later becoming confluent; usnic acid and ± zeorin ..... ***Lecanora orosthea***

14(12) Thallus thick, areoles rounded and warted with entire margins: bright yellow-green; pulvinic acid derivatives ..... ***Lecanora epanora***
Thallus thinner, areoles flattened, subsquamulose, margins often crenulate, green-grey, yellow-green or green-brown; usnic acid ..... ***Lecanora soralifera***

15(10) Thallus orange or brown to black or bluish to dark grey 16
Thallus green or pale grey to white (soredia may be bluish or black) 24

16(15) Thallus rusty orange with discrete, blue-grey soralia; confluentic, 2′-*O*-methylperlatolic and 2′-*O*-methylmicrophyllinic acids, sometimes with additional stictic, norstictic and cryptostictic acids; medulla I– ..... ***Porpidia melinodes***
Thallus not orange; brown to black or bluish to dark grey (rusty morphs of *Porpidia tuberculosa* are very similar, but have an I+ blue medulla) 17

17(16) Thallus bluish to dark grey, pigmented hyphae grey, K+ violet; no substances 18
Thallus brown to black 19

18(17) Thallus surface ± continuously blastidiate ..... ***Rinodina pityrea***
Thallus scurfy-isidiate, cracked-areolate (cf. also *C. soralifera*) ..... ***Caloplaca chlorina***

19(17) Soralia ± farinose, ± punctiform; no substances 20
Soredioid blastidia/isidia developing from the edges of the areoles 21

20(19) Thallus areolate to subsquamulose, pale brown to olive green; areoles 0.4-1.5 mm wide ..... ***Verrucaria macrostoma*** f. ***furfuracea***
Thallus areolate, dark brown, green-black or black; areoles 0.2-0.8 mm wide ..... ***Verrucaria nigrescens*** f. ***tectorum***

21(19) On limestone and calcareous schists; no substances ..... ***Thelidium papulare*** f. ***sorediatum***
On siliceous rock 22

22(21) Thallus brown with concolorous soredia; unidentified substances ..... ***Ropalospora lugubris***
Thallus brown or dark grey to black; soredia darker; miriquidic acid 23

23(22) Thallus brown; soredia marginal on the areoles ..... ***Miriquidica intrudens***
Thallus dark grey to black; soredia not marginal ..... ***Miriquidica nigroleprosa*** var. ***nigroleprosa***

24(15) Thallus continuous, grey to white, forming discrete patches 25
Thallus areolate or granular, not in discrete patches 32

25(24) Thallus waxy, often with zoned margin or delimiting prothallus; soralia often isidioid, becoming confluent or soredia effuse 26
Thallus thin to thick, without zoned margin or delimiting prothallus; soralia <1 mm diam., remaining discrete 29

26(25) Thallus without zoned margin or delimiting prothallus, uniformly whitish; variolaric and lichesterinic acids ..... ***Ochrolechia microstictoides***
Thallus with zoned margin or delimiting prothallus 27

27(26) Thallus pale grey-blue to dark blue-grey; granular-papillate becoming granular-sorediate, often with a dark green-grey delimiting prothallus; usually on coastal rocks, never overgrowing bryophytes; aspicilin ..... ***Aspicilia leprosescens***
Thallus pale grey to dark green-grey, often zoned at the margin; on siliceous or slightly base-rich rocks and walls, sometimes overgrowing bryophytes; fatty acids 28

28(27) Soralia typically concave and marginate; soredia granular .... ***Pertusaria albescens*** var. ***albescens***
Soralia less well-defined; soredia becoming granular-coralloid ..... ***Pertusaria albescens*** var. ***corallina***

29(25) Medulla I+ blue; soralia punctiform, tuberculate, surface soredia blue-grey; confluentic acid ..... ***Porpidia tuberculosa***
Medulla I– 30

30(29) Thallus glaucous, continuous to cracked-areolate; soralia usually irregular in shape, sometimes arising along cracks in the thallus; on flushed, or damp, siliceous or slightly base-rich rocks; 2′-*O*-methylsuperphyllinic acid ..... ***Porpidia rugosa***
Soralia regular, rounded 31

31(30) Soralia blue-grey; on exposed siliceous rocks; confluentic acid (in K numerous oil droplets in section) ..... ***Porpidia pachythallina***
Soralia ± concolorous; 2′-*O*-methylmicrophyllinate .. ***Porpidia contraponenda*** (sorediate morph)

32(24) Thallus UV+ pink or orange, with effuse yellow-green soralia; coronaton . ***Bacidia viridifarinosa***
Thallus UV– 33

33(32) Thallus of dispersed areoles, with discrete black soralia emerging from the sides of the areoles; no lichen substances ..... ***Aspicilia moenium***
Soredia not black 34

34(33) Thallus whitish, soredia bluish, pigmented hyphae grey, K+ violet; no lichen substances 35
Thallus grey or green, soredia not bluish, no K+ violet hyphae 36

35(34) Thallus obscurely placodioid, lobes broad and shallow; continuously scurfy . ***Caloplaca teicholyta***
Thallus effuse at the margin ..... ***Caloplaca albolutescens***

36(34) Thallus of grey, subsquamulose or convex areoles; soralia concolorous, arising from the edge of each areole but often becoming confluent; usnic acid and zeorin .... ***Lecanora handelii***
Thallus otherwise, soredia not arising from the edge of each areole 37

37(36) Thallus grey, with discrete, yellow-green soralia; soredia farinose; thallus with internal, discrete clusters of large oxalate crystals; atranorin and 2-*O*-methylsulphurellin ..... ***Lecanora jamesii***
Thallus not grey and with discrete, yellow-green soralia, and without discrete clusters of large oxalate crystals; without atranorin 38

38(37) Thallus weakly areolate, with discrete, ulcerose soralia ..... ***Caloplaca obscurella***
Thallus without ulcerose soralia 39

39(38) Thallus composed of scattered or discrete areoles; no lichen substances 40
Thallus granular to continuous 41

40(39) Thallus with soredia/blastidia on the margins of the areoles; mainly lowland habitats ..... ***Caloplaca flavocitrina*** (green shade morph)
Soredia often occupying most of the areoles; upland/montane on strongly base-rich rock (limestone or mica-schist) ..... ***Polyblastia efflorescens***

41(39) Soredia mostly in discrete soralia 42
Soredia mostly irregular or covering the whole thallus 45

42(41) Upper cortex parenchymatous ..... ***Hyperphyscia adglutinata***
Upper cortex indistinct 43

43(42) Thallus with white arachnoid prothallus ..... ***Bacidia fuscoviridis***
Thallus without prothallus 44

44(43) Thallus smooth to rimose between the soredia, soredia concolorous; soralia vertically raised with steep sides; roccellic acid present ..... ***Fellhanera viridisorediata***
Thallus finely granular, soredia yellow-green; sides of soralia not conspicuously raised; no substances ..... ***Bacidia caligans***

45(41) Thallus warted and coarsely granular, granules 40-80 µm diam.; coastal, on siliceous rocks or soil or decaying *Armeria* tufts ..... ***Bacidia scopulicola***
Thallus more finely granular or blastidiate 46

46(45) Thallus almost continuously blastidiate 47
Thallus sorediate 48

47(46) Thallus thin, effuse, scurfy, areolate ..... ***Lecania erysibe***
Thallus thick, determinate, coarsely rimose-cracked ..... ***Lecania coeruleorubella***

48(46) Thallus consisting mainly of goniocysts. ..... ***Bacidia delicata***
Thallus consisting of generally effuse soredia ..... ***Bacidia adastra***

Sterile Crustose Key 8e - Saxicolous and TerricolousLichens: C– but either K+ or Pd+ spot test reactions; without soralia; isidia or pycnidia often present.

Synopsis

1 Thallus orange, yellow or yellow-green 2
Thallus grey, green, brown or black 10

10(1) Thallus K+ red (norstictic acid), acicular crystals formed (microscope) 11
Thallus K± yellow (norstictic acid absent) 19

1 Thallus orange, yellow or pale to vivid yellow-green 2
Thallus grey, green, brown or black 10

2(1) Thallus K+ purple, orange to deep yellow (anthraquinone pigments); restricted to calcareous substrata or coastal rocks [**NB**: if placodioid or distinctly squamulose see **Key 2**] 3
Thallus surface K–, yellow-green; usnic acid or pulvinic acid derivatives 5

3(2) Thallus uniformly dissolved into a regular layer of granular soredia or blastidia (otherwise identical yellow and orange thalli often growing together) ..... ***Caloplaca dichroa***
Thallus irregularly isidiate, crustose or squamulose 4

4(3) Thallus crustose; isidia coralloid often forming a continuous crust ..... ***Caloplaca littorea***
Thallus minutely squamulose; isidia spherical, often in clusters .. ***Caloplaca britannica*** & ***C. arcis***

5(2) Thallus pale yellow-green, UV+ blackish quenching; usnic acid 6
Thallus vivid yellow-green, UV+ pink/orange; pulvinic acid derivatives 9

6(5) With concolorous ‘isidia’; thallus continuous; on coastal, rocks; chemistry various ..... ***Ramalina cuspidata*** & ***R. siliquosa*** (crustose morphs)
Thallus without ‘isidia’ 7

7(6) Thallus over 0.5 mm thick, continuous but bullate, Pd+ orange; usnic, divaricatic and thamnolic acids ..... ***Ophioparma ventosa***
Thallus under 0.5 mm thick, areolate, Pd– 8

8(7) Marginal areoles elongated, arranged in a regular jig-saw pattern; usnic acid, zeorin ..... ***Lecanora intricata***
Marginal areoles irregular, essentially roundish to angular; usnic and rangiformic acids, zeorin (cf. also morphs of *Lecanora muralis* with a reduced thallus) ..... ***Lecanora polytropa***

9(5) On rock; thallus areolate, smooth; rhizocarpic and psoromic acids .. ***Rhizocarpon geographicum***
Over soil, bryophytes or *Baeomyces rufus* in acidic habitats ..... ***Epilichen scabrosus***

10(1) Thallus K+ red (norstictic acid), acicular crystals formed (microscope) 11
Thallus K± yellow (norstictic acid absent) 19

11(10) Thallus papillate or isidiate 12
Thallus not isidiate, grey 17

12(11) Thallus of ± contiguous, effigurate squamules with papillae with pale brown apices; papillae not constricted at base but often breaking off to leave non-sorediate scars; on damp rocks and soil ..... ***Baeomyces carneus***
Thallus rimose-cracked or areolate; isidiate 13

13(12) Thallus and isidia brown to black ..... ***Rimularia furvella***
Thallus some shade of grey to white 14

14(13) Isidia few, in large, eroded, soralia-like patches, sometimes cauliflower-like clusters ..... ***Aspicilia grisea***
Isidia usually abundant, scattered, single, globose-cylindrical 15

15(14) Thallus pale creamy white; covered with more or less globose, isidiate papillae *c*. 0.1 mm diam., which may leave numerous eroded, sorediose patches when dispersed ..... ***Pertusaria lactescens***
Thallus grey with brownish tinge; isidia generally taller and with brown tips 16

16(15) Isidia 0.5-1.0 mm diam. constricted at the base, rounded or top-shaped; on dry well-lit siliceous rocks; most frequent in coastal areas, occasional in upland/montane regions ..... ***Pertusaria pseudocorallina***
Isidia <0.5 mm diam. not constricted at the base, rounded to ovoid-elongate; usually on rocks or walls overhung by trees ..... ***Pertusaria coccodes***

17(11) Conidia 7-12 µm long ..... ***Aspicilia intermutans***
Conidia >10 µm long 18

18(17) Conidia 11-16 µm long ..... ***Aspicilia cinerea***
Conidia 15-28 µm long ..... ***Aspicilia epiglypta***

19(10) Photobiont with orange pigment (*Trentepohlia*), usually on vertical rock faces; Pd+ yellow; psoromic acid ..... ***Lecanactis dilleniana***
Photobiont without orange pigments 20

20(19) Thallus consisting entirely of grey granules ..... ***Lepraria***
Thallus otherwise 21

21(20) Thallus with isidia or papillae 22
Thallus without isidia and papillae 26

22(21) Terricolous or over bryophytes on rocks; densely isidiate, almost totally obscuring the thallus .. 23
Saxicolous; isidia more scattered or absent from margin, thallus clearly visible; thallus Pd+ yellow or orange; thamnolic or protocetraric acids 25

23(22) Thallus K+ yellow, Pd–; isidia erect and swollen; scattered or crowded, cylindrical or conical, simple or branched; atranorin, fatty acids, ± squamatic acid ..... ***Pycnothelia papillaria***
Thallus K–, Pd+ red; fumarprotocetraric acid 24

24(23) Isidia 0.4-1.0 mm diam., uniformly white ..... ***Pertusaria dactylina***
Isidia 0.3-0.4 mm diam., white, ± brown and K+ purple (microscope) at the apices ..... ***Pertusaria oculata***

25(22) Thallus K+ brown, KC+ violet, Pd+ orange, with abundant coarse, crowded papillae; picrolichenic and protocetraric acids ..... ***Pertusaria melanochlora***
Thallus K+ yellow, KC+ yellow, Pd+ yellow-orange; isidia finer; thamnolic acid ..... ***Pertusaria corallina***

26(21) Thallus placodioid 27
Thallus squamulose, granular or crustose 29

27(26) Terricolous, on acid soils in upland or montane areas; thallus green-grey, marginal lobes up to 5 mm wide; stictic acid ..... ***Baeomyces placophyllus***
Saxicolous, on calcareous or nutrient-enriched substrata; marginal lobes <1 mm wide 28

28(27) Thallus green-yellow to yellow-brown, marginal lobes flat to concave, at most only slightly pruinose; medulla Pd+ yellow (psoromic acid); on calcareous or nutrient-enriched man-made substrata, also in upland areas ..... ***Lecanora muralis***
Thallus white to blue-grey-white, densely white-pruinose, marginal lobes flat to convex; medulla Pd+ red (? pannarin); on sunny hard calcareous rocks, especially limestone ..... ***Solenopsora candicans***

29(26) Pycnidia black, sessile or short-stalked, 0.1-0.4 mm diam. 30
Pycnidia immersed to slightly emergent 31

30(29) Thallus minutely granular, greyish green, without cephalodia, P+ red; pycnidia wall K+ purple; usually below overhangs; argopsin ..... ***Bacidia trachona***
Thallus granular areolate, grey, often green when wet; cephalodia often present between the areoles, K+ yellow, Pd± faint yellow; pycnidia wall K–; atranorin .. ***Pilophorus strumaticus***

31(29) Thallus black, areoles chestnut-brown, sitting on a black, prothallus, with powdery brown and warted thalloconidia; medulla K+ yellow, Pd+ orange; saxicolous, below overhangs; stictic acid. ..... ***Protoparmelia nephaea***
Thallus not blackish, without thalloconidia 32

32(31) Thallus Pd+ red (fumarprotocetraric acid), some shade of brown, usually surrounded by a delimiting brown prothallus; pycnidia brown, often sessile with lacerate margins ..... ***Fuscidea cyathoides***
Thallus Pd± yellow to orange, prothallus when present white or black 33

33(32) Pd+ orange or bright yellow, K+ yellow-orange; stictic, thamnolic or baeomycesic acids, ± atranorin 34
Thallus Pd–, K+ yellow; atranorin only 37

34(33) Thallus with schizidia; often terricolous (the abundant presence of lichenicolous fungi, especially *Arthrorhaphis* species, can obscure the schizidia) 35
Thallus without schizidia; usually on rock 36

35(34) Thallus grey-white, continuous, K+ orange, Pd+ orange; baeomycesic acid, ± squamatic acid, atranorin; terricolous ..... ***Dibaeis baeomyces***
Thallus green-grey to brown, K+ yellow, Pd+ orange; stictic acid ..... ***Baeomyces rufus***

36(34) Thallus thick, of agglutinated bullate areoles; pycnidia black; divaricatic and thamnolic acids ..... ***Ophioparma ventosa***
Thallus thin, of mostly dispersed, minute, irregular areoles; pycnidia white; atranorin and stictic acid ..... ***Cliostomum tenerum***

37(33) Thallus with blackish cephalodia containing *Scytonema* 38
Thallus without cephalodia 39

38(37) On rock; thallus KC–; atranorin ..... ***Pilophorus strumaticus***
On sandy soil and small pebbles, thallus KC+ violet; atranorin and lobaric acid ..... ***Stereocaulon condensatum***

39(37) Medulla UV+ white, thallus deeply rimose, usually thick (*c*. 0.2-0.7 mm), prothallus often bluish black; conidia thin, straight or lightly curved, 12-21 × 0.5-1 µm, atranorin and ± α-collatolic and/or alectoronic acids ..... ***Tephromela atra***
Medulla UV– 40

40(39) Conidia ellipsoid to bacilliform 41
Conidia thin and curved 43

41(40) Thallus areolate; pycnidial wall K+ purple, conidia ellipsoid, 3.5-4 × 1.5-2 µm; atranorin and roccellic acid ..... ***Cliostomum griffithii***
Thallus continuous, thick, rimose-cracked; pycnidial wall K– 42

42(41) Thallus dull green-grey, irregularly warted; conidia ellipsoid, 3-4 × 1 µm; various substances in low concentrations ..... ***Tylothallia biformigera***
Thallus clear whitish to bluish grey; conidia bacilliform, 6-9 × 1 µm; atranorin and caperatic acid ..... ***Mycoblastus sanguinarius***

43(40) Thallus whitish with irregular grey streaks, surrounded by a black prothallus; conidia 17-20 × 1 µm; atranorin and confluentic acid ..... ***Herteliana gagei***
Thallus uniformly whitish or grey; prothallus absent or generally white; black only when bordering other specimens of the same species 44

44(43) Thallus white, smooth but cracked, K+ bright yellow; atranorin, roccellic and thiophanic acids ..... ***Lecanora rupicola***
Thallus some shade of grey, surface irregular, K+ yellow reaction often less bright 45

45(44) Medulla white; thallus rather even; atranorin and zeorin ..... ***Lecanora campestris***
Medulla often with patchy yellow to orange, K+ purple pigments (skyrin); thallus mostly very uneven and bullate; atranorin and gangaleoidin ..... ***Lecanora gangaleoides***

Sterile Crustose Key 8f Saxicolous and terricolous, with all spot tests negative and without soralia. Isidia or pycnidia often present.

NB: Some squamulose species that are normally fertile are not included here (e.g. *Catapyrenium* spp., *Psora* spp., *Romjularia lurida*, *Squamarina*); for these try both leads from couplet 3 of **Key 2b**)

Synopsis

1	Thallus yellow or yellow-green; pulvinic acid derivatives (**NB**: if placodioid or distinctly squamulose see **Key 2**)	2
	Thallus grey, green, brown or black or rust-red	3
3(1)	Photobiont cyanobacteria (blue-green); no substances	4
	Photobiont green	16
16(3)	Photobiont with orange pigment (*Trentepohlia*)	17
	Photobiont without orange pigment	25
25(16)	Thallus consisting entirely of very small squamules (0.1-0.5 × 0.1-0.3 mm), coralloid isidia or goniocysts; yellow-green, green-grey or green-brown; usually associated with bryophytes in base-rich habitats; no lichen substances	26
	Thallus granular to areolate, or with larger squamules	31
31(25)	Thallus with isidia, papillae or hyphophores; no lichen substances	32
	Thallus without isidia, papillae or hyphophores; often with pycnidia	45
45(31)	Thallus of brown to ochraceous, often convex to subsquamulose areoles or squamules	46
	Thallus not of brown or ochraceous areoles or squamules	51

1 Thallus yellow or yellow-green; pulvinic acid derivatives (**NB**: if placodioid or distinctly squamulose see **Key 2**) 2
Thallus grey, green, brown or black or rust-red 3

2(1) Thallus bright golden-yellow; of coarse, rounded granules ..... ***Candelariella coralliza***
Thallus dull yellow-orange (or vivid yellow-green in f. ***flavovirella***), of flattened subsquamulose granules ..... ***Candelariella vitellina***

3(1) Photobiont cyanobacteria (blue-green); no substances 4
Photobiont green 16

4(3) Terricolous or among bryophytes; thallus completely composed of brown or blue to olivaceous grey granules; photobiont *Nostoc* 5
Saxicolous; thallus crustose, micro-squamulose or placodioid; photobiont not *Nostoc* 9

5(4) Thallus with or consisting of cylindrical isidia ..... ***Parmeliella triptophylla***
Thallus without cylindrical isidia 6

6(5) Thallus, when dry, blue-grey 7
Thallus, when dry, olivaceous, dark grey or dark grey-brown 8

7(6) Thallus granules pulverulent or fluffy, weakly corticated, not parenchymatous within ..... ***Moelleropsis nebulosa***
Thallus granules smooth, corticate, parenchymatous throughout ..... ***Epiphloea byssina***

8(6) Thallus bluish grey when wet; granules (goniocysts) 0.03-0.06 mm diam. ..... ***Gregorella humida***
Thallus olivaceous or dark grey when wet; granules often larger. ..... ***Vahliella atlantica***

9(4) Thallus with marginal lobes 10
Thallus without marginal lobes 11

10(9) Marginal lobes very narrow (0.05-0.2 mm), or if wider then with a distinct blue-black prothallus ..... ***Placynthium***
Marginal lobes wider (0.3-1.0 mm); without a blue-black prothallus ..... ***Vestergrenopsis elaeina***

11(9) Thallus surface covered by flat, granular squamules 12
Thallus areolate 14

12(11) Conspicuous, blue-black prothallus usually present; thallus rarely grey-pruinose ..... ***Placynthium nigrum***
Prothallus inconspicuous; thallus densely grey-pruinose 13

13(12) Thallus internally hyphal (microscope) ..... ***Collolechia caesia***
Thallus internally cellular (microscope) ..... ***Placynthium garovaglioi***

14(11) Photobiont *Calothrix* ..... ***Porocyphus***
Photobiont not *Calothrix* 15

15(14) Photobiont cells with a red-brown K+ purple gelatinous sheath (*Chroococcidiopsis* or *Gloeocapsa*) ..... ***Cryptothele* & *Pyrenopsis***
Photobiont cells without red-brown K+ purple gelatinous sheath (chroococcoid) ..... ***Psorotichia* & *Pterygiopsis***

16(3) Photobiont with orange pigment (*Trentepohlia*) 17
Photobiont without orange pigment 25

17(16) Thallus isidiate; pycnidia or sporodochia absent; no substances ..... ***Porina rosei***
Thallus not isidiate; pycnidia or sporodochia present 18

18(17) Conidiomata dark brown, irregular sporodochia (without wall); 2′-*O*-methylperlatolic acid ..... ***Reichlingia leopoldii***
Conidiomata pycnidia (with wall) 19

19(18) Pycnidia with white-pruinose tips that react C+ red; conidia 12-17 × 2-3 µm; lecanoric and schizopeltic acids ..... ***Lecanactis abietina***
Pycnidia without white-pruinose tips; conidia 3-5 µm long; no substances 20

20(19) Pycnidia pale dull yellow; wall colourless; conidia ellipsoid, 3.0-5.0 × 1.3-1.8 µm; usually growing over bryophytes in *Lobarion* communities ..... ***Dimerella lutea***
Pycnidia black 21

21(20) Pycnidia conical with elongated neck; conidia released in chains of cylindrical packets 22
Pycnidia ± globose or flattened; conidia free; no substances 23

22(21) Conidia 3.5-4.5 × 1.8-3 µm; pycnidia 0.08-0.15 mm diam. ..... ***Anisomeridium polypori***
Conidia 4.5-6 × 2.5-3 µm; pycnidia 0.2-0.58 mm diam. ..... ***Anisomeridium robustum***

23(21) Conidia 1-septate, *c*. 13-18 µm long ..... ***Strigula taylorii***
Conidia simple, shorter 24

24(23) Conidia 3.0-5.0 × 0.5-0.7 µm; usually on friable rocks near the coast; mainly S.W. British Isles but also recorded from Orkney, rare ..... ***Opegrapha areniseda***
Conidia 4.2-7.0 × 0.5-1.4 µm; on damp, shaded calcareous rocks and stones (including mortar); widespread and frequent ..... ***Opegrapha calcarea***

25(16) Thallus consisting entirely of very small squamules (0.1-0.5 × 0.1-0.3 mm), coralloid isidia or goniocysts; yellow-green, green-grey or green-brown; usually associated with bryophytes in base-rich habitats; no lichen substances 26
Thallus granular to areolate, or with larger squamules 31

26(25) Thallus with black globules not identifiable as pycnidia, isidia or perithecia ..... ***Agonimia globulifera***
Thallus without such black globules 27

27(26) Thallus consisting of numerous, small, ± discrete, grey-green squamules 28
Thallus composed entirely of minute, yellow-green goniocysts or green-brown, coralloid isidia 29

28(27) Thallus of minute, green, flattened micro-squamules, usually incised and often overlapping, cortex cells lacking papillae ..... ***Bacidia neosquamulosa***
Thallus variably micro-squamulose; cortex cells with microscopic papillae .. ***Agonimia tristicula***

29(27) Thallus composed entirely of green-brown coralloid isidia, 0.4-1 × 0.07-2 mm; rare montane species ..... ***Lopadium coralloideum***
Thallus composed of grey-green irregular areoles or granules 30

30(29) Hyphae of photobiont layer K/I+ blue ..... ***Thelenella muscorum***
Hyphae of photobiont layer K/I– ..... ***Bilimbia sabuletorum***

31(25) Thallus with isidia, papillae or hyphophores; no lichen substances 32
Thallus without isidia, papillae or hyphophores; often with pycnidia 45

32(31) Thallus very thin, varnish-like, over bryophytes; hyphophores present. 33
Hyphophores absent 35

33(32) Hyphophores black, scale-like with a serrated edge ..... ***Gyalideopsis muscicola***
Hyphophores otherwise 34

34(33) Hyphophores glassy white, spine-like ..... ***Jamesiella anastomosans***
Hyphophores brown, top-shaped ..... ***Jamesiella scotica***

35(32) Thallus papillate 36
Thallus regularly to quite irregularly isidiate 38

36(35) Granules 0.1-0.2 mm diam., grey to brown-grey or blue-grey; prothallus often prominent, with alternating white and green to black zones; on coastal rocks; no lichen substances ..... ***Lecanora poliophaea***
Granules >0.4 mm diam. 37

37(36) Granules 0.5(-0.7) mm diam., regular, scattered to crowded, semiglobose, brown-grey; prothallus grey; on flint nodules, S. England; aspicilin ..... ***Aspicilia tuberculosa***
Granules 0.4-0.6 mm diam., pale grey to grey-brown, often purple; thallus often indistinctly lobed at the margin; pale prothallus sometimes distinct; on coastal rocks; may contain terpenoids ..... ***Lecania aipospila***

38(35) Thallus green-brown to dark brown to black; gyrophoric acid 39
Thallus whitish to grey or pinkish 40

39(38) Isidia simple, photobiont cells 6-12 µm diam.; on exposed siliceous rocks ..... ***Rimularia furvella***
Isidia ± branched. Photobiont cells 5-9 µm diam.; on damp, shaded rocks or soil ..... ***Placynthiella icmalea***

40(38) Thallus delimited by a well-defined grey to black, often zoned, prothallus 41
Thallus without prothallus or with indistinct prothallus or prothallus mainly between the areoles 42

41(40) Thallus pale grey-blue to dark blue-grey; granular-papillate becoming granular sorediate, often with a dark green-grey delimiting prothallus; usually on coastal rocks, never overgrowing bryophytes; aspicilin ..... ***Aspicilia leprosescens***
Thallus pale grey to dark green-grey, often zoned at the margin; on siliceous or slightly base-rich rocks and walls, sometimes overgrowing bryophytes; fatty acids ..... ***Pertusaria albescens*** var. ***corallina***

42(41) Thallus yellow-green, with concolorous 'isidia'; thallus continuous; on coastal rocks; usnic acid, ± hypoprotocetraric acid ..... ***Ramalina cuspidata*** & ***R. siliquosa*** (crustose morphs)
Thallus not yellow-green 43

43(42) Thallus pale olive-green to fawn-brown, warted and coarsely granular with short, coralloid isidia; coastal, on siliceous rocks or soil or decaying *Armeria* tufts; no lichen substances ..... ***Bacidia scopulicola***
Thallus pink-grey to bluish grey 44

44(43) Thallus and isidia medium to dark blue-grey; isidia very small and fine, sometimes dense and almost totally obscuring the thallus; no lichen substances (cf. also *C. soralifera*) ..... ***Caloplaca chlorina***
Thallus and isidia pink-grey; isidia scattered, usually one per areole and thallus clearly visible; gyrophoric and 5-*O*-acetyl-4-methylhiasic acid trace only, unidentified substance ..... ***Koerberiella wimmeriana***

45(31) Thallus of brown to ochraceous, often convex to subsquamulose areoles or squamules 46
Thallus not of brown or ochraceous areoles or squamules 51

46(45) Pycnidia in warts, C+ red; conidia straight, 5-6 × 0.7 µm; thallus of ± convex, fawn to ochraceous granules; gyrophoric acid ..... ***Ainoa mooreana***
Pycnidia C– or absent 47

47(46) On rock; areoles angular, leaving open spaces or partly overlapping; on rock 48
On soil; areoles or squamules rounded; on soil; no lichen substances 49

48(47) Areoles thick, bullate, surface rough; on siliceous rock; traces of gyrophoric acid ..... ***Schaereria cinereorufa***
Areoles thin, mostly flat, surface not rough but granules often develop; mostly on nutrient-enriched rock; no lichen substances ..... ***Rinodina teichophila***

49(47) Areoles 0.1-0.3 mm diam.; on sandy or peaty soil at lower altitudes .... ***Placynthiella oligotropha***
Areoles or squamules 1-4 mm diam.; in montane habitats 50

50(49) Thallus of peltate, pale brown squamules (bright green when wet), attached by long rhizines; pycnidia often present; conidia 4-5 × 1 µm; in crevices in Scottish montane, calcareous rocks ..... ***Acarospora rhizobola***
Thallus coarsely areolate to subsquamulose, chestnut-brown to dark brown, often forming large ± orbicular patches (up to 7 cm diam.); pycnidia absent; usually terricolous in acidic montane heaths (occasionally on bryophytes on siliceous rocks) ..... ***Lecidoma demissum***

51(45) Thallus crustose with a placodioid margin 52
Thallus granular or crustose, without a placodioid margin 53

52(51) Thallus pale grey-white, scabrid; upper cortex poorly differentiated; marginal lobes indistinct; mainly on calcareous stonework, also on limestone and other base-rich rocks ..... ***Caloplaca teicholyta***
Thallus green-yellow to yellow-brown; upper cortex well-developed; marginal lobes flat to concave; on man-made substrata but also on nutrient enriched boulders in upland areas ..... ***Lecanora muralis***

53(51) Thallus partly grey, partly with rusty orange streaks; 4-*O*-demethylplanaic and ± planaic acids (some *Porpidia* species, e.g. *P. macrocarpa*, *P. hydrophila* and *P. flavocruenta* may key out here) ..... ***Lecidea lithophila***
Thallus without rusty colour 54

54(53) Thallus grey, with dark red, K+ purple, ascoma initials or pycnidia ..... ***Caloplaca crenularia***
Thallus with white, pink, brown or black pycnidia 55

55(54) Thallus pale yellow-green, UV+ blackish quenching; usnic acid 56
Thallus some shade of grey, green, whitish or creamy 58

56(55) Thallus thick (in the centre generally over 0.5 mm thick), continuous, surface dull; pycnidia pale brown to black; zeorin, usnic acid, ± α-collatolic acid, ± atranorin, ± gangaleoidin ..... ***Lecanora sulphurea***
Thallus thin, under 0.5 mm thick, areolate, surface rather glossy; pycnidia generally black (or often with black perithecia of *Cercidospora epipolytropa*) 57

57(56) Marginal areoles elongated, arranged in a regular jig-saw pattern; usnic acid, zeorin ..... ***Lecanora intricata***
Marginal areoles irregular, essentially roundish to angular; usnic and rangiformic acids, zeorin (cf. also morphs of *Lecanora muralis* with a reduced thallus) ..... ***Lecanora polytropa***

58(55) Thallus whitish to creamy, ± tartareous 59
Thallus some shade of grey, bluish or green or brownish to mauve, thin to thick but not tartareous (only further identifiable when pycnidia are present; if not, cf. e.g. *Aspicilia caesiocinerea* with blue-grey, N– prothallus and aspicilin, or various *Porpidia* species with brown to black, N+ red prothallus and medulla often strongly UV+ white and various chemistry; specimens without chemistry can be *P. macrocarpa* or *P. hydrophila*) 60

59(58) Thallus creamy white, usually surrounded by a white prothallus; pycnidia rare or absent; round, whitish apothecium initials often present; medulla UV– or faintly UV+ white; variolaric acid ..... ***Ochrolechia parella***
Thallus white but not creamy, usually surrounded by dark grey to black, often zoned, prothallus; pycnidia regularly present; conidia 7-11 × 1 µm; round, white apothecium initials absent; medulla UV–; aspicilin ..... ***Aspicilia calcarea***

60(58) Pycnidia C+ red in section; gyrophoric acid 61
Pycnidia C– in section 62

61(60) Conidia curved or sigmoid, 20-40 µm long ..... ***Micarea peliocarpa***
Conidia flexuose, 50-110 µm long ..... ***Micarea cinerea***

62(60) Pycnidia at least partly white 63
Pycnidia pink-brown to black or with yellow pruina 70

63(62) Pycnidia stalked, often branched; mesoconidia 6-8 × 1-1.8 µm; no lichen substances ..... ***Micarea stipitata***
Pycnidia immersed to sessile 64

64(63) Conidia pyriform or oblong 65
Conidia curved, filiform; no lichen substances 67

65(64) Conidia oblong, 4.5-7 × 1-1.5 µm, straight; thallus UV+ pink or orange; three unidentified xanthones ..... ***Bacidia carneoglauca***
Conidia pyriform 66

66(65) Thallus green; no lichen substances ..... ***Fellhanera subtilis***
Thallus bluish; zeorin, asemone & usnic acid ..... ***Fellhanera bouteillei***

67(64) Thallus smooth to slightly verrucose, not consisting of goniocysts or micro-squamules 68
Thallus granular, consisting of goniocysts or micro-squamules 69

68(67) Thallus surrounded by a distinct white prothallus ..... ***Bacidia inundata***
Thallus diffuse, without prothallus ..... ***Bacidia chloroticula***

69(67) Conidia strongly curved, walking-stick-like hooked ..... ***Bacidia arnoldiana***
Conidia curved but not hooked ..... ***Bacidia delicata***

70(62) Conidia helicoid, 7-l0 × 5-6 µm diam.; no lichen substances ..... ***Micarea subnigrata***
Conidia not helicoid 71

71(70) Conidia >15 µm long, often curved; no lichen substances 72
Conidia <15 µm long, straight 75

72(71) Thallus ± delimited, continuous, with convex areoles; pycnidia immersed in thallus or in thalline warts 73
Thallus effuse; pycnidia sessile, not covered by thallus; conidia 20-45 µm long 74

73(72) Thallus often surrounded by a brown prothallus; pycnidia immersed in thallus warts; conidia often not septate, thin, *c*. 15-25 × 0.5-1 µm, curved; usually on exposed siliceous rock; miriquidic acid ..... ***Miriquidica leucophaea***
Thallus without prothallus; pycnidia immersed but not is definite warts; conidia thicker, often thinly 1-3-septate, 19-36(-50) × 1-1.3 µm, curved or sigmoid; montane, terricolous and saxicolous ..... ***Micarea marginata***

74(72) Pycnidia pink-brown to brown-black, globose to usually vertically elongate; conidia curved ..... ***Fellhaneropsis vezdae***
Pycnidia black, globose; conidia often not or barely curved ..... ***Fellhaneropsis myrtillicola***

75(71) Pycnidia stalked; usually over bryophytes; conidia 3.5-5 µm long; no lichen substances ..... ***Micarea botryoides***
Pycnidia not stalked; often directly on rock or soil 76

76(75) Pycnidia with yellow pruina, usually flask-shaped; pulvinic acid derivatives ..... ***Thelocarpon***
Pycnidia without pruina 77

77(76) Conidia 3-5 µm long 78
Conidia 5-15 µm long 80

78(77) Thallus thick, irregularly warted, rimose-cracked, dull green-grey; traces of various substances ..... ***Tylothallia biformigera***
Thallus thin, not warted, continuous; no lichen substances 79

79(78) Pycnidia 80-150 µm diam., wall K+ olivaceous brown; thallus slate grey, continuous, sometimes areolate, often with a black prothallus; on pebbles and stabilized shingle ..... ***Micarea erratica***
Pycnidia 40-80 µm diam., wall K–; thallus red-brown to brown with faint mauve tinge, without prothallus; on hard siliceous coastal (mesic-supralittoral) rocks .. ***Arthonia phaeobaea***

80(77) Thallus ± delimited, continuous, grey, often with a blue tinge 81
Thallus effuse, some shade of green, rarely with a bluish tinge 82

81(80) Conidia 9-15 × 0.8 µm; pycnidia with a raised thalline margin; thallus grey, medulla I+ blue; on heavy-metal-rich rocks; perlatolic acid (some other species of *Lecidea* may key out here) ..... ***Lecidea inops***
Conidia 6-12 × 1 µm; pycnidia immersed; thallus grey with a bluish tinge, medulla I–; aspicilin (some species of ***Lecidea*** and ***Porpidia*** may key out here; they generally lack a bluish tinge) ..... ***Aspicilia caesiocinerea***

82(80) Conidia 7-12 × 1-1.3 µm; thallus dark green-black, without prothallus; on inundated rocks in montane streams; no lichen substances ..... ***Gyalidea diaphana***
Conidia (4-)5-8(-13) × 0.5-1 µm; thallus green-grey, often surrounded by a bluish pellucid prothallus; no lichen substances ..... ***Fellhaneropsis myrtillicola***