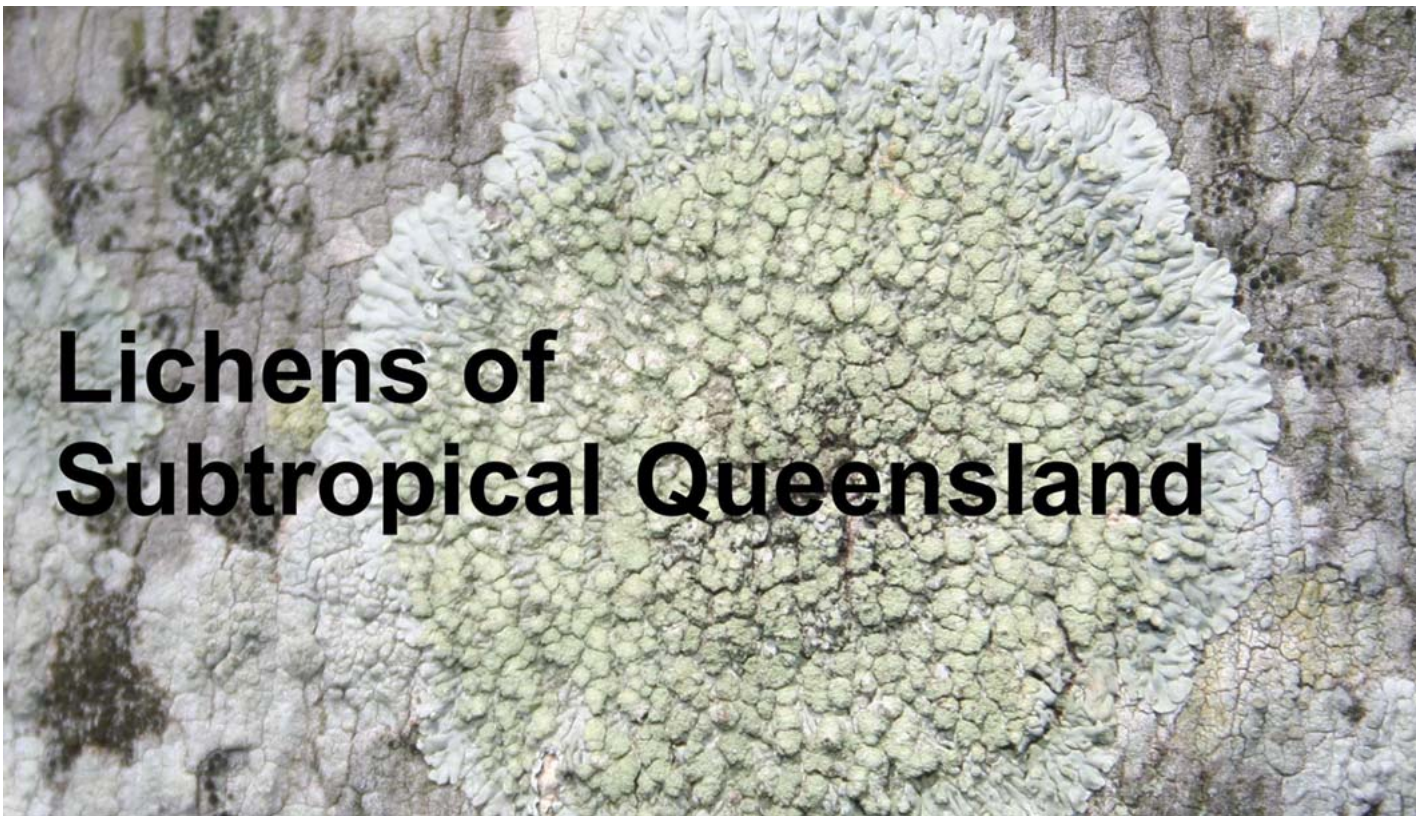

Roderick W Rogers

Lichens of Subtropical Queensland

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Preface

This set of notes and keys is written to assist identification of lichens from subtropical Queensland.

Subtropical Queensland has a rich and diverse lichen flora covering the range from rainforest through eucalypt woodlands to arid grasslands. Each environment has its characteristic suite of lichens, offering the naturalist great opportunity for study.

The keys benefit from information in the Flora of Australia series, but are not extracts from the Flora. The keys include species not reported in the Flora and some keys are to genera not yet covered in the flora project.

The task of completing the survey of lichens in subtropical Queensland is far from complete.
We need many more collections from almost all areas. There will be many new records to be discovered, new species to describe and existing species names to move into synonymy as we understand variation within species better.

These keys are preliminary, and comments would be welcome. I would like to know what has worked, what has been difficult and what is simply defective.

Rod Rogers

December 2005

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Lichens

What is a Lichen?

A lichen is complex community having a fungus and a photobiont as its main components. The photobiont (a green alga or a cyanobacterium) provides the energy source for the lichen and the fungus the structured habitat with its the absorptive and protective structures. Some cyanobacteria also provide the nitrogen for the lichen. Some lichens have both green algae and cyanobacteria in the one thallus, in this case the cyanobacteria are usually in structures called *cephalodia*.

Lichens are capable of inhabiting extreme environments, and it may be true that a lichen can only survive in an environment that would support neither of the separate components. The close mutuality of the lichen thallus may confer great stress tolerance on a lichen, but the delicate balance between the components makes lichens very susceptible to damage. Lichens are generally intolerant of all but the most chemically infertile environments, and are therefore destroyed by air pollution.

This delicate balance maintained by adversity means that lichens are usually extremely slow growing and very long lived. It is easy to destroy a decade of growth by carelessly walking on a lichen or collecting it. It may take several years for a new thallus to reach the size of a pinhead.

Lichens come in many shapes, sizes colours. The larger lichens, the shrubby and leafy lichens, are visually striking in many parts of subtropical Queensland. They occur on tree trunks and branches, on rocks and on soil. They occur in rainforests, in eucalypt woodlands and out into the driest parts of the state. Lichens are sensitive indicators of microclimate and of air quality.

History

The lichens of subtropical Queensland have been the subject of study for over one hundred years. John Shirley (an Inspector of Schools) published the first taxonomic account of the lichens of Queensland in 1888-89. Little more published information about Queensland lichens then appeared for about 80 years, when work on lichen biology was taken up in the University of Queensland. This was coincident with a burst of activity around the country. In the last thirty years Australian lichens have attracted attention within Australia and around the world. As a result we have seen the production of four lichen volumes in the Flora of Australia series, with several more yet to come. Because of this history, it is now possible to produce an account of the larger lichens in subtropical Queensland.

The larger lichens, those that are shrubby (fruticose) and leafy (foliose) are the most obvious and the easiest to determine to species. The crustose lichens are still relatively poorly understood in Queensland, and their identification requires great patience, considerable skill and a good microscope. Identifying the shrubby and leafy lichens does require patience too, especially as the set of new terms that must be understood in

identification is learned. Like all fields of studies, lichenology has its own language that, once learned, makes the task easier.

Parts of a Lichen

The Lichen Body

The lichen body is termed a *thallus.* The thallus contains two main components, a *fungus* and a photosynthetic organism, the *photobiont*. Green algal photobionts are usually present as single, bright green cells in a layer just below the cortex. Cyanobacterial photobionts are usually present as clumps of blue-black cells immediately below the cortex.

The name of a lichen applies only to its fungal component. The photobiont has its own name. Almost all lichens have a fungal component from the class Ascomycota.

The thallus of a leafy (foliose) or shrubby (fruticose) lichen usually has three distinct tissues. The outer layer is a *cortex* composed of tightly packed fungal cells that forms a protective layer around the thallus. In leafy lichens the upper and lower cortex are usually sharply differentiated. In shrubby lichens there is usually no such differentiation. Inside the cortex (upper only) is found a layer of less dense fungal tissue (the *medulla*) with the photobionts incorporated into it (see illustrations below)

The colour of the lower cortex varies from white to jet-black: colour variation is taxonomically significant in some genera. Colour of the upper surface is also taxonomically significant because of the link between colour and chemical constituents.

Peculiar Lichen Structures

Lichens have some distinctive asexual reproductive structures known as *soredia* and *isidia*. These are easily detached from the lichen, especially by raindrops, and when scattered may grow into a new thallus.

Soredia are made up of groups of algal (photobiont) cells loosely entangled with fungal hyphae. Soredia are gathered into restricted areas known as soralia. *Soralia* can be pin points, small globular structures, or linear structures along the edge of lobes.

Isidia are more complex structures that have a well-developed outer wall that encloses a central core of algae and fungi. Isidia are often finger-like, and a about 1mm tall, but they do vary considerably. Isidia have an abscission zone at their base, making their detachment from the thallus easy. In some case the isidia are hollow and swollen at the tip, and may even burst and become pustulate.

Rhizines are commonly present on the lower surface of foliose lichens. Rhizines may take a variety of forms (see below) that are taxonomically significant. In some cases the lower surface is quite naked, in others it is covered by a dense carpet-like tomentum, and in yet others by a light tomentum of hypha-like hairs. The distribution of rhizines on the lower

surface can be significant - always note whether they come right to the lobe margins or leave a distinct bare zone around the edge.

Cyphellae and *pseudocyphellae* are pores occur in both upper and lower surfaces, more commonly on the lower surface. When these pores have a well-developed margin with a concave pore behind the lower cortex the structures are *cyphellae.* If the pore is formed simply by a thinning of the lower cortex or by the development of deep fissures through the upper cortex while the lobe is young these are called *pseudocyphellae*. When pseudocyphellae occur in the lower cortex they are usually plugged with hyphae from the medulla, although they may not be the same colour as medullary hyphae. Take care not to confuse either the cracking that comes with age in the upper cortex or the fine, regular, reticulate cracking present in the upper cortex of some species with pseudocyphellae.

Cilia are hair like structures that occur on the margin of lobes and also sometimes on apothecia, arsing from the line where the upper and lower cortex meet. Care must be taken not to confuse cilia with rhizines that protrude from the lower surface. In a few genera cilia have a distinct swollen bulb at their base: these are bulbate cilia.

Dactyls are finger like structures that may be simple or branched, they my resemble isidia but that do not detach easily from the thallus. Dactyls may become sorediate.

Lichen chemicals

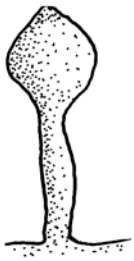
Most shrubby and leafy lichens produce large quantities of chemicals that are deposited around the hyphae. In most cases these chemicals are not water-soluble. The role of the compounds varies. Some are apparently to do with management of the light regime, some have anti-biotic properties, and some may be anti-herbivore compounds. The metabolic pathways that produce these chemicals are genetically based, which makes the chemicals themselves taxonomically useful.

The chemicals are deposited specifically in some tissues. A few chemicals are found only in the cortex, and these may influence the colour of the upper surface. Most chemicals are found in the medulla, and a few of these do colour the medulla. Melanin derived pigments are found mostly in the lower cortex, but do occur in the upper cortex of some genera. Apothecial tissues may also accumulate specific chemicals.

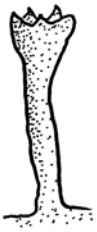
Fortunately, it has been discovered that some of the chemicals show colour reactions with a variety of reagents. This makes chemical tests easy, and, since clear-cut taxonomic characters are few on a lichen, chemical tests are very useful indeed. How to carry out these tests is discussed below.

Structures on the Upper Cortex

Branched Isidia



Swollen Isidium



Pustulate Isidium

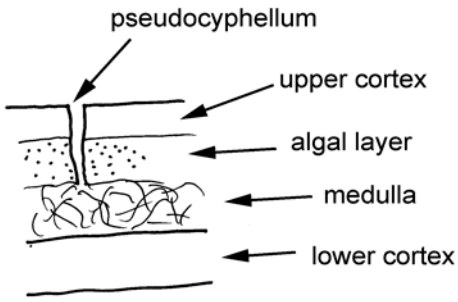
Papillum

Soralium with soredia

Pustule

Simple Cilia

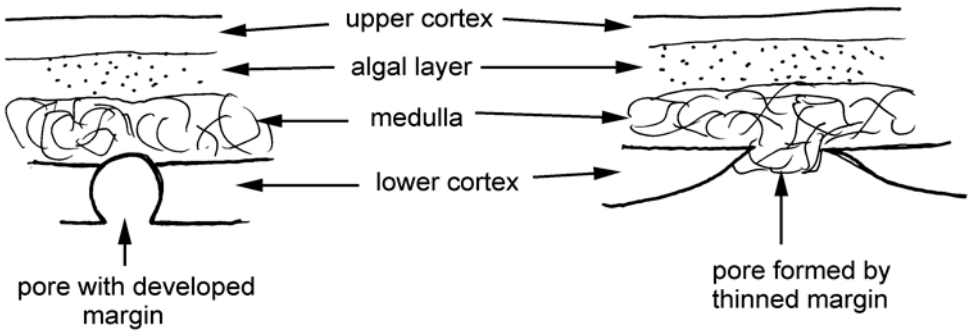
Bulbate Cilia



Pseudocyphellum penetrating upper surface

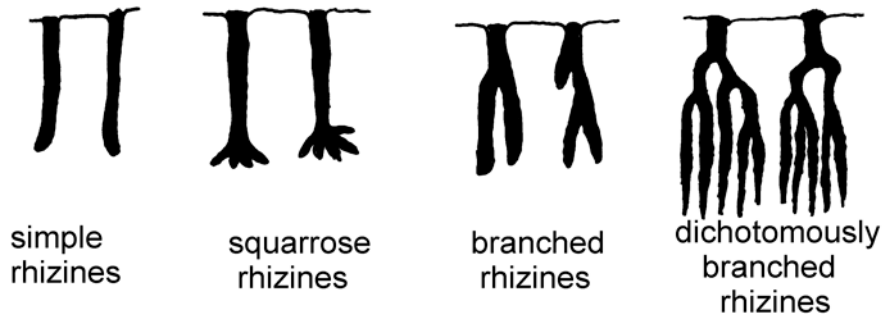
Cilia are on the margin of the thallus

Structures on the Lower Surface



Cyphellum Pseudocyphellum

Rhizines



Lichen Identification

Identification of lichens has the reputation of being very difficult. True, getting started can be a challenge!

Lichen identification works on both visible (morphological and anatomical) characters and on invisible chemical characters. Lichens are small and many of the visible characters are barely visible to the naked eye. This makes lichen identification rather different from flowering plant identification.

The materials you will need

1. A dissecting microscope to view details of lichen structure (you could scrape by with a hand lens)

2. A scalpel or razor blade to cut lichen thalli.

3. A bottle of Potassium Hydroxide solution (10%) for the **K** test. (This is caustic, so take care).

4. Some domestic bleach as a source of Calcium hypochlorite for the **C** test. (this bleaches clothes and burns skin so take care).

5. Access to paraphenylinediamine that can be dissolved in alcohol for the **P** test. The colouring used for men's beards is a useful substitute, but lacks the delicacy of the real thing. (Beware! Paraphenylinediamine stains everything it touches a permanent deep brown). This solution or gel must only be used while fresh and light coloured.

6. Glass dotting rods to add the test chemicals to the lichen. Straightened paper clips work too.

7. A compound microscope may be necessary at times to look at spores. If you ever plan to identify crustose lichens such a microscope is essential.

Performing colour tests

Lichens produce a wide range of chemicals that are taxonomically significant. In this respect lichens are similar to the fungi that produce antibiotics. The chemical variation is usually associated with visible variations, even if these are sometimes subtle. These chemicals are best detected by such techniques as Thin Layer Chromatography or Nuclear Magnetic Resonance. These techniques are beyond all but a few of us. Fortunately a range of chemical colour tests provide a lot of the information needed.

Using colour tests is simple and safe if care is taken.

Tests are performed on either the upper surface (upper cortex) of the lichen, or on the medulla, a cottony layer beneath the cortex. The medulla is usually white, but is sometimes buff or even red.

To carry out a test use a dropping rod or straightened paper clip to put a small drop of liquid on the cortex, and watch for colour changes. If you need to test the medulla, the most common test, then cut away a small area of cortex to expose the medulla, then place a drop of fluid (or gel if using beard colour for P tests) and watch for colour change. A colour change may take 20 seconds or so - and the colour may first be one colour (eg yellow) and then turn another (eg red). Sometimes the colour appears then vanishes after short time. Watch for changes!

For a KC test first add a drop of K solution then a drop of C solution.

Some lichen chemicals are fluorescent under ultra-violet light. UV reactions are rarely mentioned in these keys, but are taxonomically significant in a number of genera.

The Colour of Lichens

Lichens commonly have quite distinctive colours when they are air dry. All colour references in this account are for air-dry thalli.

The common colours of lichens can be attributed to the accumulation of complex organic chemicals in the upper and lower cortex. The colour of most lichens is therefore much the same whether living or dead. Some however, have no chemicals in their cortex or have radically different chemicals that may change with time after death of the lichen.

Some common chemicals in the cortex of lichens and the resultant colours and tests:

Thallus colour	**Chemical**	**Test**
Grey	Atranorin	K+ yellow
Grey	Lichexanthone	UV+ gold
Yellow-green	Usnic acid	K-, KC+ yellow
Gold	Parietin	K+ wine-red
Olive-brown	Melanins	

Lichen Ecology

Lichens are very widespread organisms. They occur in the darkest rainforests and on rocks in full sun. Lichens grow on rainforest leaves, on tree trunks and twigs, on rocks in creeks and on the beach rock of Heron Island. Lichens are common on the soil on roadsides and inside eucalypt forests as well as on undisturbed soil in arid lands.

Lichens have some peculiar sensitivities. By and large, lichens are sensitive to nutrient levels. City air is often too dirty for them, and lichens on tree trunks are killed by the

nutrients that flow down tree trunks in inner city areas and near main roads. By contrast, lichens that grow on rainforest leaves benefit from the extra nutrients in the dust near footpaths.

Lichens are resistant to prolonged drought and very high temperatures when dry. However, many lichens are very sensitive to heat when they are wet. Lichens can use the water deposited in dew to restart their photosynthesis and respiration. Some lichens grow only in such locations that liquid water does not touch them, but they absorb all their water from mists and the air.

Some lichens have a cyanobacterial photobiont that can fix nitrogen. This means that the photobiont provides not only the carbohydrate for the lichen, but nitrogenous compounds too. In some genera species with a predominantly green algal photobiont also have special structures that house a cyanobacterium as well.

The conditions that permit the formation of a new lichen thallus from spores and algal cells appear to be highly specific, and not often met. Survival of young thalli to the stage where identifiable tissues start to develop is probably low. Growth rates are slow. Reproduction by soredia and isidia seems easier, but many species do not have such clonal structures. When collecting always remember the years of struggle that have passed before a thallus is big enough to collect.

When collecting lichens collect as little as is necessary

Less than this is a waste

More than this is destructive

A. Key to Genera of Shrubby and Leafy Lichens

1. Lichen shrubby, not appressed to the substrate, branches usually radially symmetrical, often attached by a holdfast (fruticose) 2

   Lichen leaf-like, usually appressed to the substrate, with distinct upper and lower surfaces, usually attached by rhizines or a tomentum, occasionally with a holdfast (foliose) 12

Shrubby or Fruticose Lichens

2(1) Thallus hollow 3
Thallus solid 5

3(2) Thallus regularly perforate to the central cavity, often in a lattice-like pattern *Cladia*
Thallus not perforate or perforate only in axils of branches or irregularly fissured 6

4(3) Apothecium black, disc of loosely packed hyphae and spores *Bunadophoron*
Apothecium buff or red 5

5(4) Apothecial disc buff-coloured with a well defined thalline margin *Ramalina*
Apothecial disc red to brown or black, without an apparent margin *Cladonia*

6(2) Thallus coloured gold to orange *Teloschistes*
Thallus coloured grey, yellow-green or red 7

7(6) Thallus cylindrical with a central cartilaginous cord *Usnea*
Thallus cylindrical or flattened, without a central cord 8

8(7) Apothecia pink *Dibaes*
Apothecia buff to brown or black 9

9(8) Thallus white or pale grey 10
Thallus brown to yellow-green 12

10(9) Thallus with long rhizoidal extensions into the soil *Siphula*
Thallus attached by a holdfast, without rhizoids 11

11(10) Branches with numerous minute leafy appendages on the branches *Stereocaulon*
Branches without leafy appendages *Bunadophoron*

11(9) Apothecial disc black, on soil *Ramalea*
Apothecial disc buff, on bark, wood or rock *Ramalina*

Leafy or Foliose Lichens

12(1) The lower surface with discrete rhizines that may be simple or branched but not felted, without vein-like markings, woolly tomentum or pores. 13

Lower surface naked or with a felted or carpet-like tomentum (with or without rhizines), or with vein-like markings (from which rhizines may develop) or with pores that may be either cup-like or filled with hyphal masses. 43

Foliose lichens always and only with discrete rhizines on the lower surface

13(12) Cilia growing from the margin of the lobes at least sparsely 14
Cilia not present on the margins of the lobes 27

14(13) Cilia broadening into a bulb at the base 15
Cilia without a basal bulb, but may be thickened 16

15(14) Lobes grey *Bulbothrix*
Lobes green *Relicina*

16(14) Upper cortex brown *Phaeophyscia*
Upper cortex grey or green 17

17(16) Rhizines dichotomously branched 18
Rhizines simple or bushy at the tips 19

18(17) Upper cortex of longitudinal hyphae, often without a lower cortex, upper surface sometimes ciliate, ascospores brown, two-celled *Heterodermia*
Upper cortex of vertical hyphae, lower cortex always present, upper surface never ciliate, ascospores hyaline, one celled *Hypotrachyna*

19(17) Ascospores 2-celled, brown, lobes usually <2mm broad 20
Ascospores 1 celled, lobes usually >2mm broad 21

20(19) Thallus grey, K+ yellow *Physcia*
Thallus brown, K- *Phaeophysica*

21(19) Lobes broadly rotund, with a broad zone bare of rhizines near the tips 22
Lobes truncate at the tips, with rhizines to the margins 25

22(21) Upper surface with neither distinctive white spotting not a pattern of reticulate cracks on young lobes 23
Upper surface with either a pattern of distinctive white spots or reticulate cracks on young lobes 24

23(22) Cilia less than 5mm long and restricted to lobe axils *Parmelinella*
Cilia more than 5mm long, or less than 5mm long but not restricted to axils *Parmotrema*

24(22) Upper surface reticulately cracked *Rimelia*
Upper surface with a pattern of coarse white markings and cracks *Canomaculina*

25(21) Cilia evenly spread on lobe margins *Parmelinopsis*
Cilia mostly in axils 26

26(25) Medulla K+ yellow turning red *Parmelinella*
Medulla K- *Parmelina*

27(13) Upper surface of thallus uniformly bright yellow *Candelaria*
Upper surface of thallus white, grey, brown or green 28

28(27) Apothecia on lower surface of lobes *Nephroma*
Apothecia on upper surface of lobes 29

29(28) Upper surface brown 30
Upper surface white, grey or green 32

30(29) Ascospores simple, hyaline *Xanthoparmelia*
Ascospores two-celled, brown 31

31(30) Lobes 1-2mm wide *Phaeophyscia*
Lobes < 0.5mm wide *Hyperphyscia*

32(29) Thallus yellow-green and on rocks or soil *Xanthoparmelia*
Thallus white or grey, or, if yellow green, not on rocks or soil 33

33(32) Upper cortex pseudocyphellate 34
Upper surface without pseudocyphellae 35

34(33) Lower surface black *Parmelia*
Lower surface white or tan *Punctelia*

35(33) Rhizines dichotomously branched, prominent 36
Rhizines simple or bushy at the tip 37

36(35) Spores simple, lobes always corticate below *Hypotrachyna*
Spores two-celled, often ecorticate below *Heterodermia*

37(35) Rhizines absent from a marginal zone 38
Rhizines to lobe tips 39

38(37) Rhizines absent from a broad band on lobe tips *Parmotrema*
Rhizines absent from a narrow (1mm wide) marginal zone *Canoparmelia*

39(37) Spores 2-celled, brown 40
Spores simple, hyaline 41

40(39) Apothecia with a thalline margin when mature *Physcia*
Apothecia with a proper margin when mature *Pyxine*

41(39) Upper surface green *Flavoparmelia*
Upper surface grey 42

42(41) Lobes truncate, only on rock or soil *Xanthoparmelia*
Lobes rotund, on wood, bark or rock *Canoparmelia*

Foliose lichens with lower surfaces having features other than discrete rhizines.

43(12) Lower surface with cup-like pores or with pores showing white or yellow hyphae, or veins that give rise to rhizines 44
Lower surface without pores or veins 47

44(43) Veins on lower surface, apothecia on terminal finger-like projections *Peltigera*
Lower surface not veined, apothecia disc-like 45

45(44) Pores filled with white or yellow hyphae *Pseudocyphellaria*
Pores cup-like in the lower surface 46

46(45) Pores in the indumentum, not the lower cortex *Heterodea*
Pores in the lower cortex *Sticta*

47(44) Apothecia on the lower side of the lobe tips *Nephroma*
Apothecia on the upper side of the lobes 48

48(47) Thallus with a few well-developed rhizines restricted to margins or constrictions of the thallus 49
Thallus devoid of rhizines, but may have a tomentum 50

49(48) Rhizines in constrictions between tomentose pads *Pannoparmelia*
Rhizines on margins of lobes with a decorticate lower surface *Heterodermia*

50(49) Thallus with an indumentum on the lower surface 51
Thallus naked below 57

51(50) Thallus > 10 cm long, very loosely adnate to the substratum *Lobaria*
Thallus < 10 cm diameter, adnate to substratum 52

52(51) Upper cortex one cell thick, thallus gelatinous when wet, paper-like when dry *Leptogium*
Upper cortex many cells thick, thallus not gelatinous when wet, cartilaginous when dry 53

53(52) Ascospores thick-walled *Physma*
Ascospores thin walled 54

54(53) Apothecia with a thalline exciple *Pannaria*
Apothecia without a thalline exciple 55

55(54) Lobes with very fine longitudinal scratch-like lines *Coccocarpia*
Lobes without fine longitudinal scratch-like lines 56

56(55) Upper surface cobwebby *Leioderma*
Upper surface smooth *Fuscoderma*

57(50) Photobiont green 58
Photobiont cyanobacterial 63

58(57) Lobes fat and hollow or sparsely filled by hyphae 59
Lobes flattened, solid 60

59(58) Holes in outer wall opening to a central cavity *Mennegazzia*
No holes in outer wall *Hypogymnia*

60(58) Thallus free from substratum *Xanthoparmelia*
Thallus attached to substratum 61

61(60) Thallus olive or brown *Hyperphyscia*
Thallus green to grey 62

62(61) Thallus green *Xanthoparmelia*
Thallus grey *Dirinaria*

63(57) Upper surface of thallus with a long indumentum *Dictyonema*
Upper surface smooth or rough, but not hairy 64

64(63) Thallus gelatinous when wet 65
Thallus not gelatinous when wet *Pannaria*

65(64) Spores with a thick wall *Physma*
Spores thin walled 66

66(65) Cortex of closely packed angular cells *Leptogium*
True cortex absent, outer layer of swollen hyphae *Collema*

B. Keys to Species in Genera

Bulbothrix

Bulbothrix is a genus primarily of coastal lowlands. Thalli foliose, grey, lobes < 2mm broad, grey, margins with bulbate cilia.

1.	Medulla K+ yellow turning red	2
	Medulla K-	4
2(1)	Lower surface brown (K+y-r, C-, P+or)	***B. isidiza*** (Nyl.) Hale
	Lower surface black 3	
3(2)	Lobes < 0. mm wide (K+y-r, C-, P+or)	***B. microscopica*** Elix
	Lobes >0.5mm wide(K+ y to r C-,P+or)	***B. tabacina*** (Zenker)Hale
4(1)	Medulla C+ rose or red (K-, C+p, KC+r, P-)	***B. goebelii*** (Mont. & Bosch) Hale
	Medulla C- 5	
5(4)	Medulla KC+ rose (K-, C-,KC+ p P-)	***B. apophysata*** (Hale & Kurok.) Hale
	Medulla KC-(K-, C-,K- P-)	***B. queenslandica*** (Elix & G.N.Stevens) Eix

Bunadophoron *(Sphaerophorus)*

Bunadophoron is restricted to rainforests and montane habitats.

Grey, erect grey fruticose thalli with black powdery apothecia on one surface of the flattened lobes.

1.	Medulla hollow	***B. diplotypum*** (Ohlsson) Wedin
	Medulla solid 2	
2(1)	Medulla faintly K+ yellow, spores grey	***B. formosanum***(Zahlbr.) Wedin
	Medulla K-, spores red-brown	3
3(2)	Spores >10um diameter	***B. murrayi*** (Ohlsson) Wedin
	spores < 10 u diameter	***B. coomerense*** (Ohlsson) Wedin

Candelaria

A genus of small yellow minutely foliose thalli on bark or dry rocks.

Lobes to 0.4 mm wide, soralia marginal, spreading onto the upper surface
C. concolor **(**Dickson) B.Stein in Cohn
Lobes to 2mm broad, soralia marginal and spreading onto the lower surface
C. crawfordi (Müll. Arg) P.M.Jörg. & D.J.Galloway

Canomaculina

A parmelioid genus of dry woodlands. Thallus foliose, lobes irregularly cracked, lower surface with dimorphic simple and squarrose rhizines.

Lobes with marginal soralia, without isidia (K+ y-r, C-,P+ or) ***C. subsumpta*** (Nyl.) Elix
Lobes with isidia, without soredia (K + y-r, C-,P+ or) ***C. subtinctoria*** (Zahlbr.) Elix

Canoparmelia

A parmelioid genus living on bark and wood mostly in open woodlands, including mangroves. Thallus foliose, grey, without cilia, lower surface with a narrow marginal zone without rhizines. The four species treated here are sorediate with a mostly black lower surface.

1. Medulla K+ 2
   Medulla K- 3

2 Medulla K+ yellow, lobes 3-6mm wide (C-,KC- P-) ***C. crozalsiana*** (de Lesd.) Elix & Hale
Medulla K+ yellow turning red, lobes 2-3mm wide (KC-,C-, P+or)
C. norsticta (G.N.Stevens) Elix & Hale

3 Medulla KC+ rose (K-,C-, P-) ***C. aptata*** (Kremp.) Elix & Hale
Medulla KC- (K-,C-, P-) ***C. texana*** (Tuck.) Elix & Hale

Cladia

A genus usually living on soil of coastal woodlands and ranges, especially at altitude.
Thallus of erect fruticose pseudopodetia that are often much branched, always with openings through the cortex to the medulla or internal cavity, up to 5cm tall.

1. Thallus quite hollow 2
   Thallus with cortical strands or mass in the centre 3

2(1) Thallus much branched and forming a cushion, not sorediose, usually >20mm tall
Cladia aggregata (Sw.) Nyl.
Thallus little branched sorediose, not forming a cushion <10mm tall
Cladia schizopora (Nyl.) Nyl.

3(1) Medulla solid, pseudopodetia 2-3 mm wide ***C. corallaizon*** F. Wilson ex Filson
Medulla stranded, pseudopodetia to 8mm wide ***C. retipora*** (Labill.) Nyl.

Cladonia

A genus living on soil, rocks and wood in coastal woodlands and ranges. Thallus consists of basal squamules (which may disappear) and erect fruticose podetia. Some have well-developed cups, apothecia red or brown.

1. Thallus with cups 2
   Thallus blunt or pointed 6

2(1) Thallus sorediate 3
Thallus esorediate 5

3(2) Soredia floury (K-, KC-, P+ r) ***C. ochrochlora*** Flörke
Soredia granular 4

4(5) Thallus <1mm diameter (K-, KC-, P+ r /y) ***C. fruticulosa*** Kremp.
Thallus up to 3mm diameter (K-, KC-, P+ r) ***C. ramulosa*** (With.) J.R.Laundon

5(2) Cups often split or torn, stictic acid present (K-, KC-, P+ r)
C. kuringaiensis A.W.Archer
Cups mostly with continuous edges, fumarprotocetraric acid present
(K-, KC-, P+ r) ***C. cervicornis*** ssp. ***verticillata*** (Hoffm.) Ahti

6(1) Thallus repeatedly branched 7
Thallus not or little branched 10

7(6) Thallus K+ 8
Thallus K- 9

8(7) Thallus with longitudinal striations and splits (K+ weak y, KC-, P+ rweak y)
C. sulcata var ***striata*** A.W.Archer
Thallus neither striate nor split (KC-, P- / P+ y) ***C. pertricosa*** Kremp.

9(7) Entirely corticate (K-, KC-, P+ r) ***C. furcata*** (Huds.)Schrader
Ecorticate in upper part of podetia (K-, KC-, P+ r)
C. scabriuscula (Delise) Nyl.

10(6) Apothecia red 11
Apothecia brown 12

11(10) Soredia floury, podetia mostly ecorticate (K- / K+y, KC-, P- / P+y) ***C. macilenta*** Hoffm.
Soredia granular, podetia corticate at least in the lower half (K- / K+y, KC-, P- / P+y)
C. floerkiana Flörke

12(11) Thallus sorediate 13
Thallus esorediate 14

13(12) Thallus weakly K+ yellow, <1mm diameter (K- / K+ faint y, KC-, P+ r)
C. praeterissima A.W.Archer
Thallus K-, >1mm diameter (K-, KC-, P+ r) ***C. ramulosa*** (With.) J.R.Laundon

14(12) Thallus totally ecorticate(K+y, KC-, P+y) ***C. rigida*** (Hook. f & Tayl.) Hampe
Thallus corticate at least in the lower half 15

15(14) Thallus fully corticate 16
Thallus corticate only in the lower half 17

16(15) Thallus K+ weak yellow or K- (KC-, P+ r) ***C. corymbescens*** Nyl. Ex Leight.
Thallus K+ red (KC-, P+ y) ***C. polycarpoides*** Nyl. In W. von Zwack-Holzhausen

17(15) Apothecia red, thallus P+ yellow (K- / K+y, KC-, P- / P+y) ***C. floerkiana*** Flörke
Apothecia brown, thallus P+ red (K-, KC-, P+ r) ***C. scabriuscula*** (Delise) Nyl.

Coccocarpia

A genus of rocks bark and wood in moist and usually shady habitats. Thallus foliose, grey with a finely striated surface, photobiont cyanobacterial.

1.	Thallus without isidia	***C. erythroxyli*** (Sprengel) Swinscow & Krog
	Thallus isidiate	2
2.	Isidia strongly flattened	***C. pellita*** (Ach.) Müll. Arg.
	Isidia cylindrical	***C. palmicola*** (Sprengel) Arv. & D.Galloway

Collema

A genus usually found on rocks and trees in moist habitats, but one species is on arid soils. Thallus foliose, photobiont *Nostoc*, producing a thallus that is black and gelatinous when wet.

1.	Thallus <15mm diameter	2
	Thallus >15 mm diameter	3
2(1)	Lobes thick, isidiate, spores 2 celled	***C. coccophorus*** Tuck.
	Lobes membranous. Spores 3-4 celled	***C. pustulatum*** Ach.
3(1)	Lobes isidiate 4	
	Lobes without isidia 7	
4(3)	Apothecial margin isidiate	***C. rugosum*** Kremp.
	Apothecial margin not isidiate	5
5(4)	Isidia irregularly lumpy, margins lobulate	***C. leptaleum*** Tuck.
	Isidia globose to cylindrical	6
6(5)	Isidia dense	***C. subflaccidum***
	Isidia sparse	***C. japonicum*** (Müll. Arg.) Hue
7(3)	Spores with 10 or more cells	***C. fasciculare*** (L.) Wigg.
	Spores with 6 cells or less	8
8(7)	Spores 4 celled	***C. leptaleum*** Tuck
	Spores 6 celled	9
11(10)	Thallus pustulate, spores muriform	***C. implicatum*** Nyl.
	Thallus ridged, spores not muriform	***C. japonicum*** (Müll. Arg.) Hue

Dibeis

Rsetricted to soil, especially in and near rainforests. Thallus crustose with pink apothecia that may be sessile or stalked.

1.	Thallus without soredia	***D. absoluta*** (Tuck.) Kalb & Gierl
	Thallus sorediate	2
2.	Apothecia stalked, convex	***D. arcuata*** (Stirt.) Kalb & Gierl
	Apothecia sessile, flat	***D. sorediata*** Kalb & Gierl

Dictyonema

A Basidiolichen genus of rainforest fringes, having the appearance of a rather untidy, somewhat iridescent carpet.

Dictyonema irpicinum Mont.

Dirinaria

A weedy genus especially in eucalypt woodlands, mangroves and urban habitats. Thallus foliose, up to 5cm diameter, lobes grey, up to 2mm diameter, devoid of rhizines.

1	Thallus sorediate	2
	Thallus without soredia	7
2(1)	Apothecial disc red-purple pruinose	***D. melanoclina*** (C.Knight) D.D.Awasthi
	Apothecial disc white pruinose or black if present	3
3(2)	Sorediate dactyls	4
	Soralia sessile	5
4(3)	Medulla K+ slowly pink	***D. consimilis*** (Stirt.) D.D.Awasthi
	Medulla K-	***D. aegialita*** (Ach.) B.Moore
5(3)	Lobes convex, medulla K+ slowly pink	***D. consimilis*** (Stirt.) D.D.Awsthi
	Lobes plane, medulla K-	6
6(5)	Medulla C+ orange	***D. flava*** (Müll. Arg.) C.W.Dodge
	Medulla C-	***D. applanata*** (Fée) D.D.Awasthi
7(1)	Lobes markedly confluent almost to their tip	***D. confluens*** (Fr.)D.D.Awasthi
	Lobes discrete for almost all their length	8
8(7)	Apothecial disc purple-red pruinose	***D. purpurascens*** (Vain.) B.Moore
	Apothecial disc white pruinose or black	***D. picta*** (Sw.)Schaer ex Clem.

Flavoparmelia

A parmelioid genus occurring on bark, mostly in open woodlands. Thallus foliose, green, lobes up to 8mm diameter, without cilia.

1.	With neither dactyls nor soredia (K-, C-, KC-, P+or)	***F. rutidota*** (Hook.f. & Tayl.)Hale
	With dactyls or soredia	2
2(1)	With dactyls that may produce soredia (K-, C-, KC-, P+ or)	***F. haysomi*** (C.W.Dodge) Hale
	Without dactyls, with laminal soralia	3
3(2)	Medulla white throughout	4
	Medulla yellow in part	5

4(3)	Soralia pustulate (K-, C-, KC-, P+ r)	***F. kantvilasii*** Elix
	Soralia capitate (K- /K+ dingy y, C-, KC-, P+ or)	***F. springtonensis*** (Elix) Hale
5(3)	Thallus thin, with succinprotocetraric acid(K-, C-, KC-, P+r)	***F. succinprotocetrarica*** Elix & J.Johnst
	Thallus leathery, with protocetraric acid (K-, C-, KC-, P+r)	***F. euplecta*** (Stirt.) Hale

Heterodermia

A genus of rock and bark in open woodlands and wetter habitats. Thallus foliose, grey, lobes often have a waxy appearance, many have long rhizines and cilia.

1.	Lobes corticate below	2
	Lobes ecorticate below	4
2(1)	Thallus sorediate	***H. speciosa*** (Wulfen) Trevis
	Thallus not sorediate	3
3(2)	Thallus isidiate	***H. antillarum*** (Vain.) Swinscow & Krog
	Thallus without isidia	***H. diademata*** (Taylor) D.D.Awasthi
4(1)	Thallus without soredia	5
	Thallus sorediate	6
5(4)	Thallus isidiate/lobulate	***H. appendiculata*** (Kurok.) Swinscow & Krog
	Neither isidia nor lobules present	***H. angustiloba*** (Műll. Arg.) D.D.Awasthi
6(4)	Medulla with yellow-orange pigments	7
	Medulla without yellow-orange pigments	9
7(6)	Lobes broad, short, with cilia on upper surface	***H. comosa*** (Eschw.) Follman & Rédon
	Lobes long and narrow, without cilia on the upper surface	8
8(7)	Pigment K+ purple, medulla K-	***H. obscurata*** (Nyl.) Trevis
	Pigment K-, medulla K+ yellow turning red	***H. casarettiana***
9(6	Lobes elongate, closely adnate or ascending, with long cilia	**H. japonica** (Sato) Swinscow & Krog
	Lobes short, closely adnate, cilia absent	***H. japonica*** (Sato) Swinscow & Krog

Hyperphyscia

A genus of urban habitats and semi-arid woodlands. Thallus foliose, small (<2cm diam) grey to brown.

1.	Thallus with neither isidia nor soredia	***H. syncolla*** (Tuck. ex Nyl.)
	Thallus with isidia or soredia	2
2.	Thallus isidiate	***H. isidiata*** Moberg
	Thallus sorediate	3

3.	Soralia marginal	***H. pruinosa*** Moberg
	Soralia laminal	***H. adglutinata*** (Flörke) H. Mayrhofer

Hypogymnia

Restricted to highlands in the extreme south. Thalli foliose, usually swollen, grey with a black margin, without rhizines.

Thallus sorediate, hollow	***H. subphysodes*** (Kremp.) Filson
Thallus sorediate, solid or almost so	***H. tubularis*** (Taylor) Elix

Hypotrachyna

A parmelioid genus of woodlands and mangroves. Thallus foliose, grey, margin ciliate, rhizines dichotomous, long.

Thallus isidiate (UV-, K-,C-,KC+ y or, P-)	***H. imbricatula*** (Zahlbr.) Hale
Thallus sorediate (UV+, K-,C-,KC+ r, P-)	***H. osseoalba*** (Vain.) Y.S.Park & Hale

Leptogium

A genus of moister habitats in woodlands and mangroves. Foliose, photobiont *Nostoc* resulting in a thallus that is black and gelatinous when wet.

1.	Thallus isidiate	2
	Thallus without isidia but may have secondary lobules	9
2(1)	Isidia cylindrical or granular	3
	Isidia scale-like	7
3(2)	Lobes smooth	***L. cyanescens*** (Rabenh.) Körber
	Lobes wrinkled	4
4(3)	Isidia granular	***L. asiaticum*** P.M.Jørg.
	Isidia cylindrical	5
5(4)	Thallus cushion-like	***L. faciifictum*** Verdon
	Thallus foliose	6
6(5)	Isidia coralloid	***L. coralloideum*** (Meyen & Flotow) Vain.
	Isidia simple	***L. austroamericanum*** (Malme) C.W.Dodge
7(2)	Margin of apothecium isidiate	***L. marginellum*** (Sw.) Gray
	Lobes isidiate	8
8(7)	Lobes smooth	***L.poliophaeum*** Verdon
	Lobes wrinkled	***L. granulans*** Vain.

10(9) Lobes crumpled on the edge ***L. wilsoni*** Zahlbr.
Lobes gently wavy or straight 11

11(10) Lobes shiny ***L. corticola*** (Taylor) Tuck.
Lobes matt 12

12(11) Lower surface with holdfasts on wrinkles ***L. phyllocarpum*** (Pers.) Nyl.
Lower surface naked or with minute rhizines ***L. biloculare*** F.Wilson

Lobaria

A genus mostly restricted to rainforests and their fringes. Thalli foliose, large to very large, usually tomentose (at least in part) below.

1 Thallus reticulately ridged with deep depressions between ridges
Lobaria isidiophora Yoshimura
Thallus more or less smooth 2

2 Lobe margins with small rounded lobules ***L. hartmannii*** (MüLL.Arg.) Zahlbr.
Lobes margins without lobules 3

3 Spores 3-7 septate ***L. rhaphispora*** (C.Knight) Zahlbr.
Spores 12-15 septate ***L. plurimseptata*** (C.Knight) Zahlbr.

Menegazzia

Restricted to the extreme southern highlands. Foliose, lobes grey, perforate to a hollow central cavity, lower surface black, without rhizines.

Menegazzia fissicarpa P.James

Metus

Restricted to the extreme southern highlands. Thallus fruticose.

M. conglomeratus (F.Wilson) D.J.Galloway

Myelochroa

A parmelioid genus of southern woodlands. Thallus foliose, lobes ciliate, medulla yellow.

(K-, C-, KC-,P-) ***M. aurulenta*** (Hale) Elix & Hale

Nephroma

Mostly restricted to rainforests and their fringes. Thallus foliose, apothecia on lower surface of lobes that may be recurved so that apothecia appear to be on the upper surface.

1.	Medulla yellow	***N. laevigatum*** Ach.
	Medulla white	2
2.	Lower surface glabrous	***N. rufum*** (C.Bab.) P.James
	Lower surface pubescent to tomentose	***N. helveticum*** Ach.

Pannaria

Widespread in moist habitats, including mangroves. Foliose, lobes narrow, tomentose below, apothecia with a thalline margin.

1.	Lobes isidiate or lobulate	2
	Lobes without isidia or lobules	9
2(1)	Isidia sorediate	3
	Isidia not sorediate	5
3(2)	Soralia on the lower margin of the lobes	***P. fulvescens*** (Mont.) Nyl
	No soredia beneath the margins	4
4(3)	Lobes with longitudinal ridges	***P. elatior*** Stirt. in Bailey
	Lobes smooth	***P. elixii*** P.M.Jørg. & D.J.Galloway
5(2)	Lobes with fringed lobules	***P. fimbriata*** P.M.Jørg.
	Margins without lobules or lobules not fimbriate	6
6(5)	Lobes white marbled	***P. dissecta*** P.M.Jørg.
	Lobes more or less uniformly coloured	7
7(6)	Lobes with coralloid isidia	***P. mangroviana*** P.M.Jørg
	Lobes with marginal lobules	8
8(7)	Lobules globular	***P. globigera*** Hue
	Lobules minute, flat	***P. ramosii*** *Vain.*
9(1)	Lobes sorediate	***P. leproloma*** (Nyl.) P.M.Jørg.
	Lobes without soredia	10
10(9)	Thallus lobed	11
	Thallus squamulose to subcrustose	14
11(10)	Thallus a rosette up to 2cm diameter	***P. aenea*** Müll. Arg
	Thallus up to 10cm diameter	12
12(11)	Lobe margin upturned (not a sorediate species!)	***P. sorediata*** C.Knight in Bailey
	Lobe margin flat	13
13(12)	Lobes wrinkled when dry	***P. lurida*** (Mont.) Nyl.
	Lobes smooth when dry	***P. tjbodensis***
14(11)	Thallus more or less crustose	***P. subcrustacea*** (Räsänen) P.M.Jørg
	Thallus squamulose	15
15(14)	Disc of apothecium with circular or spiral markings	***P. immixta*** Nyl.
	Disc of apothecium smooth	***P. subimmixta***

Pannoparmelia

A parmelioid genus restricted to cool moist forests. Thallus foliose, bead-like, tomentose below

P. wilsoni (Räsänen) D.J.Galloway

Parmelia

A parmelioid genus restricted to cool moist woodlands. Thallus foliose, upper surface peudocyphellate.

1.	Lobes sorediate-isidiate (K+ y-r, C-, P+ r-o)	***P. erumpens*** Kurok.
	Lobes without soredia or isidia	2
2.	Growing on bark (K+ y-r, C-, P+ r-o)	***P. queenslandensis*** Hale
	Growing on rock (K+ y-r, C-, P+ r-o)	***P. signifera*** Nyl.

Parmeliella

A genus of cool moist habitats. Lobes narrow, tomentose below, apothecia proper.

1	Lobes isidiate or lobulate	2
	Lobes neither isidiate nor lobulate	***P. mariana*** (Fr.) P.M.Jørg
2	Isidia finger-like	***P. brisbanensis*** (C.Knight) P.M.Jørg
	Isidia papillate or warty	***P. aggregata*** P.M.Jørg & D.J.Galloway

Parmelina

A parmelioid genus of woodlands. Thallus foliose, grey, with marginal cilia.

Thallus isidiate (K-,C+ r, KC+ r - o, P-)	***P. conlabrosa*** (Hale) Elix & J.Johnst.
Thallus with neither isidia nor soredia (K-,C+ r, KC+ r, P-)	***P. pseudorelicina*** (Jatta) Kantvilas & Elix

Parmelinella

A parmelioid genus with a foliose thallus, cilia in lobe axils, rhizines simple to the edge of the lobe margins.

(K+ y-r, C-, P+ r-o) ***P. wallichiana*** (Taylor) Elix & Hale

Parmelinopsis

A parmelioid genus of moist open forests & woodlands. Thallus foliose, lobes ciliate, rhizines furcate to dichotomous..

1. Lobes with neither isidia, pustules nor soredia (K-, C+ pale pink, KC+ red, P-)
P. neodamazaniana Elix & J. Johnst.) Elix & Hale
Lobes with isidia, soredia or pustules 2

2(1) Lobes pustulate 3
Lobes with soredia or isidia, but not pustules 4

3(2) Medulla C+, lobes with pustulate isidia that may produce soredia (K-,C +p, P-)
P. spumosa (Asahina) Elix & Hale
Medulla C-, with pustulate soralia (K-,C+ p, P-) ***P. subfatiscens*** (Kurok.) Elix & Hale

4(3) Sorediate, without isidia (K-,C+ p, KC+ r, P-)
P. afrorevoluta (Krog & Swinscow) Elix & Hale
Isidiate, without soredia 5

5(4) Medulla C- (K-, KC+ p, P-) ***P. horrescens*** (Taylor) Elix & Hale
Medulla C+ (K-, KC+ r, P-) ***P. minarum*** (Vain.) Elix & Hale

Parmotrema

A parmelioid genus of usually large species common in rainforest canopies and open eucalypt forests on trees and rocks. Foliose, lobes up to 20mm broad, cilia present or absent, with a broad naked zone on the lower surface around the rotund lobe tips, rhizines simple.

1 Thallus with soredia, or isidia 2
Thallus with neither soredia or isidia 14

2(1) Thallus sorediate or with sorediate isidia 3
Thallus isidiate, but without soredia 12

3(2) Medulla K+ yellow or yellow turning red 17
Medulla K- 6

6(4) Medulla C- 7
Medulla C+ 15

7(6) Medulla KC+(K-,C-,KC+ r, P-) ***P. rimulosum*** (C.W.Dodge) Hale
Medulla KC- 8

8(7) Medulla P- (K-,C-,KC-, P-) ***P. grayanum*** (Hue) Hale
Medulla P+ 10

10(8) Lobes ciliate (K+ dingy y, C+ p, P+ o-r) ***P. robustum*** (Degel.) Hale
Lobes not ciliate 11

11(10) Lobes 4-10mm broad (K-, C-,KC+ pale y -brown, P+ or-r) ***P. judithae*** Elix & J.Johnst.
Lobes >10mm broad (K+ y-br, C-, KC-, P+ or-r) ***P. gardneri*** (C.W.Dodge) Serus.

12(2) Medulla K+ yellow (C-,KC +r, P-) ***P. crinitum*** (Ach.) M.Choisy
Medulla K- or K+ pale brown 13

13(12) Medulla C+ red (K-,C+ r, KC+ r, P-) ***P. tinctorum*** (Despr. Ex Nyl.) Hale
Medulla C- (K-/K+ purple,C-, KC-, P-) ***P. sulphuratum*** (Nees & Flot.) Hale

14(1) Medulla K+ yellow or yellow turning red (C-r, P+ o) ***P. eciliatum*** (Nyl.) Hale
Medulla K- or K+ dingy brown (C- KC+ r, P-) ***P. subrugatum*** (Kremp.) Hale

15(6)	Medulla pigmented(K-, C+ p, KC+ r, P-)	***P. permutatum*** (Stirt.) Hale
	Medulla white 16	
16(15)	Margin ciliate (K-,C+ r, KC+ r, P-)	***P. cooperi*** (J.Steiner & Zahlbr.) Serus.
	Margin without cilia (K-, C+ r, KC+ r, P-)	***P. austrosinense*** (Zahlbr.) Hale
17(3)	Medulla K+ yellow turning red (C-, P+ y to or)	***P. parahypotropum*** (W.L.Culb.) Hale
	Medulla K+ yellow (C-, P+ or-r)	***P. chinense*** (Osbeck) Hale & Ahti

Peltigera

Restricted to soil in rainforests and their margins. Thallus foliose, apothecia on finger-like marginal lobes.

Veins on lower surface pink, apothecial discs pink	***P. dolichorrhiza*** (Nyl.) Nyl**.**
Veins on lower surface brown, apothecial discs brown	***P. polydactyla*** (Neck.) Hoffm.

Phaeophyscia

Dry woodlands and forests. Thallus foliose, brown, lobes <2mm broad.

Medulla coloured orange-red	***P. endoccinodes*** (Poelt) Essl.
Medulla white	***P. hispidula*** (Ach.) Essl.

Physcia

A widely distributed genus, especially on bark in open forests. Thallus foliose, grey, lobes <2mm broad.

1.	Thallus with neither pustules nor soredia	2
	Thallus with pustules or soredia	4
2(1)	Lower surface black or dark-brown	***P. phaeocarpa*** (Nyl.) Hue
	Lower surface white or pale brown	3
3(2)	Lobes usually <1mm wide	***P. jackii*** Moberg
	Lobes usually > 2mm wide	***P. stellaris*** (L.) Nyl.
4(1)	Lobes with pustules that may become sorediate	***P. decorticata*** Moberg
	Lobes sorediate but not pustulate	5
5(4)	Lower cortex dark	6
	Lower cortex pale	7
6(5)	Lower cortex paler and striate near the lobe tips	***P. atrostriata*** Moberg
	Lower cortex paler but not striate near the lobe tips	***P. sorediosa*** (Vain.) Lynge
7(5)	Soralia laminal	***P. poncisii*** Hue
	Soralia marginal	8

8(7)	Soralia capitate	***P. tribacoides*** Nyl.
	Soralia linear	9
9(8)	Lobes up to 2mm broad	***P. undulata*** Moberg
	Lobes <1mm wide	10
10(9)	Rhizines darker than the lower cortex	***P. nubila*** Moberg
	Rhizines pale, concolorous with the lower cortex	***P. crispa*** Nyl.

Physma

A genus of rainforest margins. Thallus foliose, photobiont cyanobacterial, spores thick-walled, spherical.

P. byrsaeum (Ach.) Tuck.

Punctelia

A weedy parmelioid genus on bark in urban areas and open woodlands or forests. Thallus foliose, grey, with small pseudocyphellae on the upper surface or margins.

1.	Thallus isidiate/lobulate (K-, C+ r, KC+ r, P-)	***P. subflava*** (Tayl.) Elix & J. Johnst.
	Thallus without isidia or lobules	2
2	Thallus sorediate (K-, C+ r, KC+ r, P-)	***P. pseudocoralloidea*** (Gyeln.) Elix & Kantvilas
	Thallus with neither isidia nor soredia (K-, C+ r, KC+ r, P-)	***P. subalbicans*** (Stirt.) D.J.Galloway & Elix

Pseudocyphellaria

Usually large thalli from rainforest or other wet environments. Thallus foliose, lower surface variably tomentose always pseudocyphellate.

* = Known from the wet tropics and northern New South Wales, but not subtropical Queensland.

1	Medulla white	2
	Medulla yellow	17
2(1)	Pseudocyphellae on lower surface white	3
	Pseudocyphellae on lower surface yellow	13
3(2)	Lobes isidiate	4
	Lobes without isidia	6
4(3)	Lobes and isidia without soredia	***P. dissimilis*** (Nyl.) D.J.Galloway & P.James
	Lobes or isidia sorediate	5
5(4)	Upper surface pseudocyphellate	***P. argyracea*** (Delise)Vain.
	Upper surface without pseudocyphellae	***P. bartlettii*** D.J.Galloway
6(3)	Lobes sorediate	7

	Lobes without soredia	10
7(6)	Lower surface totally tomentose	***P. granulata*** (C.Bab.) Malme
	Lower surface with a bare marginal zone or without tomentum	8
8(7)	Upper surface smooth	***P. intricata*** (Delise) Vain.
	Upper surface foveolate or punctately depressed	9
9(8)	Upper surface foveolate	***P. dozyana*** (Mont. & Bosch) D.J.Galloway
	Upper surface punctately depressed	***P. haywardiorum**** D.J.Galloway
10(6)	Lobes phyllidiate	11
	Lobes without phyllidia	12
11(10)	Photobiont green	***P. multifida*** (Nyl.) D.J.Galloway & P.James
	Photobiont cyanobacterial	12
12(11)	Photobiont green	***P. sulphurea*** (Schaer.) D.J.Galloway
	Photobiont cyanobacterial	20
13(2)	Lobes isidiate	***P. desfontainii**** (Delise) Vain.
	Lobes without isidia	14
14(12)	Lobes sorediate	***P. crocata*** (L.)Vain.
	Lobes without soredia	15
15(14)	Lobes without phyllidia	***P. gilva*** (Ach.) Malme
	Lobes phyllidiate	16
16(15)	Lower surface totally tomentose	***P. crocatioides*** D.J. Galloway
	Lower surface with a bare marginal zone or without tomentum	***P. neglecta*** (Műll.Arg.) H.Magn.
17(1)	Lobes with sorediate isidia	***P. pickeringi*** (Tuck.) D.J.Galloway
	Lobes without isidia	18
18(17)	Lobes without soredia	***P. rubrina*** (Stirt.) D.J.Galloway
	Lobes sorediate	19
19(18)	Upper surface pseudocyphellate	***P. aurata*** (Ach.) Vain.
	Upper surface without pseudocyphellae	***P. crocata*** (L.) Vain.
20(12)	Lower pseudocyphellae punctiform	***P. rigida*** (Müll.Arg.) D.J.Galloway
	Lower pseudocyphellae conical	***P. beccarii*** (Kremp.) D.J.Galloway

Pyxine

A genus mostly of the coastal strip and ranges, but one species semi-arid. Thallus foliose, lobes <2mm diameter, grey or rarely brown, usually with discrete patches of pruina on the upper surface, medulla often coloured.

1.	Upper cortex K+ yellow, never UV+	2
	Upper cortex K-, usually UV+	4
2(1)	Thallus with lateral lobules, dactyls or soredia	3
	Thallus without vegetative propagules	***P. rugulosa*** Stirt.

3 (2)	Soredia originating from marginal pseudocyphellae; medulla yellow	***P. sorediata*** (Ach.) Mont.
	Soredia laminal, more or less orbicular; medulla white	***P. schmidtii*** Vain.
4(1)	Thallus with dactyls and/or soredia	5
	Thallus without vegetative propagules	6
5(4)	Medulla yellow, K-	***P. subcinerea*** Stirt.
	Medulla ochraceous, K+ violet	***P. albovirens*** (Meyer) Aptroot
6(4)	Medulla white or cream	7
	Medulla yellow or orange	8
7 (6)	Lobes very narrow (<0.3 mm); UV-	***P. microspora*** Vain.
	Lobes up to 1.2 mm broad; cortex K- UV+	***P. petricola*** Nyl.
8(6)	Medulla yellow to ochre	***P. australiensis*** Kalb.
	Medulla orange	***P. cognata*** Stirt.

Ramalina

A genus from diverse habitats, woodlands, mangroves and rainforests. Thallus fruticose, rising from a holdfast, often flattened, upper and lower surfaces sometimes differentiated.

1.	Thallus sorediate	2
	Thallus not sorediate	7
2(1)	Medulla K+ red or pink	3
	Medulla K-	6
3(2)	Medulla K+ red	4
	Medulla K+ pink	5
4(3)	Branches <1mm wide	***R. tenella*** Műll.Arg.
	Branches 1-4mm wide	***R. pacifica*** Asahina
5(4)	Lobes with linear pseudocyphellae	***R. nervulosa*** var ***luciae***
	Lobes with few small pseudocyphellae	***R. peruviana*** Ach.
6(3)	Coastal, with divaricatic acid	***R. nervulosa*** var. ***nervulosa*** (Műll.Arg.) Abbayes
	Montane, with sekikaic acid	***R. dumeticola*** Krog & Swinscow
7(1)	Medulla K+ red or pink	8
	Medulla K-	11
8(7)	Medulla K+ red	9
	Medulla K+ pink	10
9(8)	Lobes flat	***R. subfraxinea*** var. ***norstictica*** G.N.Stevens
	Lobes ±cylindrical	***R. tropica*** G.N.Stevens
10(8)	Lobes inflated	***R. inflata*** var. ***perpusilla*** G.N.Stevens
	Lobes flat	***R. subfraxinea*** var. ***subfraxinea*** Nyl.
11(7)	Lobes inflated	***R. inflata*** var. ***inflata*** Stirt.

	Lobes flat or ±cylindrical	12
12(11)	Lobes ±cylindrical	13
	Lobes flat	15
13(12)	On maritime rocks	***R. litorea*** G.N.Stevens
	On bark or wood	14
14(13)	Lobes tufted near the tips, usually on mangroves	***R. filicaulis*** G.N.Stevens
	Lobes not tufted, in rainforest	***R. australiensis*** Nyl.
15(14)	Lobes about 1mm wide, apothecia spurred	***R. exiguella*** Stirt.
	Lobes 2-4mm broad	16
16(15)	Apothecia aligned on both margins	***R. celastri*** var. ***celastri*** (Spreng.) Krog & Swinscow
	Apothecia laminal	17
17(16)	With cryptochlorophaic acid	***R. subfraxinea*** var. ***confirmata*** (**N**yl.) Elix
	With boninic acid	***R. subfraxinea*** var. ***leiodea***. G.N.Stevens

Relicina

A parmelioid genus of moist forests and woodlands. Thallus foliose, green, lobes <2mm broad, margins with bulbate cilia.

1	Lobes isidiate	2
	Lobes without isidia	4
2(1)	Lower surface black (K+ pale y, C+ y-o, P+ y)	***R. planiuscula*** (Kurok.) Hale
	Lower surface brown to dark brown	3
3(2)	Medulla K+ yellow (K-,C+ p, P-)	***R. sydneyensis*** (Gyeln.) Hale
	Medulla K+ yellow turning orange-red (K+ y-r, C-, P+ o)	***R. ramboldii*** Elix & J.Johnst.
4(1)	Lower surface brown to dark brown (K+ y, C-, P+ o)	***R. limbata*** (Laurer) Hale
	Lower surface tan (K-/= pale brown, C-, KC-, P+ o)	***R. sublanea*** (Kurok.) Hale

Rimelia

A parmelioid genus of open forests. Thallus foliose, up to 2cm broad, finely reticulately cracked even on young lobes.

Thallus sorediate (K+ y to r, C-, P+ or-r)	***R. reticulata*** (Taylor) Hale & Fletcher
Thallus without soredia (K+ y to r, C-, P+ or-r)	***R. austrocetrata*** (Elix & J.Johnst.) Hale & Fletcher

Siphula

In Queensland known only from Idalia National Park (semi-arid).

Thallus squamulose or ± fruticose – **Siphula coriacea**

Sticta

A genus of rainforests and their fringes. Thallus foliose, lobes up to 5cm diameter, lower surface cyphellate, variably tomentose.

1	Thallus with a well defined hold-fast	2
	Thallus broadly attached by rhizines	11
2(1)	Thallus with phyllidia	3
	Thallus without phyllidia	4
3(2)	Cyphellae pinpricks	***S. filix*** (Sw.) Nyl.
	Cyphellae with a developed margin and deep cavity	***S. myrioloba*** (Müll. Arg.) D.J.Galloway
4(2)	Lobes isidiate	5
	Lobes without isidia	7
5(4)	Lobes with stalked marginal lobules	***S. marginifera*** Mont.
	Lobes without lobules	6
6(5)	Tips of lobes down-rolled, lobes 5-10mm broad	***S. brevipes*** (Műll. Arg.) Zahlbr.
	Tips of lobes straight, lobes 2-4mm wide	***S. cyphellulata*** (Műll. Arg.) Hue
7(4)	Lobes with stalked marginal lobules	***S. marginifera*** Mont.
	Lobes without lobules	8
8(7)	Lower surface smooth	***S. sayeri*** Műll. Arg.
	Lower surface tomentose at least in part	9
9(8)	Undersurface smooth at the margin	***S. camarae*** Műll. Arg.
	Undersurface totally tomentose	10
10(9)	Tomentum black	***S. subtomentella*** (C.Knight ex Shirley) Zahlbr.
	Tomentum brown	***S. latifrons*** A.Rich.
11(10)	Lobes isidiate	12
	Lobes without isidia	14
12(11)	Medulla K+ yellow	***S. diversa*** (Stirt.) Zahlbr.
	Medulla K-	13
13(12)	Lower surface black	***S. fuliginosa*** (Hoffm.) Ach.
	Lower surface pale	***S. weigelii*** (Ach.) Vain.
14(11)	Lobes without phyllidia	***S caperata*** (Nyl.) Nyl.
	Lobes with phyllidia	15
15(14)	Medulla K+ yellow	***S. rutilans*** (Stirt.) Zahlbr.
	Medulla K-	16
16(15)	Lower surface smooth	***S. variabilis*** Ach.
	Lower surface tomentose at least in part	17

17(16) Thallus on plants, lobes usually >10mm wide ***S. baileyi*** D.J.Galloway
Thallus on soil or rock, lobes usually <5mm wide ***S. martinii*** D.J.Galloway

Teloschistes

From diverse habitats - rainforest canopies to semi-arid woodlands. Thallus fruticose, commonly bright yellow (at least on apothecia), lobes cylindrical and pendant or flattened.

1 Lobes +cylindrical, sometimes pendulous ***T. flavicans*** (Sw.) Norman
Lobes flattened, never pendulous 2

2(1) Lobes without cilia ***T. xanthoroides*** J.S.Murray
Lobes ciliate 3

3(2) Margins of apothecia without cilia ***T. sieberianus*** (Laurer) Hillman
Margins of apothecia ciliate ***T. hypoglaucus*** (Nyl.) Zahlbr.

Thysanothecium

Found in open woodlands, usually associate with charred wood. Thallus of basal granules from which erect, flattened podetia arise with apothecia on one surface

Thysanothecium scutellatum (Fries) D. Galloway

Usnea

A very diverse genus from open forests, mangroves and rainforest fringes. Thallus fruticose, cylindrical, with a strong axis in the centre of the axes surrounded by a looser medulla and compact cortex. Axes range from 1cm to 200 cm long in mature thalli.

1. Medulla K+ 2
Medulla K- 30

2(1) Medulla K+ yellow 3
Medulla K+ yellow turning red 13

3(2) Thallus isidiate 4
Thallus without isidia 11

4(3) Thallus shrubby 5
Thallus pendulous 10

5(4) Medulla pigmented (K+ y) ***U. himantodes*** Stirt.
Medulla white 6

6(5) Thallus branched from the holdfast (K + y or K + y to r) ***U. bismolliuscula*** Zahlbr.
Thallus with a well defined trunk at the base 7

7(6) Trunk red (K+ bright yellow) ***U. rubicunda*** ssp. ***rubicunda*** Stirt.
Trunk pale or dark, not red 8

8(7) Branches without papillae (K+ y to r) ***U. undulata*** Stirt.
Branches papillate 9

9(8) Branches with annular rings of isidiate pseudocyphellae (K+ y)
U. effusa G.N. Stevens
Branches with annular cracks near the tips, and with raised punctiform pseudocyphellae that appear as white spots ***U. alboverrucata*** G.N. Stevens

10(4) Medulla pigmented yellow to brown (K+ y) ***U. himantodes*** Stirt.
Medulla mostly white (K+ y) ***U. hossei*** v. ***hossei*** Vain.

11(3) Thallus shrubby (K+ y to r) ***U. scabrida*** ssp. ***elegans*** G.N.Stevens
Thallus pendulous 12

12(10) Medulla pigmented (K+ y) ***U. himantodes*** Stirt.
Medulla white (K+ y) ***U. hossei*** var ***hossei*** Vain.

13(2) Branches sorediate 14
Branches without soredia 16

14(13) Lobes isidiate ***U. subeciliata*** (Motyka) Swinscow & Krog
Lobes without isidia 15

15(14) Rings of white calcium oxalate encircling punctate soralia (K- or K+ y)
U. pycnoclada Vain.
Soralia large, on terminal branches, without oxalate (K+ y to r) ***U. perplexans*** Stirt.

16(13) Branches isidiate 17
Branches without isidia 24

17(16) Medulla pigmented 18
Medulla white 19

18(17) Axis solid (K+ y to r) ***U. bicolorata*** Motyka
Axis tubular (K+ y to r) ***U. baileyi*** Stirt**.**

19(17) Thallus pendulous (K+ y to r) ***U. nidifica*** Taylor
Thallus shrubby or sub-pendulous (to 15cm long) 20

20(19) Thallus branched from the holdfast (K + y or K + y to r) ***U. bismolliuscula*** Zahlbr.
Thallus with a well defined trunk at the base 21

21(20) Trunk red (K+ y to r) ***U. rubicunda*** var. ***spilota*** (Stirt.) G.N.Stevens
Trunk dark or pale, not red 22

22(21) Pseudocyphellae punctiform with white calcium oxalate deposits (K- or K+ y/ y to r/ b)
U. alboverrucata G.N.Stevens
Pseudocyphellae not appearing as white spots 23

23(22) Branches without papillae(K + y to o-r) ***U. undulata*** Stirt.
Branches papillate (K + y to r) ***U. confusa*** Asahina

24(16) Thallus pendulous 25
Thallus shrubby or sub-pendulous 26

25(24) Branches 5-sided (K+ y to o or r) ***U. angulata*** Ach.
Branches cylindrical (K + y to r) ***U. hossei*** var ***squarrosa*** G.N.Stevens

26(24) Trunk and or part of the thallus coloured red 27
Thallus without red colouration 28

27(26) Apothecia common, terminal on branches (K + y to r)
U. sanguinea Swinscow & Krog
Apothecia not common, on lateral branchlets (K+ y to r)
U. rubicunda var ***spilota*** (Stirt.) G.N.Stevens

28(26) Secondary branches articulated at the base (K + y to r) ***U. confusa*** Asahina
Secondary branches continuous with the main axis 29

29(28) In mangroves (K + y to r) ***U. ramulosissima*** G.N.Stevens & R.W.Rogers
In woodlands other than mangroves (K + y to r)
U. mollisucula ssp ***queenslandica*** (Motyka) G.N.Stevens

30(1) Thallus sorediate 31
Thallus without soredia 33

31(30) Thallus without isidia (K-) ***U. pycnoclada*** Vain.
Thallus isidiate 32

32(31) Cortex pigmented red in part (K-) ***U. roseola*** Vain.
Cortex without red pigmentation (K+ y to o or K-)
U. subeciliata (Motyka) Swinscow & Krog

33(30) Thallus isidiate 34
Thallus without isidia 41

34(33) Medulla pigmented 35
Medulla white 37

35(34) Thallus pendulous, axis solid (K-) ***U. mekista*** (Stirt.) D.D.Awasthi

Thallus shrubby to sub-pendulous, axis hollow 36

36(35) Medulla pink (K-) ***U. elata*** Motyka
Medulla dark brown (K-) ***U. eizanensis*** Asahina

37(34) Thallus shrubby 38
Thallus pendulous or sub-pendulous (K+ y to r or K-) ***U. nidifica*** Taylor

38(37) Thallus with patchy red pigmentation (K-) ***U. maculata*** Stirt.
Thallus not pigmented red 39

39(38) Pseudocyphellae punctiform with white calcium oxalate deposits (K-)
U. alboverrucata G.N.Stevens
Thallus without white spots 40

40(39) Apices simple, tapering (K-) ***U. inermis*** Motyka
Apices commonly bifurcate (K-) ***U. punctulata*** G.N.Stevens

41(33) Axes not papillate (K- or K+ y to o) ***U. trichodeoides*** Motyka
Axes papillate (K-) ***U. elixii*** G.N.Stevens

Xanthoparmelia

A very large parmelioid genus restricted to rocks and soils mostly in dry, sunny habitats. Thallus foliose, upper cortex green, grey or brown, lobes truncate, lower surface rhizinate to margins.

Key to sections

1.	Upper surface grey, K+ yellow	**Section 1**
	Upper surface brown or yellow-green to green, K-	2
2.	Upper surface brown	**Section 4**
	Upper surface yellow-green to green	3
3	Thallus isidiate	**Section 2**
	Thallus without isidia	**Section 3**

Section 1

Upper cortex grey (*Paraparmelia*)

1.	Lobes isidiate	2
	Lobes without isidia	8
2(1)	Lower surface mostly jet black	3
	Lower surface entirely brown	7
3(2)	Medulla K+ yellow turning red	4
	Medulla K- or K+ pale yellow to brown (K+ pale y-b, C-, P+ r)	***X. fumarprotocetrarica*** (Elix & J. Johnst.) Elix
4(3)	Lobes up to 1mm wide (K+ y-r, C-, P+ r / or)	***X. subtropica*** (Elix & J. Johnst.) Elix
	Lobes 1-3mm wide	5
5(4)	Medulla K+ blood red (K+ y, C-, P+ y)	***X. murina*** (Kurok.) Elix
	Medulla K+ pale red-orange (K+ y-r, C-, P-)	***X. numinbahensis*** (Elix & J. Johnst.) Elix
7(2)	Medulla K+ yellow turning blood red (K+ y-r, C-, P+ y-or)	***X. scotophylla*** (Kurok.) Elix
	Medulla K+ yellow turning orange- red (K+ y-r, C-, P-)	***X. neoquintaria*** (Hale) Elix
8(1)	Lower surface mostly black	9
	Lower surface brown	13
9(8)	Medulla K+ yellow turning red	10
	Medulla K- or K+ pale yellow-brown	11
10(13)	Lower surface brown at the margin (K+ y-r, C-, P+ y-or)	***X. lithophila*** (Kurok.) Elix
	Lower surface black at the margin (K-r, C-, P+ o)	***X. subspodochroa*** (Elix & J. Johnst.) Elix
11(9)	Lobes <1mm wide (K-, C-, KC-, P-)	***X. mongaensis*** (Elix) Elix
	Lobes 1-3mm wide	12
12(11)	Lobes strongly overlapping on the edges (K+ pale y-b, C-, P+ r)	***X. roderickii*** (Elix & J. Johnst.) Elix
	Lobes not or barely overlapping (K+ pale y-b, C-, P+ r)	***X. rugulosa*** (Elix & J. Johnst.) Elix
9(8)	Medulla K+ yellow turning red	10
	Medulla K- or K+ pale yellow-brown	11
10(13)	Lower surface brown at the margin (K+ y-r, C-, P+y-or)	***X. lithophila*** (Kurok.) Elix
	Lower surface black at the margin (K-r, C-, P+ o)	

X. subspodochroa (Elix & J. Johnst.) Elix

11(9) Lobes <1mm wide (K-, C-, KC-,P-) ***X. mongaensis*** (Elix) Elix
Lobes 1-3mm wide 12

12(11) Lobes strongly overlapping on the edges (K+ pale y-b, C-, P+ r)
X. roderickii (Elix & J. Johnst.) Elix
Lobes not or barely overlapping (K+ pale y-b, C-, P+r)
X. rugulosa (Elix & J. Johnst.) Elix

Section 2

Upper cortex yellow to green, isidiate.

1 Lower surface black 2
Lower surface brown 8

2(1) Medulla K- ***X. thamnoides*** (Kurok.) Hale
Medulla K+ yellow or yellow turning orange 2

3(2) Medulla K+ yellow ***X. mougeotina*** (Nyl.) D.J.Galloway
Medulla K+ yellow turning red 4

4(3) Medulla KC+ red 5
Medulla KC- 7

5(4) Lobes >2mm broad (K+ y-r, C-, KC+ r, P+ o) ***X. australasica*** D.J.Galloway
Lobes 1-2mm broad 6

6(5) Isidia simple (K+ y-r, C-, P+ o) ***X. isidiigera*** (Műll. Arg.) Elix
Isidia branched (K+ y-r, C-, KC+ r, P+ o) ***X. isidiosa*** Elix & J. Johnst.

7(4) Lobes <1mm broad (K+ y-r, C-, P+ y) ***X. filsonii*** Elix & J. Johnst.
Lobes >2mm broad (K+ y-r, C-, KC-, P+ y) ***X. neotinctina*** (Elix) Elix & J. Johnst.

8(1) Medulla K- or K+ pale yellow turning brown 9
Medulla K+ yellow turning red 25

9(8) Isidia inflated to erumpent 10
Isidia cylindrical, never erumpent 20

10(9) Lobes <1mm broad 11
Lobes more than 1mm broad 16

11(10) Lower medulla patchy orange (K-, C-, KC-, P-) ***X. zonata*** Elix & J. Johnst.
Medulla white in total 12

12(11) Medulla KC+ pink 13
Medulla KC- 15

13(12) Isidia cylindrical, coralloid ***X. orchardi*** Elix
Isidia globular to cylindrical, not branched 14

14(13) Lobes to 0.4mm wide, isidia globose (K-, C-, KC-, P-) ***X. mayrhoferi*** Elix
Lobes to 0.7mm wide, isidia globose to cylindrical ***X. maccarthyi*** Elix

15(12) Isidia commonly erumpent, with colensoic acid (K-, C-, KC-, P-)
X. ballingalliana Elix & J. Johnst.
Isidia rarely erumpent, with constipatic acid (K-, C-, KC-, P-)

X. globulifera (Kurok. & Filson) Hale

16(10) Medulla KC+ rose (K-, C-, P-) ***X. scabrosa*** (Taylor) Hale
Medulla KC- 17

17(16) Thallus loosely adnate (K-, C-, KC-, P-) ***X. exuviata*** (Kurok.) Hale
Thallus closely adnate 18

18(17) Lobes <2mm broad, isidia rarely erumpent (K-, C-, KC-, P-)
X. remanens (Elix) Elix & J. Johnst.
Lobes up to 3mm broad, isidia mostly erumpent 19

19(18) Containing scabrosins ***X. weberiella*** Elix
Without scabrosins (K-, C-, KC-, P-) ***X. weberi*** (Hale) Hale

20(9) KC+ rose 21
Medulla KC- 23

21(20) Growing on soil (K-, C-, KC+ p, P-)
X. constipata (Kurok. & Filson) Elix & J. Johnst.
Growing on rock 22

22(21) Lobes <1mm broad (K-, C-, KC+ p, P-) ***X. exillima*** (Elix) Elix & J. Johnst.
Lobes 0.8 – 3.0mm broad (K-, C-, KC+ p, P-) ***X. amplexula*** (Stirt.) Elix & J. Johnst.

23(20) Thallus completely foliose (K-, C-, K-, P-) ***X. blackdownensis*** Elix & J. Johnst.
Thallus subcrustose at least in the centre 24

24(23) Isidia globular becoming cylindrical (K-, C-, KC-, P-) ***X. immutata*** Elix & J. Johnst.
Isidia always cylindrical (K-, C-, KC-, P-) ***X. nonreagens*** Elix & J. Johnst.

25(8) Thallus crustose (K y-r, C-, KC-, P+ y)
X. praegnans (Elix & P.M.Armstr.) Elix & J. Johnst.
Thallus lobate 26

26(25) Lobes >1.5mm broad (K y-r, C-, KC-, P+ o) ***X. mexicana*** (Gyeln.) Hale
Lobes up to 1.5mm broad 27

27(26) Isidia globose ***X. barthlottii*** Elix & U.Becker
Isidia cylindrical 28

28(27) Thallus adnate to loosely adnate ***X. microcephala*** Elix & Kantvilas
Thallus tightly adnate to subcrustose 29

29(28) Isidia to 3mm tall (K+ y-r, C-, KC-, P+ y) ***X antleriformis*** Elix & J. Johnst.
Isidia to 0.5mm tall (K+ y-r, C-, KC-, P+ y)
X. streimannii (Elix & P.M.Armstrong) Elix & J. Johnst.

Section 3

Upper cortex yellow to green, without isidia

1. Lower surface black 2
Lower surface cream to brown 12

2(1) Medulla K- (C-, KC-, P-) ***X. notata*** (Kurok.) Hale
Medulla K+ yellow or yellow turning red 3

3(2) Medulla K+ yellow 4
Medulla K+ yellow turning red 7

4(3) Lobes <1mm broad (K y to b, C-, P+ o-r) ***X. pseudohypoleia*** (Elix) Elix & J. Johnst.
Lobes 1-3mm broad 5

5(4) Thallus very loosely adnate, sometimes mat-forming (K+ y to b, C-, P+ o/r)
X. rogersii Elix
Thallus adnate, not mat forming 6

6(5) Upper surface strongly white-spotted (K y to b, C-, P+ o-r) ***X. yowaensis*** Elix & J.Johnst.
Upper surface not white-spotted (K y to b, C-, KC-, P+ r)
X. hypomelaenoides Elix & J. Johnst.

7(3) Lobes up to 1mm broad 8
Lobes 1-5mm broad 9

8(7) Medulla P+ orange-red (K y to r, C-, P+ o) ***X. rubireagens*** (Gyeln.) Hale
Medulla P+ yellow-orange(K y to r, C-, P+ y) ***X. subnuda*** (Kurok.) Hale

9(7) Secondary lobes formed in the centre, on soil (K y to r, C-, P+ y-o) ***X. versicolor*** Hale
Without secondary lobes, on rock 10

10(9) Lobes 2-5mm broad, very loosely adnate(Ky-r, C-, P+or-r)
X. tasmanica (Hook. f. & Tayl.) Hale
Lobes 1-3mm broad, adnate 11

11(10) Medulla P+ orange-red (salazinic acid), not mat forming (Ky-r, C-, P+or-r)
X. incerta(Kurok. & Filson) Elix & J. Johnst
Medulla P+ yellow-orange (norstictic acid), mat forming (Ky-r, C-, P+y-o)
X. congesta (Kurok. & Filson) Elix & J.Johnst.

12(1) Medulla K- 13
Medulla K+ yellow or yellow turning red 24

13(12) Medulla KC+ yellow or rose 14
Medulla KC- 21

14(13) Medulla KC+ yellow 15
Medulla KC+ rose 16

15(14) Medulla pigmented (K-, C-, P-) ***X. boonahensis*** Elix & J. Johnst.
Medulla white (K-, C-, P-) ***X. barbatica*** (Elix) Egan

16(14) Thallus closely adnate (K-, C-, P-) ***X. filarszkyana*** (Gyeln.) Hale
Thallus loosely adnate 17

17(16) On soil, with secondary lobes near the centre (K-, C-, KC+p, P-)
X. eilifii Elix & J.Johnst.
On rock, without secondary lobes in the centre 218

18(17) Upper surface strongly white-spotted (K-, C-, KC+ p, P-)
X. metamorphosa (Gyeln.) Hale
Upper surface not white-spotted 19

19(18) Lower surface without rhizines, rolling into a ball when dry
(*Chondropsis*) (Kb, C-, P+ r) ***X. semiviridis*** (F. Muell. ex Nyl.) Elix
Lower surface with rhizines, not rolling when dry 20

20(19) Lobes 0. 3– 1.5mm broad, tapering uniformly (K-, C-, P-)
X. furcata (Műll. Arg.) Hale
Lobes 1.5 – 3.0mm broad, of irregular width (K-, C-, P-)
X. flavescentireagens (Gyeln.) D.J.Galloway

21(13) Thallus closely adnate ***X. ustulata***
Thallus loosely adnate 22

22(21) On rock (K-, C-, P-) ***X. spargenosa*** Elix & J. Johnst.
On soil 25

23(22) Upper and lower surface green, concolorous, lobes often tangled (Kfaint y, C-, KC-, P+y - o) ***X. willisii*** (Kurok. & Filson) Elix & J.Johnst.
Lower surface pale brown, with secondary lobes at the centre (K-, C-, P-)
X. condaminensis Elix & J.Johnst.

24(12) Medulla K+ yellow 25
Medulla K+ yellow turning red 26

25(24) Thallus closely adnate, on rock (K+ pale y - b, C-, KC-,P+ o-r)
X. pertinax (Kurok. & Filson) Elix & J.Johnst.
Thallus loosely adnate, on soil (K+ pale y - b, C-, KC-, P+ y)
X. reptans (Elix) Elix & Johnst.

26(24) Thallus very closely adnate 27
Thallus loosely adnate 28

27(26) Thallus subcrustose at the centre (K+ y to r, C-, KC-, P+ y - o)
X. neorimalis (Elix & P.Armstr.) Elix & T.H.Nash
Thallus foliose at the centre (K+ y to r, C-, KC-, P+ y) ***X. lineola*** (E.C.Bery) Hale

28(26) On soil, with secondary lobes at the centre (K+ y to r, C-, KC+ r, P+ o)
X. taractica (Kremp.) Hale
On rock, without secondary lobes 29

29 (28) Rhizines dichotomously branched (K+ y to r, C-, P+ o) ***X. substrigosa*** (Hale) Hale
Rhizines simple (K+ y to r, C-, P+ y) ***X. arapilensis*** (Elix & P.Armstr.) Filson

Section 4

Upper cortex brown (*Neofuscelia*)

1. Medulla K+ yellow turning red (K+ y to o, C-, KC-, P+ o-r) ***X. parviloba*** (Essl.) O.Blanco, A. Crespo, Elix, D.Hawksw. & Lumbsch
Medulla K- 2

2(1) Lobes dark brown beneath (K+- or k+ b, C+ y or p, KC+ o, P-) ***X. delisii*** (Duby) O.Blanco, A. Crespo, Elix, D.Hawksw. & Lumbsch
Lobes black beneath 3

3(2) Medulla C+ rose (K- , C- or C+ p, KC+p , P-, UV+) ***X. glabrans*** (Nyl.) O.Blanco, A. Crespo, Elix, D.Hawksw. & Lumbsch
Medulla C- 4

4(3) Medulla KC- (K- , C- , KC-, P-, UV-) ***X. pulla*** O.Blanco, A. Crespo, Elix, D.Hawksw. & Lumbsch
Medulla KC+ (K- , C-, KC+p , P-, UV+) ***X. verisidiosa*** O.Blanco, A. Crespo, Elix, D.Hawksw. & Lumbsch

C. Squamulose lichens in Subtropical Queensland

Key to Genera

1.	Photobiont a cyanobacterium	2
	Photobiont green	4
2(1)	Asci with 16 or more spores	***Peltula***
	Asci with 8 spores	3
3(2)	Spores simple	***Heppia***
	Spores septate	***Placynthium***
4(1)	Ascocarps perithecia	5
	Ascocarps not perithecia	6
5(4)	Thick rhizines present below, spores muriform	***Endocarpon***
	Fine rhizoids present below, spores simple	***Placidium***
6(5)	Spores septate	7
	Spores simple	8
7(6)	Spores brown	***Buellia***
	Spores hyaline	***Toninia***
8(7)	Apothecia erumpent	***Trapelia***
	Apothecia sessile or adnate	9
9(8)	On bark in moist forests	10
	On soil bark or wood	12
10(9)	Squamules fringed or finely lacerate, often imbricate, usually dark coloured	***Phyllopsora***
	Squamules more or less entire, grey to green	11
11(10)	Squamules orbicular to auriculate, pale grey, scattered, never fertile, always K-, C, P-	***Normandina***
	Squamules elongate, grey to green, bearing pseudopodetia at maturity, often K+ or C+ or P+	***Cladonia***
12(9)	Squamules elongate, free at the tip, apothecia on pseudopodetia	***Cladonia***
	Squamules more or less umbilicate, orbicular, apothecia sessile	13
13(12)	Squamules green, apothecia with a thalline margin	***Ramalinora***
	Squamules pink-brown or grey, apothecia with a proper margin or none	***Psora***

Key to Species

Buellia

A mostly crustose genus with one squamulose species on soil in Queensland.

Squamules white, often convex ***Buellia subcoronata*** (Müll.Arg.) Malme

Cladonia

A genus in which squamules from an initial growth and later produce podetia bearing apothecia.
Identification of sterile squamules is not currently practicable.
See key to fruticose species.

Endocarpon

A genus of squamulose lichens mostly on soil, with immersed perithecia, grey to dark brown thalli and well developed rhizines below.

1.	Squamules with black margins	2
	Margins of squamules concolorous	3
2.	Asci with one spore	***E. simplicatum*** var ***simplicatum*** (Nyl.) Nyl.
	Asci with two spores	***E. simplicatum*** var ***bispora*** P.M.McCarthy
3.	Squamules pale below	4
	Squamules dark below	5
4.	Squamules pruinose when young, stellate lobate	E***. rogersii*** P.M.McCarthy
	Squamules epruinose, entire to lobed	***E. pallidum*** Ach.
5.	Squamules 3-12mm broad, spores 1 per ascus	***E. aridum*** P.M.McCarthy
	Squamules 1-3mm broad, spores 2 per ascus	***E. pusillum*** Hedw.

Heppia

A genus of to sub-foliose lichens mostly from arid soils, with immersed apothecia one or several per squamule.

Heppia lutosa (Ach.) Nyl

Normandina

A genus of sterile light grey orbicular squamules found on bark in damp environments.

Normandina pulchella (Borrer) Nyl.

Peltula

Thallus of variable squamules, usually olive in colour but one yellow, on soil and rocks in arid locations.

1.	Thallus growing on soil	2
	Thallus growing on rock	3
2.	Thallus yellow	*P. radicata*
	Thallus olive	*P. patellata*
3.	Thallus sorediate	*P. euploca*
	Thallus without soredia	4
4.	Thallus more or less erect, club-shaped	*P. clavata*
	Thallus squamulose or areolate	5
5.	Thallus more or less crustose	*P. placodizans*
	Thallus squamulose to peltate	6
6.	Thallus peltate, distinctly stalked	*P. omphaliza*
	Thallus squamulose to subfruticose, not stalked	*P. obscurans*

Phyllopsora

Small finely divided squamules bearing inconspicuous apothecia. Species from Queensland are poorly understood.

Placynthium

A genus of inconspicuous rock and soil surface lichens with septate spores

Placynthium nigrum (Huds.) Gray

Psora

A genus of squamulose lichens with sessile to adnate apothecia.

Thallus pink-brown, apothecia marginal,upper surface smooth or irregularly cracked, with fine rhizoids below ***P. crenata*** (Taylor) Reinke
Thallus grey, apothecia laminal, upper surface regularly crystalline, with thick rhizines below ***P. crystallifera*** (Taylor) Müll. Arg.

Ramalinora

Endemic to Queensland and found on exposed red earths in moist areas.

Ramalinora glaucescens (Müll. Arg.) Lumbsch, Rambold & Elix

Toninia

Thallus of small bullate squamules, often blue-grey pruinose and reticulate. On arid soils.

Spores 3 septate	***T. aromatica*** (Sm.) A.Massal.
Spores 1 septate	***T. sedifolia*** (Scop.) Timdal

Trapelia

A genus of small squamulose lichens on arid soils, with erumpent apothecia.

Trapelia coarctata (Sm.) M.Choisy in Wern.

Glossary

Apothecium	Reproductive body having an open disc with a layer of asci and sterile structures. The disc of the apothecium may have a distinct margin that is said to be *thalline* (or lecanorine) if it has algae in its tissue and *proper* (or lecideine) if it does not.
Axil	The angle made where one branch gives rise to another
Axis	A major elongate strand of a *fruticose* lichen.
b	Brown (of chemical reactions)
Bulbate Cilia	Cilia with an onion shaped bulb at the base where they arise from the margin of a lobe.
C	Medullary reaction to an aqueous solution of calcium hypopchlorite
Capitate	A sub-globular head-like shape.
Cartilagenous	Having the structure of cartilage; tough.
Cephalodia	structures housing cyanobacteria within a lichen that otherwise has a green algal photobiont. Cephalodia may be on the thallus surface or embedded within it.
Cilia	A coarse hair-like structure growing on the margin or upper surface of lobes or on *apothecia*.
Cortex	A developed layer of compact fungal tissue enclosing other lichen tissues.
Crustose	A thallus with the lower surface without a developed cortex, and the lower surface inseparable from the substratum.
Cyanobacteria	Blue-green algae: photosynthetic bacteria.
Cyphellae	Pores in the lower surface of lichens that are cup-shaped and have a distinct, well developed margin. (cf *pseudocyphellae*)
Dactyls	Finger-like protrusions on the upper *cortex* of a lichen that may burst or become *sorediate*. Dactyls do not have an abscission layer at their base (cf *isidia*)
Erumpent	Bursting at the tip, especially of *dactyls* and *isidia*.
Foliose	Leafy; a *thallus* that is flat and thin with pronounced differences between the upper and lower surface, usually more-or-less attached to the substrate along the length of the lobes. (cf *fruticose, crustose*)
Fruticose	Shrubby; a thallus that has little or no dorsiventral differentiation, *lobes* or *axes* with radial symmetry; usually attached only by a *holdfast*. (cf *foliose, crustose*)
Holdfast	A tough structure attaching a lichen thallus to its substrate at a single point.
Hyphae	Fine strands of fungus
Inflated	Swollen, with loosely packed internal *hyphae* or hollow.
Isidia	Tiny cylindrical, coral-like or globular structures on thalli that have a developed cortex-like outer layer; serve as reproductive bodies. Isidia have an abscission layer at their base. (cf *dactyls*)

K	Medullary Reaction to potassium hydroxide (of chemical reactions)
KC	Medullary Reaction to potassium hydroxide followed by calcium hypochlorite Medullary Reaction to potassium hydroxide (of chemical reactions)
Lobes	Major individual portions of the *thallus*.
Lobules	Small lobe-like structures that may grow on the margin or upper surface of a *lobe*.
Marginal	On the edge of the *thallus* where upper cortex meets the lower *cortex*.
Medulla	A cottony tissue within a lichen, devoid of algae.
Muriform	Of spores - having longitudinal and transverse septa.
o	Orange Medullary Reaction to potassium hydroxide (of chemical reactions)
P	Medullary reaction to a fresh alcoholic solution of paraphenylene diamine (of chemical reactions)
p	Pink (of chemical reactions)
Papilla	A small pimple-like swelling on a lobe or axis.
Pendulous	Hanging.
Photobiont	The photosynthetic organism that provides energy for the lichen. These are either green algae (often *Trebouxia* or a close relative) or cyanobacteria (commonly *Nostoc*).
Phyllidia	Small lobule-like structures that occur on the lobe margin or *upper cortex* of some lichens.
Pseudocyphellae	Openings through the upper or lower *cortex* of a lichen, the pores not having a developed margin (cf *cyphellae*). Pseudocyphellae may be pinprick size, small irregular pores or elongate crack-like structures that penetrate the upper or lower *cortex*. They are evident on young lobes and should not be confused with cracks that come with age or fine reticulate cracks that sometimes occur as a function of cortical structures.
Pustulate	Bursting open, sometimes to produce *soredia*.
Pustules	Small eruption in a surface.
r	red (of chemical reactions)
Rhizines	Well-developed organs of attachment on the lower surface of a foliose lichen. These may be simple (unbranched), irregularly branched, dichotomously branched or terminate in a bushy branching system.
Rotund	With a broadly rounded end (cf *truncate*).
Secondary lobes	Small lobes that grow from the centre of an older *thallus*.
Septate	Of spores - having dividing walls.
Soralia	Aggregates of s*oredia* to form powdery masses.
Soredia	Small clusters of algal cells entangled in fungal hyphae to from granules.

Squamule	A scale-like structure.
Squamulose	Made of scale-like structures.
Striate	Having fine lines, rather like fine scratches.
Thallus	A term used loosely here to indicate the main photosynthetic body of the lichen, including podetia (in *Cladonia*) and pseudopodetia (in *Cladia*)
Tomentum	A layer of hair-like structures other than discrete *rhizines*.
Truncate	The ends (usually of lobes) squared, having the appearance of having been cut of at right angles to the lobe axis (cf *rotund*).
UV	Response of cortex to UV light
y	Yellow (of chemical reactions)