

KEYS TO THE LICHENS OF CHINA

COMPILED AND WRITTEN BY

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INTRODUCTION

Prior to the publication of *An Enumeration of Lichens in China* (Wei, 1991) there was no summary of the scattered references to Chinese lichens. The identification of lichens from that large country was very difficult because of the lack of keys. This set of keys is presented as a first step in filling this gap.

In most cases the genera and species included in these keys are based on Wei (1991). A few species have been added based on more recent collections deposited in MIN and HMAS-L. Many additional species will certainly be found as more collecting is done.

The first preliminary keys were prepared in 1994 by Zuowu Yao and Clifford Wetmore using collections in MIN supplemented with literature descriptions of species not in that herbarium. Keys for the few genera that had published revisions for China were incorporated as published. Wetmore then revised all keys and added keys to additional genera by revising published keys to include only the known Chinese species. In some genera a few species are not keyed out because of the lack of adequate descriptions and specimens. These additional species are listed at the end of the key. Some of the large genera could not be included at this time and are noted by "Not treated". Some of the nomenclature was revised in 2003 by Wetmore.

Because of the incomplete knowledge of the species in China, one should use great caution when using these keys. There will be many additional species not in the keys and all identifications based on these keys should be confirmed by comparison with reliably identified herbarium material.

The authors would appreciate receiving corrections and additions for future versions of the keys.

In the index in the K column "x" indicates a key is included, in the C column C= crustose, F= fruticose, L= foliose, S= squamulose, in the Sp column is the number of species reported from China for that genus.

LIST OF GENERA

The species count is according to Wei 1991.

- K C Sp
- C 26 . ACAROSPORA (p 20)
- x F 1 . ACROSCYPHUS p 10
- x C 6 . ALECTORIA p, 25
- C 2 ALLARTHONIA See Arthonia
- C 1 ALLARTHOTHELIUM See Arthothelium
- x C 2 AMYGDALARIA p, 25
- x L 9 . ANAPTYCHIA p 25
- x C 1 . ANEMA p 16
- C 1 . ANISOMERIDIUM
- C 6 . ANTHRACOTHECIUM (p 19)
- x L 8 . ANZIA p, 26
- x L 2 ARCTOPARMELIA p, 26
- C 14 . ARTHONIA (p 24)
- C 5 . ARTHOPYRENIA
- C 3 . ARTHOTHELIUM
- x L 1 . ASAHINEA p 14
- C 48 . ASPICILIA (p 25)
- C 1 ASTEROTHYRIUM
- C 2 ASTROTHELIUM
- C 26 BACIDIA (p 26)
- x C-F 8 BAEOMYCES p, 26
- C 1 BELLEMERA (23)
- C 3 BIATORELLA (p 21)
- x C 6 BLASTENIA See Caloplaca p 28
- x L 1 BOTRYDINA p 13
- x C 1 BRIGANTIAEA p 21
- x F 1 BRYOCAULON p 10, p 11
- x F 10 BRYORIA p, 27
- C 26 BUELLIA (p 22)
- C 2 BUELLIASTRUM
- x L 4 BULBOTHRIX p 28 ← Bundophoron p 76
- C 1 BYSSOLECANIA
- x C 1 BYSSOLOMA p 24
- C 2 CALICIUM
- x C 42 CALOPLACA p, 28
- x C 2 CALOPADIA p, 35
- x L 2 CANDELARIA p, 35
- C 6 CANDELARIELLA
- x L 1 CANOPARMELIA See Parmelia sens. lat.
- C 2 CARBONEA
- S 12 CATAPYRENIUM p 13
- C 14 CATILLARIA (p 24)

- x C 1 CATINARIA p24
- x C 1 CATOLECHIA p17
- x L-F2 CETRARIA p.35
- x L 1 CETRARIOPSIS See Cetraria
- x L 13 CETRELIA p.38
- x L 1 CETRELIOPSIS See Cetrelia
- x C 3 CHAENOTHECA p39
- x C 3 CHIODECTON p.39
- x C 2 CHRYSOTHRIX p.39
- x F 1 CLADIA p9
- x F 9 CLADINA p39
- C-F83 CLADONIA
- x L 5 COCCOCARPIA p40
- C 1 COCCOTREMA
- x F 1 COELOCAULON p10
- L 2 COENOGONIUM p12, 23
- x L 21 COLLEMA p.40
- C 2 CROCYNIA
- x F 3 DACTYLINA p.42 *Cryptohelia p39*
- x F 1 DENDRISCOCAULON p9
- x L 7 DERMATOCARPON p.42
- C 3 DICTYONEMA p15
- x C 1 DIMELAENA p22
- x C 2 DIMERELLA p43
- C 1 DIPLOICIA
- C 8 DIPLOSCHISTES (p22)
- x C 1 DIPLATOMMA p22
- x L 6 DIRINARIA -p43
- C 2 ECHINOPLACA
- x S 4 ENDOCARPON p.43
- x F 2 EPHEBE p44
- x L 1 ERIODERMA p15
- x F 3 EVERNIA p44
- x F-L8 EVERNIASTRUM p44
- C 2 FELLHANERA
- x L 1 FLAVOPARMELIA p59
- x L 2 FLAVOPUNCTELIA p45
- x S 1 FULGENSIA p12
- C 3 FUSCIDEA *Furcillaria de Parmelia (58)*
- C 1 GLOSSODIUM
- C 1 GLYPHIS p18
- x L 2 GLYPHOLECIA p46
- F 2 GONOHYMENIA p9, p14
- C 28 GRAPHINA (46)
- C 53 GRAPHIS (45)
- x C 1 GYALECTA p24
- x C 1 GYALECTIDIUM p21

- x L 2 GYMNODERMA p 46
- x C 1 GYRSTOMUM p 18
- x C 3 HAEMATOMMA p 46
- C 3 HAPLODINA
- x S 1 HEPPIA p 46
- L-F 36 HETERODERMIA (p 11)
- C 1 HYMENELIA
- x L 2 HYPERPHYSICA p 47
- S HYPOCENOMYCE (p 17)
- x L 31 HYPOGYMNA p 47
- x L 13 HYPOTRACHYNA p 49
- C 1 ICMADOPHILA
- C 3 IONASPIS
- C JULELLA (p 19)
- x L 10 LASALLIA p 50
- C 4 LECANACTIS (p 24)
- C 3 LECANIA (p 24)
- C 63 LECANORA
- C 40 LECIDEA (p 23)
- C 6 LECIDELLA
- C 1 LECIDOMA
- C 2 LEPRARIA p 16
- x F 4 LEPROCAULON p 51
- x C 1 LEPROPLACA p 16
- x L 17 LEPTOGIUM p 51
- C 1 LEPTOPTERYGIUM
- C 1 LEPTOTREMA See Thelotrema
- x F 5 LETHARIELLA p 52
- x C 1 LETROUITIA p 21
- C 1 LIMBORIA
- x L 27 LOBARIA p 53
- x C 2 LOPADIUM p 54
- C 1 MARONEA p 21
- x C 4 MAZOSIA p 54
- C 2 MEGALARIA
- x L 1 MEGALOPSORA p 54
- x C 2 MEGALOSPORA p 54
- C 1 MEGASPORA
- x L 9 MELANELIA p 55, (36)
- C 1 MELANOLECIA (p 19)
- C 2 MELANOTHECA
- x C 1 MELASPILEA p 24, 46
- x L 2 MENEGAZZIA p 55
- C 2 MICAREA
- C 1 MIRIQUIDICA
- C 1 MOSIGIA
- x C 3 MYCOBLASTUS p 55

- x C 1 MYCOMICROTHERIA p 19
- C 2 MYCOPORELLUM (p 20)
- x C 2 MYRIOTREMA p 56, 81
- x L 2 NEOFUSCELIA p 56
- x L 9 NEPHROMA p 56
- L 9 NEPHROMOPSIS See Cetraria
- x L 1 NORMANDINA p 13
- x C 1 OCELLULARIA See Myriotrema p 21
- x C 11 OCHROLECHIA p 57
- C 5 OPEGRAPHIA (24, 46)
- C 2 OPHIOPARMA See Haematomma p 46
- F 3 OROPOGON
- x L 9 PANNARIA p 57
- x L 1 PANNOPARMELIA p 13
- C 1 PARAPORPIDIA
- x L 29 PARMELIA 58 + 59
- x L 1 PARMELIELLA p 15
- x L 19 PARMELINA p 61
- L 2 PARMENTARIA (p 19)
- x L 33 PARMOTREMA p 62
- x F 2 PECCANIA p 65
- x L 26 PELTIGERA p 65
- x S 8 PELTULA p 67
- C 44 PERTUSARIA (p 23)
- C 18 PHAEOGRAPHINA (46)
- C 18 PHAEOGRAPHIS (45)
- x L 16 PHAEOPHYSCIA p 68
- x C 1 PHLYCTIS p 72
- x S 2 PHYLLISCUM p 69
- C 3 PHYLLOPSORA p 17
- x L 22 PHYSCIA p 69
- x L 1 PHYSCIELLA See Phaeophyscia
- x L 9 PHYSCONIA p 71
- L 5 PHY SMA p 15
- x F 3 PILOPHORUS p 72
- C 1 PLACOLECIS
- C 2 PLACOPSIS
- x L 5 PLATISMATIA p 72
- C 1 PLEUROTHELIOPSIS
- C 3 POLYBLASTIA (p 19)
- C 2 POLYBLASTIOPSIS See Julella (p 20)
- C 10 PORINA (p 20)
- C 9 PORPIDIA
- C 5 PROTOBLASTENIA p 23
- x C-F 1 PSEUDOBAEOMYCES See Baeomyces
- x L 5 PSEUDOCYPHELLARIA p 72
- x L 1 PSEUDOPARMELIA p 59

L 4 PSEUDOPYRENULA (p20)
 S 5 PSORA
 x L 2 PSOROMA p73
 C 6 PSOROTICHIA p16
 x S 1 PSORULA p13,19
 x L 3 PUNCTELIA p73
 C 1 PYRENOCOLLEMA
 C 19 PYRENULA (p19)
 x L 10 PYXINE p73
 F 32 RAMALINA
 x L 8 RELICINA p74
 C 18 RHIZOCARPON
 x C-L 6 RHIZOPLACA p75
 C 24 RINODINA
 x L 1 RIMELIA
 F 2 ROCCELLA
 C 3 SARCOGRAPHIA
 C SARCOGRAPHINA (p22)
 x C 5 SARCOGYNE p75
 x C 1 SCHISMATOMMA p24
 C 1 SCLEROPHYTON
 x C 1 SCOLICIOSPORUM p20
 x F 1 SIPHULA p10
 S 1 SOLENOPSORA
 x L 6 SOLORINA p76
 x F 6 SPHAEROPHORUS p76
 x C 2 SPORASTATIA p76
 C 2 SPOROPODIUM
 S 9 SQUAMARINA
 C 9 STAUROTHELE (p19)
 C 1 STENHAMMARELLA
 x F 25 STEREOCAULON p76
 x L 16 STICTA p78
 x C 4 STRIGULA p80
 x F 2 SULCARIA p86
 x C 1 TAPELLARIA p21
 x F 4 TELOSCHISTES p80
 C 1 TEPHROMELA
 x F 2 THAMNOLIA p81
 x C 1 THELENELLA p19
 C 5 THELOTREMA p81,
 C 2 THROMBIUM (p18)
 x F 3 THYREA p81
 S 5 TONINIA p17
 C 1 TORNABENIA
 C 2 TRAPELIA (p23)
 C 2 TRAPELIOPSIS

- C 2 TRICHARIA (p22)
- x C 1 TRICHOHELUM p19
- C 1 TRYPETHELIOPSIS
- C 3 TRYPETHELIUM (p20)
- x L 5 TUCKERMANNOPSIS See Cetraria
- x C 2 TYLOPHORON p81
- x L 31 UMBILICARIA p81
- F 85 USNEA
- C 29 VERRUCARIA (p18)
- x L 26 XANTHOPARMELIA p85
- x L 10 XANTHORIA p88

Fruticose lichens

Note: The number in parenthesis is the species number.

- 1. Thallus and apothecia(if present) orange, K+ purple (parietin) Teloschistes(4) *p 80*
- 1. Thallus gray, white, brown or yellowish green 2
 - 2. Algae blue-green; thallus minutely fruticose 3
 - 2. Algae green 7
- 3. Thallus not black; spores septate Dendriscoaulon bolacinum
- 3. Thallus black; spores simple 4
 - 4. Thallus, hair-like, fragile, tufted, on rocks; asci with 16 spores Ephebe(2) *p 44*
 - 4. Thallus thicker, not hair-like 5
- 5. Terminal branches of thallus terete and swollen, groups of branches resembling verrucose squamulules or discrete to the surface, about 1mm high; sterile or asci with many spores; on rock or soil Peccania(2) *p 65*
- 5. Terminal branches flattened, thalli often sub-umbilicate 6
 - 6. Thalli with thallinocarps (asci burried in thallus) in swollen ends of lobes Gonohymenia
 - 6. Thalli sometimes with distinct apothecia, swollen tips of lobes without asci Thyrea *p 81*
- 7. Thallus or podetia erect; growing mainly on soil and rock 8
- 7. Thallus pendulous or ducumbent; growing mainly on trees 23
 - 8. Podetia hollow 9
 - 8. Podetia solid 13
- 9. Podetia with perforations at intervals; apothecia dark brown, aggregated at tips of podetia Cladia aggregata
- 9. Podetia lacking perforations 10
 - 10. Podetia richly branched, ecorticate, primary thallus crustose, soon disappearing Cladina(9) *p 39*
 - 10. Podetia simple to branched, corticate, primary thallus squamulose or absent 11
- 11. Primary thallus squamulose, podetia cup-shaped, pointed or branched, squamules on bases of podetia Cladonia(83)
- 11. Primary thallus absent, without any squamules 12
 - 12. Thallus blunt-shaped, finger-like, brownish or yellowish green; apothecia rare Dactylina(3) *p 42*

12. Thallus pointed, worm-like, white or grey; apothecia unknown Thamnotia(2) p 81
13. Thallus flattened 14
13. Thallus terete (round) or nearly so 15
14. Thallus with white dots or lines, not stiff, with branched, broad tips; apothecia mostly marginal, spores simple Cetraria(22) p 35
14. Thallus without white dots or lines, stiff, with sharp, pointed tips; apothecia ascolocular, laminal, spores 3-septate; usually from coastal regions Roccella(2)
15. Thallus dimorphic, with a crustose to subfoliose primary thallus and erect podetium with terminal apothecium 16
15. Thallus otherwise, not dimorphic in nature 17
16. Thallus or podetioid parts with cephalodia, pseudopodetia little branched; apothecia black, spores simple; no phyllocladia Pilophorus(3) p 72
16. Without cephalodia; apothecia brown to tan or pink Baeomyces(8) p 26
17. Thallus brown, shrubby (caespitose) 18
17. Thallus gray or green, podetioid 19
18. Branches short, spinulate, with depressed pseudocyphellae, very brittle, thallus chestnut brown, erect on soil, arctic and alpine, medulla C- Coelocaulon aculeatum *Cetraria*
18. Branches longer, no spinules, with raised pseudocyphellae, arctic and alpine, medulla C+ red Bryocaulon divergens
19. Apothecia unknown 20
19. With apothecia 21
20. Thallus small, less than 1cm tall, with distichous dendroid pseudopodetia and granular phyllocladia Leprocaulon(4) p 51
20. Thallus simple or slightly branched, milky white to pale grey, on acidic soil and peat in alpine regions Siphula pteruloides
21. Spores hyaline, not in mazaedium, pseudopodetia coarse, usually well branched; spores transversely septate; phyllocladia (squamule-like lobules) present Stereocaulon(25)
21. Spores brown, in mazaedium; thallus dichotomously branched 22
22. Fruiting bodies sessile, without thalloid sphere; medulla yellow Acrosyphus sphaerophoroides
22. Fruiting bodies forming inside spherical thalloid structures; medulla white Sphaerophorus(6) p 76
23. Thallus filamentous, terete 24
23. Thallus flattened or angular 31

24. Thallus with a cartilaginous central strand 25
 24. Thallus lacking a cartilaginous central strand 27
25. Thallus with dense longitudinal wrinkles and grooves on surface, papillae; pseudocyphellae absent; on granite, ducumbent Lethariella(5) p 52
25. Thallus lacking wrinkles and grooves on surface, papillae; pseudocyphellae present or absent 26
26. Thallus yellow green (usnic acid), usually pendulous on trees Usnea(85)
 26. Thallus brown to brownish red, shiny, tips of branches hook-shaped, erect-caespitose Bryocaulon divergens
27. Thallus yellow or yellowish green 28
 27. Thallus gray or brown; usnic acid absent 29
28. Pseudocyphellae raised, conspicuous; usnic acid present cortex KC+ yellow; true lateral spinules absent; spores brown Alectoria(2) p 25
 28. Pseudocyphellae sunken; vulpinic acid and virensic acid present; apothecia geniculate, often pruinose; spores yellow to brownish Sulcaria(2) p 80
29. Medulla mostly hollow, thallus perforate, spores brown, 1 per ascus Oropogon (3)
 29. Medulla solid, thallus not perforate, spores usually 8 per ascus 30
30. Thallus brown to grayish white; pseudocyphellate or not; cortex KC- or KC+ reddish; spores colorless Bryoria(13) p 27
 30. Thallus grey to badius or bright yellow, erect or ducumbent; spores brown pseudocyphellae present in longitudinal furrows, sunken Sulcaria (2) p 80
31. Thallus angular, surface wrinkled Evernia(3) p 44
 31. Thallus flattened 32
32. Thallus caespitose or pendulous, not subfoliose, eciliate Ramalina(32)
 32. Thallus more or less lobed, subfoliose, ciliate or with cilia-like rhizines; medulla K+ yellow or red(usually salazinic acid) 33
33. Thallus margins ciliate, laciniae up to 1.5mm wide; apothecia stipitate, marginally lacinulate; only salazinic acid Heterodermia leucomelos
 33. Thallus rhizinate; pycnidia black and numerous; other acids also present .Everniastrum(8) p 44

Foliose lichens

1. Thallus orange, yellow or yellow orange 2
 1. Thallus grey, yellowish grey, tan, brown or black 5

- 2. Thallus and apothecia K+ purple or red violet (parietin) 3
- 2. Thallus and apothecia K- 4
- 3. Thallus orange; spores polari-bilocular Xanthoria(10) p 88
- 3. Thallus yellow-orange spores simple; on soil Fulgensia bracteata p 12
- 4. Lobes narrow, appressed to the substrate; spores contain oil droplets resembling bilocular Candelaria(2) p 35
- 4. Lobes broader, ascending; spores lacking oil droplets Cetraria(few species) p 35
- 5. Algae green 6
- 5. Algae blue-green 38
- 6. Thallus of loose network of algal filaments, fungus not prominent Coenogonium (2)
- 6. Thallus dominated by fungus 7
- 7. Thallus attached to the substrate at a single point near the middle of the thallus (umbilicate) 8
- 7. Thallus attached at more than one point 12
- 8. Thallus pustulate Lasallia(10) p 50
- 8. Thallus lacking pustules 9
- 9. Thallus with immersed perithecia or, if lacking perithecia, then with obvious immersed flask-shaped pycnidia; thallus usually pale Dermatocarpon(7) p 42
- 9. Thallus with rounded to angular apothecia or often sterile; pycnidia not obvious 10
- 10. Thallus green or yellow green; apothecia lecanorine Rhizoplaca(6) p 75
- 10. Thallus usually dark colored although pruinose forms appear paler (never greenish) 11
- 11. Thallus thick, tan to brown, heavily pruinose; lower surface chalky white; apothecia immersed, asci with 100 or more spores Glypholecia p 46
- 11. Thallus thinner, not pruinose or only lightly so; lower surface brown to black; apothecia lecideoid, asci with 8 spores Umbilicaria p 81
- 12. Thallus with cyphellae or pseudocyphellae on lower surface 13
- 12. Thallus lacking cyphellae or pseudocyphellae below 14
- 13. Thallus with cyphellae Sticta(16) p 78
- 13. Thallus with pseudocyphellae Pseudocyphellaria(5) p 72
- 14. Thallus squamulose to squamulose-foliose 15
- 14. Thallus distinctly foliose with elongated lobes 20
- 15. Thallus with immersed perithecia or obvious immersed pycnidia 16
- 15. Thallus with apothecia or apothecia unknown..... 17

16. Algae present in the hymenium; squamules small, 1-3mm across, slightly lobed; spores muriform and becoming brown Endocarpon(4) p 43
16. No algae in the hymenium; squamules large, over 3mm across, pale; spores simple and colorless Catapyrenium(12)
17. Apothecia present; squamules reddish, brown or olive 18
17. Apothecia always absent; thallus of green or gray scales 19
18. Thallus olive; apothecia black Psorula rufonigra
18. Thallus reddish or brown Psora (5)
19. Thallus tiny simple scales, 0.5-2.0mm diam., gray, often sorediate; margin thickened and uprolled Normandina pulchella
19. Thallus larger, somewhat lobed, over 1 cm diam., thin, bright green, sometimes sorediate; margin not thickened Botrydina viridis
20. Thallus inflated, medulla hollow 21
20. Thallus not inflated, medulla solid 22
21. Upper surface with round perforations; soralia laminal, usually initiated around a pore
Menegazzia(2) p 55
21. Upper surface lacking pores; soralia when present terminal or subterminal . Hypogymnia(31) p 47
22. Lower surface with dense tomentum obscuring lower surface of thallus 23
22. Lower surface mostly bare or with rhizines 26
23. Lobes broad (over 1 cm); lower surface veined and rhizinose-tomentose; thallus bright green when wet, with black scale-like cephalodia on the upper or lower surface ... Peltigera p 65
23. Lobes narrower (less than 1 cm) 24
24. Lower surface with white tomentum; lobes bright green when wet Megalopsora p 54
24. Lower surface with brown or black tomentum 25
25. Lower surface with continuous dense black tomentum; lobes not irregular and notched; medulla K+ deep yellow, P+ yellowish; spores sickle-shaped Anzia(8) p 26
25. Lower surface with irregular discontinuous patches of dense brown tomentum; lobes irregular and notched; cortex and medulla K- Pannoparmelia angustata
26. No rhizines or cilia on margins or lower surface 27
26. Rhizines and/or cilia present on lower surface or margins of lobes 31
27. Lobes subfruticose, strap-shaped, rarely branched; apothecia stalked, black, strongly convex
Gymnoderma (2) p 46
27. Lobes foliose, usually broader, branched; apothecia sessile 28

28. Lobes broad and rounded; loosely attached 29
 28. Lobes narrow and linear; closely attached to substrate 30
29. Thallus yellow; lower surface black, without bare areas; medulla KC+ red Asahinea chrysantha
 29. Thallus not yellow; lower surface tan or brown, with bare areas Lobaria (some) p 53
30. Upper cortex K+ yellow (atranorin); apothecia black when present Dirinaria (6) p 43
 30. Upper cortex K- Hyperphyscia (2) p 47
31. Lobes long and linear, raised from substrate, wide-spaced and not touching each other 32
 31. Lobes shorter, appressed to substrate, usually touching 33
32. Thallus cortex K+ yellow (atranorin) Heterodermia (36) p 11
 32. Thallus cortex K- Anaptychia (9) p 25
33. Lobes narrow (to 5 mm), much longer than wide 34
 33. Lobes wider (over 5 mm), nearly as wide as long 35
34. Hypothecium brown, epithecium K+ purple; medulla often yellow Pyxine (10) p 73
 34. Hypothecium hyaline, epithecium K-; medulla usually white (occasionally red-orange) Physcia sens. lat. p 69
35. Pycnidia internal, appearing as dark dots, on surface of thallus Parmelia sens lat. p 58
 35. Pycnidia superficial, usually marginal 36
36. Cortex paraplectenchymatous (distinctly cellular) Cetraria (some) p 35
 36. Cortex prosoplectenchymatous (no distinct cells) 37
37. Caperatic acid present; conidia without inflated ends Platismatia (5) p 72
 37. Caperatic acid absent; conidia with inflated ends Cetrelia (13) p 38
38. Lower surface with cyphellae or pseudocyphellae 39
 38. Lower surface without cyphellae and pseudocyphellae 40
39. Lower surface with cyphellae Sticta (some)
 39. Lower surface with pseudocyphellae Pseudocyphellaria (some)
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40. Thallus umbilicate (may also be deeply lobed) 41
 40. Thallus not umbilicate 44
41. Margins of thallus sorediate; thallus small and not deeply lobed Peltula euploca p 67
 41. Margins of thallus not sorediate; thallus usually deeply lobed 42
42. Thallus black; thallinocarps on margins Gonohymenia (2)
 42. Thallus dark brown; apothecia sometimes present 43

43. Thallus deeply lobed and divided, usually pruinose Thyrea (3) p 81
43. Thallus discoid, without pruina Phylliscum (2) p 69
44. Thallus distinctly foliose 45
44. Thallus squamulose or areolate or subcrustose 56
45. Upper surface with white, stiff, prominent hairs Erioderma asahinea
45. Upper surface without distinct upright hairs 46
46. Apothecia immersed on upper surface; disk broadly open Solorina (6) p 76
46. Apothecia not immersed on upper surface 47
47. Thallus gelatinous, black, blue gray or brownish olive 48
47. Thallus not gelatinous, usually with tomentum below 50
48. Distinct upper and lower cortex present Leptogium (17) p 51
48. No upper or lower cortex; no distinct hyphal medulla 49
49. Spores simple Physma (5)
49. Spores septate or submuriform Collema (21) p 40
50. Lower cortex absent 51
50. Lower cortex present 54
51. Lower surface with abundant tomentum and rhizines, often with veins; apothecia
 marginal
 Peltigera (26) p 65
51. Lower surface without veins and rhizines 52
52. Lobes rounded and shelf-like with concentric or transverse rings on upper or lower
 surface; lower surface without long tomentum Dictyonema
52. Lobes elongated 53
53. Apothecia with thalline margin Pannaria (9) p 57
53. Apothecia without thalline margin Parmeliella incisa
54. Lower surface bare or with scattered tomentum; apothecia on lower or upper
 surface
 .. 55
54. Lower surface with uniform tomentum; upper surface with transverse lines; thallus
 blue gray Coccocarpia (5) p 48
55. Lower surface usually bare or with uniform tomentum; apothecia on lower surface of lobe
 ends Nephroma (9) p 56
55. Lower surface with patchy tomentum and usually bare areas; upper surface ridged or smooth;
 apothecia on surface of thallus Lobaria(some)

56. Thallus squamulose, attached to soil by hyphae or branched rhizines; asci without apical gelatinous sheath, with 8 spores Heppia p 46
56. Thallus squamulose, areolate or subfruticose, attached to rock or soil by rhizines or umbilicus; asci with apical gelatinous sheath, with 16-100 spores Peltula p 67

Crustose lichens

1. With basidiocarp; blue-green algae; tropical distribution Dictyonema (3) p 15
1. With ascocarps or sterile 2
2. Thallus with blue-green algae 3
2. Thallus with green algae 4
3. Thallus more or less monophyllous, crust-like, umbilicate; asci 8(-16)-spored; on rocks; hyphae forming paraplectenchymatous network throughout thallus Anema asahinae
3. Thallus minutely squamulose to coralloid; asci (4-)8(-32)-spored; on rocks and soil Psorotichia(6)
4. Fruiting bodies unknown 5
4. Fruiting bodies present 8
5. Thallus squamulose, squamules mostly plane to concave, underside exposed, white; mostly on soil, but on a variety of substrates sterile Cladonia(about 3 species)
5. Thallus not squamulose, consisting entirely of soredia or partly sorediate 6
6. Thallus orange, K+ red purple Leproplaca xantholyta
6. Thallus gray, yellow or yellow green, not K+ red or purple 7
7. Thallus yellow or bright yellow green, on trees or rocks Chrysothrix(2) p 39
7. Thallus gray or green, containing a variety of acids, on ground, bark of trees or on rock Lepraria(2)
8. Fruiting bodies elongated (lirelliform) Key A
8. Fruiting bodies not elongated 9
9. Fruiting bodies flask-shaped(perithecia or perithecioid) Key B
9. Fruiting bodies disk-shaped or wart-like(apothecia) 10
10. Thallus squamulose 11
10. Thallus crustose 18
11. Cortex K+ yellow (atranorin) or K-; thallus lobate, yellow-green (usnic acid present); spores colorless, non-septate (or apothecia absent); medulla chalky; on soil or rocks in deserts

<u>Squamarina</u> (9)	
11. Cortex K-; thallus brown, gray or white	12
12. On wood or bark; thallus green	13
12. On soil, rock or mosses	14
13. Cortex C+ red or orange; on wood, frequently burned; spores simple	<u>Hypocenomyce</u>
13. Cortex C-; thallus distinctly squamulose or coralloid isidiate	<u>Phyllopsora</u> (3)
14. Spores transversely septate	15
14. Spores simple	17
15. Squamules surrounded by free-living blue-green algae; thallus umbilicate; spores narrow	<u>Psorula rufonigra</u>
15. Squamules free of blue-green algae; thallus not umbilicate	16
16. Paraphyses branched and anastomosing; spores brown, 1-septate, uniformly thick-walled	<u>Catolechia wahlenbergii</u> p 17
16. Paraphyses simple; spores colorless, 1-7-septate, thin-walled; thallus pustulate to squamulose	<u>Toninia</u> (5)
17. On rock; apothecia pale rose, sunken; asci I+ blue, green, yellow or red; spores with oil globules in young condition; thallus often rust-yellow in epilithic condition	<u>Hymenelia</u>
17. On soil or rock; apothecia marginal, black and convex; thallus brown, pink or brick red	<u>Psora</u> (5)
18. Spores in mazaedium, mazaedia on stipes	19
18. Spores not in mazaedium	20
19. Spores 1-septate, cross wall distinct, dark brown, thick walled; mazaedium black; apothecia black stalked, capitulum globose, subglobose, obconical or lenticular	<u>Calicium</u> (2)
19. Spores simple, brown; mazaedium brown; thallus distinct; spores spherical to ellipsoid	<u>Chaenotheca</u> (3) p 39
20. Asci containing more than 8 spores	Key C
20. Asci containing 8 or fewer spores	21
21. Spores submuriform to muriform	Key D
21. Spores with transverse septa only or simple	22
22. Spores brown	Key E
22. Spores colorless	Key F

Key A

Apothecia elongated (lirelliform), the walls often carbonized; spores septate to muriform, colorless or brown.

- 1. Spores brown 2
- 1. Spores hyaline 5
 - 2. Spores muriform; paraphyses simple; exciple black-carbonaceous, brown-black, pale brown or yellow Phaeographina (18)
 - 2. Spores transversely septate 3
- 3. Paraphyses lightly branched and anastomosing; thallus thin, apothecia 0.4-0.5mm diam., more or less constricted at base, disk urceolate, concave, dark, margin black, brown or grey, asci 8-spored, spores (20-)30-50x10-15um., corticolous Gyrostomum scyphuliferum ^{p 18}
- 3. Paraphyses simple 4
 - 4. Apothecia sunken in stroma; asci thickened at apex, 4-8-spored, transversely 3-11-septate, elongate to fusiform, I+ blue to violet Sarcographa (3)
 - 4. Apothecia emergent or immersed; asci usually 8-spored, transversely 3-15-septate Phaeographis (18)
- 5. Spores muriform Graphina (28)
- 5. Spores transversely septate; locules lentiform 6
 - 6. Asci 4-8-spored, spores 3-11-septate, I+ blue or violet blue Glyphis cicatricosa
 - 6. Asci clavate to subcylindrical, (1-)2-4-8-spored, spores transversely 3-many septate; rarely saxicolous or foliicolous Graphis (53)

Key B

Ascocarps perithecia, singular, confluent, superficial or immersed in thallus or stroma

- 1. Spores simple, colorless 2
- 1. Spores transversely septate or muriform, colorless or brown 3
 - 2. Paraphyses much branched; perithecial wall black, with numerous periphyses; asci thick walled Thrombium (2)
 - 2. Paraphyses gelatinized; perithecial wall colorless or black, without periphyses Verrucaria (29)
- 3. Spores muriform 4
- 3. Spores transversely septate 10

4. Hymenial algae present 5
 4. Hymenial algae absent 6
5. Thallus squamulose Endocarpon (4) ^{p 43}
 5. Thallus crustose Staurothele (9)
6. Spores brown 7
 6. Spores colorless..... 9
7. No paraphyses; perithecial wall K+ blackish green; asci (4-)8-spored, spores dark brown in maturity, with a thick gelatinous wall(halo) when youngPolyblastia (3)
7. Paraphyses present; spores multicelled-muriform 8
8. Paraphyses simple, free; perithecial wall I+ vinose-red; asci (1-)8 spored; a dark or brown-black hypothallus usually present Anthracotheicum (6)
 8. Paraphysoids netlike branched and anastomosing; asci (2-)8 spored Parmentaria (2)
9. Paraphysoids branched and anastomosing in upper part; asci 4-6-spored; perithecia sunken; thallus externally covered by an epinecral layer of fungal tissue Thelenella brasiliensis
9. Paraphyses simple or disappearing; no thallus algae Julella
10. Spores brown 11
 10. Spores colorless 13
11. Perithecia usually united in more or less rounded stroma, exciple black; paraphyses simple, free or branched and anastomosing, usually indistinct; spores 1-to several septate, ellipsoid to fusiform Melanotheca (2)
11. Perithecia solitary 12
12. Paraphyses usually simple, spores with lenticular cells, thick walled, 1-5-septate, triangular, rhomboidal to octagonal Pyrenula (19)
 12. Paraphysoids branched and anastomosing, asci transversely 1(rarely 3)septate, upper cell usually larger, with a gelatinous sheath swelling in K; corticolous
Mycomicrothelia fumicosula
13. Perithecia with a crown of stiff, black-brown or white setae; thallus olive green to badius, ecorticate, foliicolous; paraphyses simple; asci 8-spored, spores usually 7-septate, fusiform Trichothelium "annulatum"
13. Perithecia without a crown of stiff, black-brown or white setae 14
14. Paraphyses simple 15
 14. Paraphysoids branched and anastomosing 17
15. Spores with blunt ends, transversely (1-)5-septate, constricted at septa; no algal cells in hymenium Arthopyrenia (5) (Anisomeridium (1) or Pyrenocollema(1))

15. Spores lacking blunt ends, not constricted at septa; often foliicolous 16
16. Perithecia convex to conical; perithecial wall usually differentiated into two walls; asci 8-spored, spores 1-3-septate Strigula (4) p 80
16. Perithecia singular, dispersed; perithecial wall usually not differentiated into two walls; asci 6-8-spored, spores 1-many septate Porina (10)
17. Perithecia dispersed; corticolous; spores 2-3-septate 18
17. Perithecia embedded or immersed; spores 3-many-septate 19
18. Perithecial wall carbonaceous, often very hard and brittle; spores 3-septate, with globular to lentiform locules Pseudopyrenula (4)
18. Perithecial wall colorless; spores 2-3-septate, fusiform, lentiform Mycoporellum (2)
19. Asci thin walled, 8-spored; perithecia embedded in stroma; spores 3-many-septate, elongate, fusiform, cells usually lentiform Trypethelium (3)
19. Asci thick walled, 6-8-spored; perithecia immersed in verrucae, aggregated in small radiating group; spores usually 3-septate, cells globose to lentiform Polyblastiopsis (2) = Julella?

Key C

Ascocarps apothecia; asci containing more than 8 spores; spores minute, colorless.

1. Thallus saxicolous or terricolous 2
1. Thallus corticolous 6
2. Paraphysoids anastomosing; hymenium K⁺ yellowish; thallus areolate, apothecia prominent; spores numerous, acicular, twisted; on rocks ... Scoliciosporum umbrinum
2. Paraphyses simple, hymenium K⁻ 3
3. Asci thick walled, more than 100-spored; hymenium I⁺ dark blue; paraphyses apices swollen; margins of the areolate are more or less bluish gray pruinose Sporastatia (2) p 76
3. Asci thin walled; hymenium I⁺ or I⁻ 4
4. Apothecia biatorine or lecideine; thallus poorly developed; hymenium I⁺ greenish or reddish yellow; asci at least 50-spored, spores elliptic to cylindrical Sarcogyne (5) p 75
4. Apothecia lecanorine; thallus well developed; hymenium K⁻ 5
5. Thallus areolate to subsquamulose or subfoliose, corticate; paraphyses moniliform at apices; medulla and cortex CaCl⁺ red; asci more than 64-spored; on rocks and on ground Acarospora (26)
5. Thallus small, sometimes only sterile areolae or squamules; medulla and cortex CaCl⁺ red; spores numerous; on rocks Glypholecia (2) p 46

6. Apothecia biatorine or lecideine, yellow or dark; thallus yellowish-brown; spores simple Biatorella (3)
 6. Apothecia lecanorine, hymenium mucilaginous; spores simple to 1-septate; thallus greyish to brown Maronea rubra

Key D

Asci containing 8 or fewer spores; spores submuriform, muriform to sometimes transversely septate

1. Epithecium or/and exciple K+ red, violet or black 2
 1. Epithecium or/and exciple K- 7
2. Paraphyses branched and anastomosing 3
 2. Paraphyses simple to slightly branched, but not anastomosing 6
3. Thallus corticate 4
 3. Thallus ecorticate; thallus and exciple K+ purple; asci with inner apical apparatus and inner wall layers, (1-)2-8-spored Letrouitia domingensis
4. Epithecium K-; apothecia sunken in thallus; Asci thick walled, 1-spored; foliicolous Gyalectidium filicinum
 4. Epithecium K+ violet purple or purplish-red-brown; apothecia sessile 5
5. Apothecia lecanorine, disc red, pinkish red to red brown, epithecium K+ violet purple, hypothecium colorless; corticolous Haematomma (3)
 5. Apothecia lecideoid, black, hypothecium and often also epithecium purplish brown, K+ purplish-red -brown; foliicolous Tapellaria nana
6. Epithecium K+ violet, exciple K+ violet blue; apothecia biatorine; asci thick walled, I+ blue, 1-spored; mainly corticolous Brigantiaea leucoxantha
 6. Epithecium K+ red or black, hymenium I+ blue; apothecia lecideine; asci 1-2-8-spored; thallus muscicolous, saxicolous or corticolous Lopadium (2) p 54
7. Exciple carbonized; columella often present, simple to sometimes reticulate; cortex dense, often splitting and exfoliating; medulla well developed Ocellularia alba
 7. Exciple not carbonized, columella absent 8
8. Thallus ecorticate 9
 8. Thallus corticate 10
9. Thallus with black and white hairs; foliicolous, rarely on decaying plants or corticolous;

- hyphores long stalked, setaceous, apex lanceolate, palmate to helmet shaped Tricharia (2)
9. Thallus without hairs; corticolous; hyphores absent; asci thick walled; excipuloid tissue absent
Arthothelium (3)
10. Exciple free or fused, the inner face with short periphyses, pore often broad and gaping; corticolous Thelotrema (5)
10. Periphyses absent 11
11. Spores colorless 12
11. Spores brown 14
12. Thallus foliicolous, thin; apothecia sessile, constricted at base; asci 1-4-(-8)-spored
Calopadia (2) p 35
12. Thallus corticolous 13
13. Apothecia sunken in thallus or erumpent, with indistinct thalline margin, proper exciple present or absent, thallus smooth to verrucose Phlyctis schizospora
13. Apothecia immersed or raised, with or without thalline margin, exciple colorless or reddish brown Myriotrema p 56, 81
14. Apothecia simple or branched, sunken in stroma; paraphyses simple, free; asci thickened at apices; thallus endophloedal Sarcographina
14. Apothecia sunken or sessile; paraphyses simple or apically branched 15
15. Apothecia perithecioid or apothecioid, urceolate; asci 4-8-spored, spores thin walled; thallus saxicolous, terricolous or muscicolous Diploschistes (8)
15. Apothecia black, lecideine, sessile; asci 8-spored, spores thick walled; thallus generally corticolous Diplotomma alboatrum

Key E

Spores with transversely septa only, brown

1. Hypothecium hyaline; spores dark brown, 1-septate; on rock Dimelaena oreina
1. Hypothecium brown; spores 1-septate, surface smooth or ornamented; saxicolous or corticolous Buellia (26)

Key F

Spores simple or with transversely septa only, colorless

1. Spores polarilocular; epithecium and margin usually K+ red or purple Caloplaca (42) p 28
1. Spores simple or with thin septum 2

2. Spores simple	3
2. Spores transversely septate	10
3. Apothecia completely sunken in thallus	4
3. Apothecia sessile or only partly immersed	5
4. Spores thin-walled; paraphyses simple with moniliform tips; asci 1-8-spored; saxicolous or terricolous	<u>Aspicilia</u> + <u>Bellinera</u>
4. Asci and spores thick walled; paraphyses branched and variously reticulately anastomosing, not capitate; usually corticolous	<u>Pertusaria</u> (44)
5. Paraphyses simple	6
5. Paraphyses branched and anastomosing	9
6. Apothecia K+ deep red(anthraquinone); asci 8-(-16)spored; thallus crustose to squamulose, whitish-grey to orange, corticolous or saxicolous ...	<u>Protoblastenia</u> (5)
6. Apothecia K-; asci 1-8-spored	7
7. Thallus composed of branched, septate hyphae forming a network on the surface of the green algal photobiont filaments, and often giving the appearance of a prostrate or upright branched thallus; apothecia biatorine; spores simple or 1(-3)-septate	<u>Coenogonium</u> (2)
7. Thallus not composed of branched, septate hyphae; apothecia lecideine	8
8. Asci 8-spored; thallus and apothecia variously colored; mainly growing on bark and rock	<u>Lecidea sens. lat.</u>
8. Asci 1-2(-3)-spored; spores thick walled; corticolous or lignicolous ...	<u>Mycoblastus</u> (3) p 55
9. Apothecia margin prominent; asci (2-)6-8-spored, spores rather large; paraphyses branched and compact; thallus often verrucose; terricolous, on decaying debris, corticolous or saxicolous	<u>Ochrolechia</u> (11) p 57
9. Apothecia without prominent margin, constricted at base; asci 8-spored; paraphyses weakly capitate; saxicolous	<u>Trapelia</u> (2)
10. Paraphyses branched and anastomosing	11
10. Paraphyses simple or slightly branched or thin and indistinct	16
11. Apothecia lecanorine or somewhat immersed	12
11. Apothecia lecideine	13
12. Disc red, pinkish-red to red brown; epithecium K+ violet purple; corticolous, saxicolous	<u>Haematomma</u> (3) p 46
12. Disc not red; epithecium K-, foliicolous; apothecia somewhat immersed, excipuloid tissue formed by radiating hyphae, thin, distinct, dark; asci thick walled, spores fusiform or acicular, microcephalic	<u>Mazosia</u> (4) p 54
13. Spores more than 1-septate, fusiform to acicular	14

13. Spores usually 1-septate (9-17 septate) 15
14. Asci 8-spored, spores transversely 3-5-septate, with cylindrical locules; ascocarps perithecioid apothecia; thallus epiphloedal Chiodecton (3) ^{p 39}
14. Asci 4-8-spored, spores transversely 2-12(-15)-septate; ascocarps lecideine; corticolous or saxicolous Lecanactis (4)
15. Apothecia pallid or yellowish; paraphyses big brown capitate; asci 8-spored, more or less twisted; on bark and rock Catillaria (14)
15. Apothecia brownish or blackish; paraphyses not big brown capitate Catinaria kelungana
16. Excipuloid tissue black-carbonaceous; ascigerous region I+ blue, vinose or vinose-red; asci (4-)8-spored, spores transversely 1-17-septate; corticolous or rarely foliicolous Opegrapha (5)
16. Excipuloid tissue absent; asci thick walled, 2-8-spored, spores transversely 1-9-septate; corticolous, foliicolous or para-symbiont on other lichens..... Arthonia (14)
17. Spores thick walled, rather large, often 1-septate; asci 1-8-spored, mainly tropical distribution Megalospora (2) ^{p 54}
17. Spores thin walled; asci 8-(-32)-spored, 18
18. Asci 8-(16-32)-spored, spores 1-3-septate; thallus corticolous or saxicolous Lecania (3)
18. Asci 8-spored 19
19. Spores when mature dark, 1-(rarely more) septate; apothecia simple or shortly branched Melaspilea urceolata ^{p 46}
19. Spores colorless, 1-septate 20
20. Spores 1-septate (rarely more); apothecia round, constricted at base; corticolous or foliicolous Dimerella (2) ^{p 43}
20. Spores 1-many septate 21
21. Spores transversely 3-many septate or muriform; corticolous Gyalecta alutacea
21. Spores 1-septate 22
22. Predominantly foliicolous; apothecia lecideine, hymenium I+ blue; asci thick walled, spores 1-3-septate Byssoloma tricholomum
22. Corticolous, rarely saxicolous; hymenium I- 23
23. Spores transversely 2-11-septate, straight or curved, cells cylindrical; apothecia round, stellate to lirellate Schismatomma margaritaceum

23. Spores 1-many septate; asci thick walled; apothecia sessile and round Bacidia (26)

Alectoria

- 1. Thallus yellow or yellowish green; pseudocyphellae present and conspicuous; cortex KC+ yellow (usnic acid); true lateral spinules absent 2
- 1. Thallus grayish white to brown; pseudocyphellate or not; cortex KC- or KC+ reddish (usnic acid absent) Bryoria
 - 2. Thallus erect, usually 5-8cm tall, yellow to yellowish green; branching anisotomic dichotomous; medulla usually KC-; a tundra species A. ochroleuca
 - 2. Thallus pendent, usually 20-40cm long, greenish grey to bright golden yellow; branching mainly isotomic dichotomous; medulla usually KC+ red; a boreal-montane species A. sarmentosa

Amygdalaria

- 1. Apothecia adnate, sessile between the areoles; no lichen substances found; excipulum proprium well-developed, very dark; prothallus narrow and black; cephalodia large and hemispherical A. aeolotera
- 1. Apothecia mostly depressed into areoles; gyrophoric acid and a trace of lecanoric acid present; excipulum proprium usually extremely thin, generally not visible; prothallus absent; cephalodia rough, prominent or flat and disk-like A. pelobotryon

Anaptychia

- 1. Thallus isidiate, isidia laminal and marginal, often cylindrical and branched A. isidiza
- 1. Thallus without isidia 2
 - 2. Apothecia margins with lacinules 3
 - 2. Apothecia margins without lacinules 5
- 3. Lobes tomentose, ascending apically; beneath decorticate, irregularly veined A. ciliaris
- 3. Lobes not tomentose; beneath corticate 4
 - 4. Medulla K+ yellow or red; lower surface white, lobes ascending apically ... A. pacifica
 - 4. Medulla K-; lower surface black only with a pale periphery, lobes not ascending A. tentaculata
- 5. Upper surface and apothecia margins coarse and ridged, distinctly white pruinose, thallus greyish to dirty white A. ulotricoides
- 5. Upper surface and apothecia margins without pruina 6
 - 6. Thallus chestnut brown to blackish brown; rhizines simple and rarely branched ... (A.

fusca) .. A. thucinata

6. Thallus usually greenish olive; rhizines squarrosely or fasciculately branched A. palmulata

Species not included in the Key

A. sanguineus

A. wrightii

Anzia

1. Thallus with small lobules and white powder on lobe margin A. ornata
1. Thallus without lobules and white powder 2
2. Thallus dichotomously lobed 3
2. Thallus not dichotomously lobed; medulla C- 4
3. Medulla single-layered, C+ red; thallus palmatilobate toward lobe tips; lobe tips crenate; thallus reddish brown, shiny A. japonica
3. Medulla two-layered, C-; thallus not palmatilobate toward lobe tips; lobe tips obtuse or subcrenate; thallus ashy gray A. formosana
4. Apothecia very large with upturned rim; thallus thick and finger-like, brown; tomentum reddish brown or brown A. leucobatooides
4. Apothecia rare 5
5. Medulla KC+ red A. hypoleucooides
5. Medulla KC- (A. semiteres).... A. opuntiella

Species not included in Key:

A. cristulata

Arctoparmelia

1. Thallus with capitate soralia on upper surface A. incurva
1. Thallus without soralia A. centrifuga

Baeomyces

1. Primary thallus subfoliose or squamulose, lobed at periphery 2
1. Primary thallus granulose, crustose or membranous; adnate to the substrate 4
2. Primary thallus squamulose, glaucous white, rugose; podetia up to 10mm long, 4mm in diam., corticate B. pachypus

- 2. Primary thallus subfoliose 3
- 3. Apothecia singular, cylindrical; medulla K+ yellow, P+ reddish brown (stictic) B. placophyllus
- 3. Apothecia numerous, aggregated, granular; medulla K+ yellow or red, P+ yellow B. botryophorus
- 4. Apothecia disk flesh colored; medulla K+ yellowish, P+ orange yellow (baeomycesic & squamatic) 5
- 4. Apothecia disk brown or flesh red; medulla K+ yellow or flesh red, P+ reddish brown 6
- 5. Primary thallus green, thin, membranous; non-sorediate; apothecia usually stalkless Dibaeis absolutus
- 5. Primary thallus grey, thin, crustose; sorediate; apothecia stalk 2-6mm tall ... Dibaeis fungoides
- 6. Apothecia disk brown, K+ yellow, P+ reddish brown (stictic or norstictic) B. rufus
- 6. Apothecia disk flesh red, K+ yellow or flesh red B. sanguineus

B. brevis is not included.

Also add here Pseudobaeomyces insignis (cephalodia, th K+ y, C-, septate spores)

Bryoria

- 1. Isidioid spinules present 2
- 1. Isidioid spinules absent; thallus usually sorediate 6
 - 2. Medulla P+ orange-red 3
 - 2. Medulla P- 5
- 3. Medulla KC+ red; thallus pendent, more than 5cm long B. lactinea
- 3. Medulla KC- 4
 - 4. Soralia usually abundant, becoming covered with tufts of isidioid spinules; pseudocyphellae absent; thallus caespitose, 3-12cm long B. furcellata
 - 4. Soralia absent; pseudocyphellae usually sparse; thallus erect to caespitose, rigid, 2-4cm tall B. bicolor
- 5. Thallus sorediate, about 9cm tall, up to 0.8mm in diam. B. smithii
- 5. Thallus non-sorediate, 3-5cm tall, about 0.3mm in diam. (B. acanthodes) ... B. confusa
 - 6. Thallus stiff, curved, up to 7cm long, brown, but black at the base; medulla and soralia P- B. variabilis
 - 6. Thallus soft, not curved 7

- 7. Inner cortex and sometimes medulla P+ red, contains fumaroprotocetraric acid and chloroatranorin; pseudocyphellae usually abundant B. trichodes
- 7. Inner cortex and medulla P-, contains only fumaroprotocetraric acid 8
- 8. Thallus usually black, branches narrow(0.1-0.25mm in diam.) and extremely brittle; soralia P+ red B. lanestris
- 8. Thallus brown, branches not brittle (B. jubata) .. B. prolixia

Species not included:

- B. asiatica
- B. cornicularioides
- B. divergescens
- B. orientalis

Bulbothrix

- 1. Thallus lacking isidia, lobes 2-5mm wide, lower surface brown; medulla K+ yellow turning red, C-, KC-, P+ orange B. setschwanensis
- 1. Thallus isidiate 2
 - 2. Medulla K+ yellow turning red, C-, KC-, P+ orange 3
 - 2. Medulla K-, C+ rose or red, KC+ red; rhizines richly branched B. geobelii
- 3. Lower surface brown B. isidiza
- 3. Lower surface black, with at most a narrow brown zone at the margins B. tabacina

Caloplaca

Adapted from Poelt & Hinteregger, 1993

Key to groups

- 1. Thallus on soil, vegetabilia or bryophytes Key A
- 1. Thallus on other substrates 2
 - 2. Thallus on bark or wood Key B
 - 2. Thallus on rock or parasitic on saxicolous lichens 3
- 3. Thallus distinctly lobate at the margin Key C
- 3. Thallus not or not distinctly lobate 4
 - 4. Thallus whitish to brown or blackish, never yellow or orange, always K-. Apothecia brownish or blackish without K+ red-violet reaction (or disks orange-brownish and K+ red with blackish margins) Key D

4. Thallus yellow or orange to red (or if whiteish, grayish or blackish then apothecial disks yellow or orange to red with K+ red-violet reaction) Key E

Key A Thallus on soil, vegetabilia or bryophytes.

4

1. Thallus finely granulate to blastidiate-sorediate from beginning, or becoming sorediate 2

1. Thallus neither granulate, nor blastidiate, nor sorediate, but crustose to squamulose or sublobate, often inconspicuous 3

2. Thallus areolate to subsquamulose from the beginning, soon sorediate at the margins, often becoming completely sorediate, yellow to yellowish-orange, attached to soil with central strand. C. tominii

2. Thallus squamulose-blastidiate, never areolate to subsquamulose from the beginning. Only very young thalli somewhat finely squamulose, soon becoming completely granulose-blastidiate, yellowish to reddish-orange, blastidia $\pm 25\mu\text{m}$ in diam. C. epiphyta

3. Thallus distinctly effigurate, with flat, nearly foliose, \pm elongate marginal squamules, gray to orange. Spores \pm constricted in middle, mature septa very thin. On dry, calcareous soils C. geoica

3. Thallus not effigurate, crustose, dirty whitish, often indistinct. Apothecia or at least disks yellowish to reddish-orange (but sometimes discolored and therefore olivaceous to blackish), whitish to dark bluish-gray, cortex of margin very thick, mostly strongly gelatinized. Spores $10-15.5 \times 5.5-8.5 (-10) \mu\text{m}$, with thick septa. Over bryophytes or vegetabilia C. cerina

a. Disks mostly yellow to olivaceous green - var. chloroleuca

b. Disks orange-brownish to dark red - var. muscorum

Key B Growing on wood or bark

8

1. Thallus sorediate, blastidiate-granulose, or isidiate. Apothecia absent or dispersed 2

1. Thallus neither sorediate, nor blastidiate, nor isidiate, usually with many apothecia 4

2. Mature thalli gray, finely squamulose, soralia crateriform. Apothecia brown .. C. obscurella

2. Thallus sorediate, blastidiate, or isidiate, soralia not crateriform 3

3. Thallus continuous, whitish, with isolated yellow soralia (but soralia sometimes becoming confluent) at first roundish, 0.5-0.7 mm diam. Apothecia not very rare, 0.5-0.8 mm in diam. with a distinct proper margin. Spores $12-18 \times 6-9 \mu\text{m}$, septa $3-6 \mu\text{m}$ C. chrysophthalma

3. Thallus continuous only at margin, smooth at beginning, membranaceous, bright yellow, developing isidia-like, \pm branched blastidia. Apothecia rare, orange-brownish, their excipular margins finely also blastidiate. Tropical to subtropical C. malaensis

4. Spores trilocular, very broad. Thallus whitish to grayish. Margins dark grayish-white, disks brownish.

- Spores 24-35 x 10-15 μm C. triloculans
4. Spores polar-diblastic, but septa sometimes reduced later 5
5. Disks dark brownish to black, margins brown to grayish-violet. Thallus \pm grayish 6
5. Apothecia or at least disks yellow to orange. Asci usually with 8 or fewer spores, margins yellow to orange in the upper part and around disk, the flanks often discoloring, whitish or grayish; thallus smooth to rough 7
6. Spores 21-30 x 11-14 μm , with thick inner wall, K+ yellow. Margins brown, no algae in margin, disks blackish-brown. On bark of Picea. C. yunnana
6. Spores 11-15 x 6-7 μm . Algae in margin. Thallus K+ purple C. delicata
7. Thallus of the Xanthoriella type, \pm orange, but often thickly impregnated with dust and more grayish. Apothecia \pm distinctly stipitate. Spores 12-15 x 5.5-8 μm C. polycarpoides
7. Thallus not of the Xanthoriella type. Apothecia not distinctly stipitate 8
8. Thallus yellow to greenish-yellow, more rarely orange-yellow, often very ample. Apothecia up to 1.5 mm in diam., orange-yellow, brownish when old. Hypothecium and lower part of the hymenium strongly inspersed. Spores (12)13-20 x (6)7-11 μm , sometimes swollen in the middle, septa 4-7 μm . Mainly on broad-leaved trees C. flavorubescens
8. Thallus whitish or grayish, only the initials of apothecia, ostioles of spermagonia, or (rarely) the tips of thalline warts yellowish to reddish. Thallus smooth or crustose-membranaceous 9
9. Apothecia uniformly ferruginous, biatorine to lecanorine. Hypothecium often \pm brownish. Spores 13-20 x 8-12(-15) μm broadly ellipsoid to subglobose, septa 4-7 μm ..C. ferruginea s.l.
9. Apothecia yellowish-orange to orange or brownish-orange, but flanks of the margins often becoming grayish. Spores usually 11-14 (-15) x 5-7 μm .. C. pyracea-holocarpa complex

C

Key C Thallus on rock, distinctly lobate at the margin.

1. Thallus distinctly soresiate or blastidiate, yellow to orange or brownish-orange 2
1. Thallus not soresiate or blastidiate 3
- [2. Thallus small, marginal lobes 1-1.8 x 0.1-0.2 mm, their ends usually whitish-pruinose. Soralia in the center of the thallus or at the base of the lobes, often somewhat concave, soredia lemon-yellow to greenish-yellow. Apothecia very rare. Under overhanging calcaeous rocks C. cirrochroa]
2. Thallus much larger and thicker, mostly brownish-orange. Marginal lobes 2-3 (-5) x 0.2-0.3 mm, not pruinose, but often rough. Soralia produced at the ends of ascending secondary lobes, soredia brownish-orange. Apothecia not too rare. Strongly nitrophilousC. decipiens
3. Thallus \pm grayish-brown, upper medulla \pm ochraceous-yellow, containing anthraquinones, K+ red, marginal lobes mostly 1-2 mm long, applanate, disks ceraceous C. chrysophora
3. Thallus yellow to orange, medulla not colored 4

4. Thallus very thin, as if glued to the substrate, sharply areolate in the center, distinctly effigurate at the margin, but flat in all parts, brownish-orange. Apothecia remaining immersed, disks often irregular in outline. Spores 8.5-14 x 4-5.5 μm , septa 2-4 μm C. cinnabarina
4. Thallus \pm thick, lobes \pm convex, apothecia elevate 5
5. Cortex composed of \pm irregularly arranged hyphae, \pm prosoplectenchymatic. Spore septa thin 6
5. Cortex composed of anticlinal hyphae, \pm paraplectenchymatic. 7
6. Lobes 5-10 mm long, mostly densely compacted, \pm terete, rough to lumpy. Apothecia mostly densely aggregated. Margins often becoming excluded. Spores 14-17 x 5-6 μm C. trachyphylla
6. Lobes 2-3 mm long, strongly sloping towards the ends, densely packed, but divided by sharp gaps, smooth to finely fissured. Thalli rosulate on flat surfaces, but more common as garlands of many partial rosettes on steep surfaces, older parts dying early. Spores often nearly rhombic in side view, 14-20 x 6-8 μm C. scrobiculata
7. Cortical cells small. Spores 13-15 x 7-8 μm , septa 1.7 μm C. bohlinii
7. Cortical cells 3-5 (-7) μm 8
8. Spores mostly broadly ellipsoid, 9-15 x 6-8 μm , septa comparatively thin, 1.5-3 μm . Thallus regularly rosulate, reddish-orange to red, the lobes adnate only with narrow longitudinal stripe. Cortical cells 3-5 (-7) μm . Apothecia often broadly substipitate. Usually on steep to overhanging surfaces of calcareous or manured rocks C. biatorina
8. Spores ellipsoid to narrowly ellipsoid. Lobes usually fixed to the substrate with a broader base. Lobes adhering. Spores usually shorter, septa also mostly thin. Rosettes, brownish to brownish-orange, more rarely miniate. Spores mostly 9-14 x 3.5-6 μm C. saxicola

D

Key D Thallus saxicolous, not or not distinctly effigurate, white to brown or blackish, no red solution in K. Apothecia brownish to blackish, without red solution in K, sometimes with orange-brownish epipsamma on the disks and therefore K+ red, but then margins blackish.

1. Disks brownish to blackish from the beginning, (sometimes whitish-pruinose), without red solution in K, but sometimes the grayish cell walls at the ascocarp surface K+ lalac to violet. Spores mostly broadly ellipsoid, with thin, often closed septa, 12-20 x 6-10 μm . Apex of spermagonia blackish. Thalli mostly large (except 2a) 2
1. Disks containing anthraquinones (at least when young), often with orange-brownish epipsamma, K+ red. Thallus indistinct, \pm areolate to scaly 5
2. Thallus endo- to indistinctly epilithic. Apothecia completely or partly immersed, 0.3-0.6 mm in diam., \pm pruinose, margins indistinct to well differentiated. On calc rocks C. alociza
2. Thallus distinctly epilithic, continuous to areolate, often \pm thick, white to gray or brownish-gray,

- mostly rather large. Apothecia about 1 mm diam. 3
3. Thallus K- macroscopically, ± thick, white to whitish, upper surface macroscopically K-. Margins of apothecia thick, white at least on the outside, disks black, usually not pruinose. Spore septa often not closed. Spores 15-20 x 7-10 µm, septa 1.5-3 µm. On calcareous rocks C. transcaspica
3. Thallus K+ purple macroscopically 4
4. Thallus thin, with flat areoles, grayish, occasionally somewhat brownish. Disks at least pruinose in young apothecia, margins indistinctly zeorine. Spore septa thin, 2-3.5 µm. C. variabilis
4. Spores 12-18 x 6-8 µm, septa (3-)5 µm. On calcareous rocks C. aegyptiaca
5. Medulla containing orange and ochraceous anthraquinones, thallus dark to olivaceous-grayish. Apothecia variable in color, disks orange-brownish to blackish, margins orange to gray or blackish. Thallus lobed C. chrysophora
5. Medulla without anthraquinones, thallus whitish 6
6. Thallus cyanotrophic, on irrigated rocks. Areoles dispersed, surrounded by cyanobacteria at base, ochraceous-gray. Usually one apothecium per areole, disks reddish-brown. Medulla I+ violaceous. Spores 14-18 x 7-10 µm C. giraldii
6. Thallus not cyanotropic 7
7. Thallus ± dark olivaceous gray, areolate to squamulose 8
7. Thallus whitish, grayish or grayish-brown. Thallus whitish to ochraceous-white, not brown. Marginal areoles somewhat elongate, 1-1.5 mm long, also central areoles shortly sublobate. Spores ellipsoid to fusiform, 10-14 x 5-7 µm C. ochrotropa
8. Thallus squamulose to somewhat lobate, the squamules slightly lifted from the substrate, 0.2-0.8 mm. Apothecia 0.2-0.7 mm, disks dark without yellow epipsamma. Spores 9-12 x 6-8 µm C. plumbeoolivacea
8. Thallus areolate, with angulate to rimose areoles, never uplifted from the substrate, thin but distinct, rimose-areolate, flat, olivaceous-brownish to whitish, with black prothallus. Apothecia dispersed, mostly one per areole, with immersed to constricted base, disks flat, ochraceous-brown to brownish-black, margins ± of the same color. Spores 9-15 x 4.5-7.5 µm, septa 3-4.5 µ. C. cervina

Key E Thallus saxicolous, not or not distinctly effigurate; thallus and apothecia or at least apothecia yellow to orange-red or ferruginous. E

1. Thallus sorediate or blastidiate-granulose. Thallus or at least soredia (or blastidia, resp.) yellow to red-orange. Apothecia unknown 2
1. Thallus neither sorediate nor blastidite-granulose. Apothecia mostly common 3
- [2. Thalus soon completely leprose-blastidiate, never areolate or squamulose (not even at the beginning) C. chrysodeta]
2. Thallus areolate to squamulose, flat, yellow to orange, the squamules soon sorediate at the margin,

- often completely dissolved in yellow soredia C. citrina
3. Thallus cyanotrophic or parasitic, at least when young 4
3. Thallus neither cyanotrophic nor parasitic. 10
4. Thallus cyanotrophic, growing upon or between colonies of mostly trichial cyanobacteria. Thallus bright ochraceous, thick, areolate. Apothecia brownish-red, usually one per areole. Spores 14-18 x 7-10 μm , septa 4-7 μm C. giraldii
4. Thallus parasitic on other lichens, at least at the beginning of the ontogeny 5
5. Apothecia vermilion, margins brownish to grayish-brown. Without proper epikapylic thallus. Silicicolous. Spores 9-12 x 5-6.5 μm , septa 2-3 μm . On Candelariella coralliza and Candelariella vitellina C. grimmiae
5. Apothecia or at least disks yellow to orange, rarely scarlet; if rusty red to rusty orange, then with a distinct, yellow to orange thallus 6
6. On Aspicilia, mostly on intermediate rocks. Thallus orange to scarlet, often very small, consisting of a few squamules 13
6. On Caloplaca transcaspica. Thallus areolate, yellow-orange to orange. Disks flat to convex. Spores 10-16 x 5.5-8 μm , septa 2.5-5 μm C. sororicida
7. Medulla I-. Thallus areolate, the areoles adnate on the host. Spores 4 to 8, broadly ellipsoid, 12-16 x 6.5-9 (-10) μm , septa 4-6 μm C. infestans
7. Medulla I+ violaceous, at least at the base of the squamules 8
8. Apothecia and thallus scarlet to scarlet-orange, thalli mostly very small. Spores 9-13 (-15) x 5-7 (-9) μm , septa 1-4 μm C. anchon-phoeniceon
8. Apothecia and thallus yellow to orange or brownish-orange, disks mostly orange-brown 9
9. Thallus brownish-orange, consisting only of apothecia and their initials, margins mostly thick. Ascospores variable, 10-15 x 6.5-8 (-10) μm , septa narrow, 1.5-3 μm C. insularis
9. Thallus areolate, \pm large, \pm orange. Margins of the apothecia thin. Ascospores 9.5-15 x 6-8 μm , septa 3-4 μm C. intrudens
10. Apothecia or at least disks rusty-red to scarlet. Thallus not phyllidiate, whitish to grayish, or indistinct. 11
10. Apothecia or at least disks or only margins yellow, orange to orange-brownish. Thallus brown, gray, yellow or orange. 12
11. Thallus thick, areolate, whitish to gray. Apothecia 0.5-1 mm in diam., disks scarlet to rusty red, thalline excipulum grayish on the outside. Spores 8, 6 or 4, \pm broadly elliptic with distinct outer wall, 13-20 x 7.5-10 μm C. bicolor
11. Thallus thin or indistinct. Apothecia mostly 0.2-0.6 mm in diam. Spores narrowly ellipsoid, 10-15 (-17) x 4.5 (-5) μm , septa very thin, often not closed. C. arenaria

12. Thallus distinctly brownish, brownish pigment in walls of outer cortical cells. Areoles subumbilicate, 0.5-1 mm in diam. Apothecia 1-2 per areole, replacing it, disks dirty red-brown. Spores 11-16 x 7.5-10 μm C. cupreorufa
 12. Thallus not brown, (white, gray or yellow to orange) 13
13. Margins of apothecia whitish to gray, sharply distinct from the disks. Thallus very thick, subsquamulose. Apothecia obconical, the margins zeorine, proper margin orange. Spores 8 or less, 12-20 x 7.5-10 μm , septa 3.5-5 μm . Apices of spermagonia blackish C. dickoreana
 13. Margins yellow to orange or red, sometimes whitish or grayish on the outside 14
14. Thallus yellowish, yellow, orange or ochraceous-yellow 15
 14. Thallus whitish, grayish or very indistinct 19
15. Parathecium \pm paraplectenchymatic, composed of roundish to angular cells. Thallus distinctly squamulose, adnate to mostly somewhat desisting, squamules yellow to reddish-orange, up to 1 mm in diam. Spores 10.5-15 (-16) x 6-8 μm , septa 2.5-4 μm C. "subsoluta"
 15. Parathecium paraplectenchymatous. Thallus thin. Spores (12) 13-16 (17) x 6.5-7 μm , septa 4-5 μm C. mongolica
 15. Parathecium not distinctly paraplectenchymatic, composed of elongate cells. Cortex of thallus (if present), and apothecia paraplectenchymatic, composed of anticlinally arranged hyphae. Disks not scarlet 16
16. Thallus thick, areolate to squamulose 17
 16. Thallus thin, membranaceous to slightly areolate 18
17. Thallus very thick, indistinctly effigurate. Apothecia mostly irregular in outline. Ascospores broadly elliptic, 12-17 x 7-10 μm , septa 3-6 μm C. pachythallina
 17. Thallus moderately thick, never effigurate, areolate to subsquamulose, but very often damaged and then \pm smooth, greenish-yellow, more rarely bright yellow. Apothecia mostly dispersed, brownish-orange. Spores 11-16 x 6.5-8.5 μm , septa 3-5 μm C. flavovirescens
18. Thallus large, mostly greenish-yellow C. flavovirescens
 18. Thallus small, vividly yellow. Apothecia 0.2-0.5 mm in diam., reddish-brown. Spores 10-15 x 6-8 μm , septa 3-5.5 μm , always completely closed C. amoena
19. Apothecia mostly very dense, 0.3-0.5 mm in diam., mostly yellow to orange hymenium 70-80 μm . Spores 8, ellipsoid to fusiform, 10-15 x 5.5-8 μm , septa 3-4 μm , often not completely closed C. submodesta
 [19. Apothecia dispersed to dense, mostly reddish-orange, sometimes yellow. Spores broad, with thick septa. C. lithophyla s. l.]

Species not in key
C. aurantia
C. cinnamomea

- C. ferrugineoides
- C. ionaspidea
- C. modestula
- C. polioterodes
- C. polytropoides
- C. sinensis
- C. vitellinula

Synonyms

- C. elegans = Xanthoria elegans
- C. kansuensis = C. bicolor
- C. paulsenii = C. transcaspica
- C. lucens = misident.

Calopadia

- 1. Apothecia black, hypothecium dark aeruginous, epithecium aeruginous, spores 55-80 x 12-20 μ C. subcoerulescens
- 1. Apothecia dark to blackish brown, hypothecium dark brown with an aeruginous tinge, spores 57-84 x 16-28 μ C. puiggarii

Candelaria

- 1. No soredia present; fibrils under apo. margin; lobes broad C. callopizoides
- 1. Soredia present 2
- 2. Lobe ends granular sorediate spreading to upper surface; lobes narrow C. concolor
- 2. Lobe margins broadly labriform sorediate, lobes broad and short; lobes wider C. crawfordii

Catapyrenium See Dermatocarpon key

Cetraria

- 1. Thallus isidiate or sorediate 2
- 1. Thallus lacking isidia or soredia 6
- 2. Thallus isidiate, yellowish green; medulla K-, C-, KC-, P- C. togashii
- 2. Thallus sorediate 3
- 3. Medulla yellow; thallus and soredia bright yellow C. pinastri (Vulpicida)
- 3. Medulla white; thallus yellow green 4
- 4. Medulla K+ yellowish, P+ yellow to orange-red; thallus not deeply lobed, less than 3cm

across	<u>C. xizangensis</u>	
4. Medulla K-, P-		5
5. Thallus irregularly lobed, more than 1cm across	<u>C. laureri</u>	
5. Thallus narrower, elongate, less than 1 cm wide	<u>C. oakesiana (Allocetraria)</u>	
6. Thallus foliose, horizontally spreading, usually wide lobate, somewhat ascending along margins, often rhizinate on lower surface		7
6. Thallus subfruticose, suberect to erect, laciniate-lobate, attached to substratum by basal end		16
7. Saxicolous; medulla K+ yellow or red, P+ orange yellow; lobe margins and pycnidia with granular projections	<u>Melanelia hepatizon</u>	
7. Corticolous		8
8. Thallus yellow or yellow green		9
8. Thallus brown		15
9. Lower surface with pseudocyphellae		10
9. Lower surface without pseudocyphellae		14
10. Medulla yellow		11
10. Medulla white		12
11. With marginal cilia	<u>C. ornata</u>	
11. Without marginal cilia	<u>C. asahinae</u>	
12. Upper surface wrinkled and ridged	<u>C. kamarovii</u>	
12. Upper surface smooth		13
13. Without marginal cilia	<u>C. pallescens</u>	
13. With marginal cilia	<u>C. stracheyi</u>	
14. Thallus foveolate; many small apothecia on upper surface	<u>C. wallichiana (Cetrariopsis)</u>	
14. Thallus not strongly foveolate, apothecia marginal	<u>C. juniperina (Vulpicida)</u>	
15. Margins of lobes without cilia, often with short spinules; microphyllinic acid present (medulla C-, KC+ pink)	<u>C. microphyllica</u>	
15. Margins of lobes with cilia; chemistry varies	<u>C. ciliaris</u> group (Tuckermannopsis)	
16. Thallus brown to dark brown		17
16. Thallus yellow, yellowish green or ochraceous		22
17. Thallus with marginal cilia(up to 2mm long), small, 0.5-1.5 cm tall, lobes 0.5-1.5mm wide, pseudocyphellae on lower surface	<u>C. nigricans</u>	
17. Thallus without marginal cilia, pseudocyphellate		18

18. Medulla P+ red (fumarprotocetraric acid present) 19
 18. Medulla P- 20
19. Pseudocyphellae laminal and submarginal on lower surface, lobes 2-3(-5)mm wide, involute-canalicate, surface pitted or ridged C. islandica
 19. Pseudocyphellae submarginal forming a distinct continuous line, lobes 1-3mm wide, canalicate to subtubular, surface smooth C. laevigata
20. Medulla C+ red, KC+ reddish; thallus lacinate on margin C. delisei (Cetrariella)
 20. Medulla C-, KC-; thallus with marginal projections 21
21. Long pseudocyphellae only present on lobe margins; medulla P+ orange or P- C. ericetorum
 21. Pseudocyphellae marginal and laminal, narrow; medulla P- C. reticulata
22. Obvious large pseudocyphellate on surface of lobes 23
 22. Thallus lacking obvious pseudocyphellae on surface but may have them on the margins (some species may have minute pseudocyphellae on lower surface) 24
23. Lower surface with brown rimmed pseudocyphellae, thallus 2-3.5cm tall, uniformly 2-6mm wide C. melaloma
 23. Pseudocyphellae on lower surface distinct, white and round; medulla KC+ yellow C. pallida
24. Thallus 5-10cm tall, lobes 2-6mm wide, curled into tubes, margins crisped, bases usually reddish-purple; minute flush pseudocyphellae on lower surface C. cucullata (Flavocetraria)
 24. Thallus shorter, not strongly curled into tubes, margins not crisped 25
25. Ends of lobes or whole thallus thick and angular, thallus caespitose, erect, 2-4cm tall, surface smooth to foveolate (Medulla yellow-ochraceous containing pigments) C. everniella
 25. Whole thallus flat, no parts angular 26
26. Thallus strongly foveolate, frequent branches, few scattered small pseudocyphellae on lower surface, terricolous C. nivalis (Flavocetraria)
 26. Thallus slightly foveolate on lower surface, upper surface mostly smooth, few branches, no pseudocyphellae on lower surface 27
27. Growing on twigs, suberect C. ambigua
 27. Growing on mosses and ground, thallus small, 1-3 cm tall, lobes 1-3mm wide, foveolate, elongated branched lobes; pseudocyphellae marginal C. potaninii

Species not included:

C. yunnanesis

C. pachysperma

C. denticulata

Species of other groups near this not in key:

Nephromopsis

endocrocea
globulans
laxa
morisonicola
pseudocomplicata
 Tuckermannipsis
microphyllica

Cetrelia

Adapted from Culberson & Culberson (1968)

- 1. Thallus isidiate or sorediate 2
- 1. Thallus lacking isidia or soredia 6
 - 2. Thallus sorediate, soralia marginal 3
 - 2. Thallus isidiate 5
- 3. Medulla C+ pink or red(olivetoric acid present), lobes up to 18 mm wide, light tan to brownish; lower surface brown to black C. olivetorum
- 3. Medulla C- 4
 - 4. Medulla KC+ weak pink or KC-; soralia marginal to laminal; pseudocyphellae small (up to 0.5 mm across); lobes tan or pale, lower surface jet black C. cetrarioides
 - 4. Medulla KC+ red; soralia marginal; pseudocyphellae larger (usually 1.0mm across) C. chicitae
- 5. Medulla C+ red C. isidiata
- 5. Medulla C-, KC+ pink or red, UV+ (alectoronic) C. braunsiana
 - 6. Flattened lobules present in tufts or clusters on upper surface or along margin 7
 - 6. Lobules absent 9
- 7. Medulla C-; upper surface greyish green, lower surface black C. sinensis
- 7. Medulla C+ pink or red 8
 - 8. Pseudocyphellae distinct; medulla C+ pink or red (olivetoric acid present); upper surface grey, grey white to light brown, smooth to cracked C. pseudolivetorum
 - 8. Pseudocyphellae sometimes inconspicuous or absent; medulla C+ pink to red (anziaic acid present); upper surface whitish tan to brownish, smooth to wrinkled C. sanguinea

- 9. Pseudocyphellae very small, rarely to 1 mm, simple, punctiform 10
- 9. Pseudocyphellae large, 1mm or more, compound and irregular 11
 - 10. Medulla C+ pink or red (olivetric) C. davidiana
 - 10. Medulla C- (imbricatic); lobes thick C. delavayana
- 11. Lobes 6-18mm wide; medulla KC+ pink, UV+ (alectoronic, a-collatolic); upper surface grayish white C. nuda
- 11. Lobes up to 25mm wide; medulla KC-, UV- (imbricatic, atranorin) C. collata

C. monachorum = C. cetrarioides

Chaenotheca

- 1. Apothecia with little white pruina or none, algae Stichococcus, thallus thin, farinose C. stemonea
- 1. Apothecia with yellow or yellow-green pruina 2
 - 2. Thallus bright yellow, abundant, apothecia with strong yellow pruina, spores ellipsoidal-short cylindrical C. chrysocephala
 - 2. Thallus greenish or scant but not abundant and strong yellow, spores sphaerical C. furfuracea

Note. Tibell (1987) reports confusion between C. furfuracea and C. brachypoda. The report of C. furfuracea from China may be in error.

Chiodecton

From Thor, 1990

- 1. Thallus with red color Cryptothecia rubrocincta (Ch. sanguineum)
- 1. Thallus yellow or gray-green 2
 - 2. Lower part of medulla with yellow pigments, mainly around stromatic structures, thallus yellowish-white, K+ red, UV+ C. congestulum
 - 2. Lower part of medulla lacking yellow pigments, thallus grayish-green, with white pruina, K-, UV+ C. mucorinum

Chrysothrix

- 1. On trees; thallus bright yellow green; soredia very fine C. candelaris
- 1. On rocks; thallus yellow, fairly thick; soredia medium-sized C. chlorina

Cladina

After Wei et al., 1986. Now included within Cladonia.

- 1. Branching isotomic 2
- 1. Branching anisotomic 4
 - 2. Branching predominantly dichotomic, main stems absent, P- C. pseudoevansii

- 3. P-, psoromic acid absent C. stellaris
- 3. P+, psoromic acid present C. stellaris var. aberrans (C. aberrans)
 - 4. Branching predominantly dichotomic 5
 - 4. Branching predominantly tetrachotomic or tetrachotomic trichotomic 7
- 5. Yellowish-gray, usnic acid present 6
- 5. Ash-gray, usnic acid absent (P+r, K-,KC-) C. grisea
 - 6. Main stems rather robust, resembles C. arbuscula C. imshaugii
 - 6. Main stems thin C. ciliata var. tenuis (C. tenuis)
- 7. Ash-gray, usnic acid absent 8
- 7. Yellowish-gray, usnic acid present 9
 - 8. Dead inner bases of podetia black C. stygia
 - 8. Dead inner bases of podetia gray C. rangiferina
- 8. Podetia P+, terminal branches mostly curved in one direction C. arbuscula
- 8. Podetia P-, terminal branches of podetia curved in different directions C. mitis

Coccocarpia

- 1. Thallus isidiate, apothecia rare 2
- 1. Thallus not isidiate, apothecia usually present 3
 - 2. Isidia terete, all laminal C. palmicola
 - 2. Isidia flattened, microphylline, sometimes marginal, sometimes incised to finely lobulate..... C. pellita
- 3. Upper surface pruinose, especially toward lobe apices, pruina white or pale yellow C. smaragdina
- 3. Upper surface epruinose C. erythroxyli

Collema

- 1. Thallus isidiate 2

1. Thallus non-isidiate	8
2. Isidia squamiform	3
2. Isidia globular, simple or branched	5
3. Spores muriform; lobes up to 2.5mm wide; apothecia up to 0.5mm diam; thallus terricolous	<u>C. furfureolum</u>
3. Spores not muriform, apothecia rare	4
4. Thallus corticolous, bluish-grey to brown, smooth, lobes 0.7mm wide; apothecia rare	<u>C. flaccidum</u>
4. Thallus saxicolous, dark green to blackish, lobes 1-3mm wide	<u>C. crispum</u>
5. Thallus with irregularly arranged coarse ridges, grey to blackish green, lobes up to 15mm wide	<u>C. rugosum</u>
5. Thallus without ridges	6
6. Apices of lobes swollen and plicate; thallus dark olive grey, lobes up to 2.5mm wide	<u>C. tenax</u>
6. Apices of lobes not swollen and plicate	7
7. Isidia becoming lobulate with age; lower surface wrinkled; thallus saxicolous	<u>C. cristatum</u>
7. Isidia not becoming lobulate; lower surface not wrinkled; on rocks and on ground	<u>C. glebulentum</u>
8. Thallus with coarse ridges and/or pustules	9
8. Thallus without coarse ridges or pustules	14
9. Apothecia disk with white pruina; lobes strongly pustulate and ridged; apothecia on pustules and ridges	<u>C. pulcellum</u>
9. Apothecia disk without white pruina	10
10. Thallus with both coarse ridges and pustules, lower surface pitted; apothecia very common	<u>C. nigrescens</u>
10. Thallus only with pustules or ridges	11
11. Thallus pustulate, saxicolous, dark green to black, lobes 3-6mm wide	<u>C. ryssoleum</u>
11. Thallus only ridged	12
12. Ridges radiating, anastomosing; thallus up to 20cm across	<u>C. subnigrescens</u>
12. Ridges not radiating and anastomosing	13
13. Lobes wrinkled, up to 15mm wide, olive green; thallus irregularly ridged from margin inwards, remaining part smooth	<u>C. japonicum</u>
13. Lobes not wrinkled, ridges faint; thallus very thin	<u>C. complanatum</u>

14. Thallus distinctly foliose, flat, deeply lobed; lower surface with white hyphal hairs; apothecia numerous, up to 2mm diam. C. texanum
14. Thallus crustose, subcrustose to subfoliose 15
15. With swollen lobules, terricolous; thallus subcrustose to subfoliose C. limosum
15. t without lobules; lobes often fenestrate, thallus crustose to subcrustose 16
16. Lobes wrinkled; thallus crustose; apothecia numerous C. callibotrys
16. Lobes not wrinkled, indistinct or minute; thallus crustose to subcrustose 17
17. Apothecia dense and crowded; spores bacillar, usually 4-celled C. leptaleum
17. Apothecia not dense and crowded; spores acicular, fusiform, 6-10-celled ... C. substipitatum

Species not included:

- C. fasciculare
C. peregrinum
C. subconveniens

Dactylina

1. Thallus slightly branched, greatly swollen 2
1. Thallus frequently branched, slightly swollen 3
2. Medulla C+ red, P- (gyrophoric) D. arctica
2. Medulla C-, P+ red (physodalic) D. chinensis
3. Medulla white, K- ^{*Allocetraria*} D. madreporiformis
3. Medulla yellow, K+ red turning greenish-black D. endochrysea

Dermatocarpon

1. Rhizines present 2
1. Rhizines absent 3
2. Rhizines coralloid branched, black, about 1mm long, upper surface pruinose D. vellereum
2. Rhizines simple, brown, 0.2-0.3mm long; upper surface pruinose D. moulinsii
3. Upper surface pruinose 4
3. Upper surface epruinose 5
4. Thallus white; lobes broad, not crowded D. muhlenbergii
4. Thallus brown to whitish gray; lobes crowded or not D. miniatum
5. On rocks frequently wet; lobes with many points of attachment; spores

- ellipsoidal D. luridum
 5. On rocks in dry places; lobes attached by central point spores spherical D. leptophyllum

Dimerella

1. On mosses and bark; apothecia orange yellow; thallus thin, grayish green D. lutea
 1. On leaves; apothecia brownish; thallus smooth D. epiphylla

Dirinaria

1. Thallus with soredia or isidia 2
 1. Thallus without soredia or isidia D. confusa
2. Thallus purely isidiate; isidia papilliform or teretiform D. papillulifera
 2. Thallus sorediate 3
3. Lobes linearly folded and plicate 4
 3. Lobes flat, not plicate 5
4. Soredia from raised ridges; lobes subdichotomously, dichotomously or irregularly divided, confluent from the peripheral region of thallus; apices generally fan-shaped; apothecia rare D. applanata
 4. Soredia from coarse swollen tubercles D. aegialita
5. Soredia farinose; lobes pinnately or subpinnately divided, discrete at periphery of the thallus; apices narrow to oblong; apothecia frequent D. picta
 5. Soredia granular or coarse granular 6
6. Soralia capitate; soredia granular; divaricate and sekikaic acids absent; on rocks D. caesiopicta
 6. Soralia not capitate; soredia coarse granular; divaricatic acid present; on bark and rocks D. aegialita (D. aspera)

Endocarpon

1. Thallus of ascending, imbricate squamules 2
 1. Thallus mostly closely attached to soil, not ascending-overlapping; hyphae or roots present .. 3
2. Lower surface black; younger squamules building on top of older ones; no rhizines or hyphae E. sinense var. ascendens
 2. Lower surface pale; on rock & soil E. pallidum

- 3. Growing on soil 4
- 3. Growing directly on rock 6
 - 4. Squamules attached by hyphae only E. pusillum
 - 4. Squamules with root-like attachment 5
- 5. Squamules scattered, non-lobate E. sinense
- 5. Squamules not scattered, often lobate E. pusillum
 - 6. Thallus gray; squamules with raised undulating margin; perithecia superficial .. E. sp 2
 - 6. Thallus brown or tan, areolate/squamulose 7
- 7. Thallus tan; margin undulating with downturned margins; no perith. E. sp 3
- 7. Thallus brown; squamule slightly lobed, margin slightly uplifted; perith. half immersed E. desquamescens?

Ephebe

- 1. Branches with hispids, coarse; thallus tufted to erect E. hispidula
- 1. Branches without hispids, thinner; thallus not erect E. lanata

Evernia

- 1. Isidiate soredia present; lobes relatively short E. mesomorpha
- 1. No soredia or isidia present 2
 - 2. Lobes long and flaccid; with a central cord; cortex thin and fragile; apothecia rare or absent E. divaricata
 - 2. Lobes shorter and stiffer; no central cord; cortex thicker; apo common E. esorediosa

Everniastrum

Thallus glaucous grey, ashy-grey to darkish, subfruticose, loosely attached to substrata, lobes linear, with or without cilia along margin; rhizinae throughout the lower surface, simple or squarrosely branched; apothecia imperforate.

From Jiang & Wei (1993)

- 1. Soredia, isidia or lobulets present; rhizines marginal 2
- 1. Soredia, isidia or lobulets absent; rhizines laminal or marginal 5
 - 2. Soredia absent 3
 - 2. Soredia present 4

- 3. Isidia present E. vexans
- 3. Lobulets present E. sinense
 - 4. Medulla K-, salazinic acid absent E. subsorocheilum
 - 4. Medulla K+, salazinic acid present E. sorocheilum
- 5. Rhizines richly branched, short E. rhizodendroideum
- 5. Rhizines unbranched or occasionally poorly branched 6
 - 6. Rhizines only marginal E. cirrhatum
 - 6. Rhizines mostly laminal 7
- 7. Rhizines short (1mm long); diffractaic acid absent 8
- 7. Rhizines long (2mm long); diffractaic acid present E. diffractaicum
 - 8. Alectorialic acid absent..... E. nepalense
 - 8. Alectorialic acid present E. alectorialicum

Flavopunctelia

Thallus yellow green (usnic acid present), with white dots or/and lines

- 1. Soralia only on margins of lobe tips, convex; upper surface without white dots .. F. soredica
- 1. Soralia on lobe margins and laminal, not convex; upper surface with white dots F. flaventior

Graphidaceae

Genera in parentheses have not yet been reported for China.

- 1. Spores non-septate (Xylographa)
- 1. Spores septate 2
 - 2. Spores transversely septate 3
 - 2. Spores muriform 8
- 3. Spores brown Phaeographis (18)
- 3. Spores hyaline 4
 - 4. Spores with lenticular cells 5
 - 4. Spores with cylindrical or cubical cells 6
- 5. Paraphyses unbranched Graphis (53)
- 5. Paraphyses branched and interwoven (Helminthocarpon)

- 6. Paraphyses unbranched Melaspilea urceolata
- 6. Paraphyses branched and interwoven 7
- 7. Parasitic on lichens (Opegraphoidea)
- 7. Not parasitic on lichens Opegrapha (5)
- 8. Spores brown Phaeographina (18)
- 8. Spores hyaline, with lenticular cells Graphina (28)

Glypholecia

- 1. Pycnidia numerous; apothecia not known; cortex C+ reddish G. tibetica
- 1. Pycnidia rare; apothecia common and immersed; cortex C- G. scabra

Gymnoderma

- 1. Thallus subfoliose, upper surface smooth to scrobiculate; spores 9-12 μ x 2.5-3.5 μ G. coccoarpum
- 1. Thallus squamulose, upper surface smooth; spores 8-12 μ x 3 μ wide G. insulare

Haematomma

- 1. Growing on bark 2
- 1. Growing on rock ~~2~~ 3
- 2. Base of apothecia constricted; spores 7-9 septate; apothecia large(1-3mm in diam.); cortex K+ yellow; medulla P+ yellow (psoromic); apothecia disk bright red H. fauriei
- 2. Base of apothecia not constricted; spores 4-6 septate; apothecia small(0.2-0.6mm in diam.); cortex K+ yellow to brownish (atranorin); medulla P-; apothecia disk orange red; epithecium K+ purplish red H. puniceum
- 3. Medulla P+ red (fumarprotocetraric), med. and cortex K+ yellow Ophioparma ventosum
- 3. Medulla P-, med. and cortex K- Ophioparma lapponica

H. similis = H. puniceum

Heppia

- 1. Thallus white pruinose, squamules lobed, regularly arranged into +- round thallus; apo brown, open, flush; th K-, H. reticulata
- 1. Thallus olive, squamules scattered 2

- 2. Thallus with light spots on upper surface; apo 1 per squamule, open disk; th K- H. psammophila
- 2. Thallus without light spots; apo unknown; th K-; squamules large, concave, with raised ridges, minute cracks on upper surface H. lutosa

Hyperphyscia

- 1. Soredia present; thallus not warty-wrinkled; lower surface cream colored H. adglutinata
- 1. Soredia absent; thallus warty-wrinkled; lower surface brown; no cilia around apothecia H. syncolla

Hypogymnia

- 1. Thallus yellow or light yellow green; lobes broad and short; holes under 2
- 1. Thallus gray or brown 3
 - 2. Sorediate; soredia pustulose at first then convex and granular H. hypotrypella
 - 2. Lacking soredia; holes under H. hypotrypa
- 3. Thallus hollow 4
- 3. Thallus with solid medulla, sometimes with isidia breaking into soredia H. mundata
 - 4. Sorediate 5
 - 4. Lacking soredia 14
- 5. Soralia at tips of lobes 6
- 5. Soralia diffuse over upper surface 11
 - 6. Soralia labriform 7
 - 6. Soralia somewhat capitate on upper surface of lobe tips; lobes diverging ... H. tubulosa
- 7. Lobes subarticulate H. subarticulata
- 7. Lobes not subarticulate 8
 - 8. Lobes with black edge (lower surface exceding upper surface); med. P- H. vittata
 - 8. Lobes lacking black edge 9
- 9. Med. P+; no holes under; upper surface dull H. physodes
- 9. Med. P-; upper surface shiny 10
 - 10. Inner medulla white; no holes under H. metaphysodes
 - 10. Inner medulla brown; some holes under H. subduplicata

11. Medulla P+ H. pseudophysodes
 11. Medulla P- 12
12. Soredia isidioid or developing from isidia; upper surface brownish gray to brown or dark brown, shiny H. austerodes
 12. Soredia not isidioid 13
13. Holes under tips of lobes; upper surface gray or greenish gray, dull H. submundata
 13. No holes under lobes; soredia developing from pustules on upper surface and lobe ends; thallus gray to brown; inner med black to brown on older lobes; P- H. bitteri
14. Thallus isidiate 15
 14. Thallus lacking isidia 18
15. Thallus almost subfruticose, rather soft; isidia globose, swollen and cylindrical, constricted at base; holes under containing unknown substance and barbatic H. hengduanensis
 15. Thallus foliose; lacking barbatic 16
16. Thallus brownish gray, brown to dark brown, shining; with isidioid warts breaking into soredia on upper surface H. austerodes
 16. Thallus whitish mineral gray 17
17. Med. P+ red; not perforate on lower surface H. subcrustacea
 17. Med. P-; perforate on lower surface H. duplicatoides
18. Spores >10u; containing unknown substance, lacking physodic and physodalic acids 19
 18. Spores <10u 20
19. Spores 14-17.5 x 12-14u H. macrospora
 19. Spores 12-14 x 9-12u; lower surface exceding upper surface H. subvittata
20. Upper surface with dense pruina; lacking physodalic & physodic acids, with unknown subst. (UV+) H. pruinosa
 20. Upper surface lacking dense pruina; containing physodalic or physodic or both 21
21. Upper surface with papillae; with physodic H. yunnanensis
 21. Upper surface without papillae 22
22. Lower surface with a cluster of perforations H. fragillima
 22. Lower surface without cluster of perforations 23
23. Upper surface shiny H. laccata
 23. Upper surface not shing 24
24. Lobes with lateral lobules, short; apothecia large H. delavayi
 24. Lobes lacking lateral lobules, longer H. pseudoenteromorpha

Reported but not in key:

bullata
farinacea
lugubris
nikkoensis
pseudobitteriana
pseudohypotrumpa
subvittata
taiwanalpina

Hypotrachyna

Thallus with narrow eciliate lobes; sublinear to subtruncate apically, sometimes subrotund; rhizinae present throughout the lower surface, dichotomously branched.

1. Thallus sorediate or isidiate 2
1. Thallus lacking soredia or isidia; medulla P+ orange; lobes 2-3mm wide; apothecia concave, up to 1.5mm diam. H. adducta
2. Thallus sorediate 3
2. Thallus isidiate 8
3. Thallus greenish yellow; medulla K+ yellow turning red (salazinic, norstictic, usnic); lobes 1-3mm wide H. sinuosa
3. Thallus whitish to ashy gray(usnic acid absent) 4
4. Medulla uniformly yellow, KC+, P+ or. (barbatic) H. endochlora
4. Medulla white 5
5. Soralia pustulate, laminal toward the center of the thallus; lichexanthone present H. osseoalba
5. Soralia distinct, usually terminal or subterminal, soredia powdery 6
6. Medulla C-, P+ red; lobes narrow, 1-2mm wide; thallus closely adnate .. H. pseudosinuosa
6. Medulla C+ or KC+ red 7
7. Soralia orbicular, distinct; KC+ pink (barbatic) H. laevigata
7. Soralia more irregular and diffuse; C+ red (gyrophoric) H. revoluta
8. Medulla K+ yellow(stictic acid present); isidia sometimes lobulate; lobe margins crenate H. crenata
8. Medulla K- 9
9. Medulla P-, KC+ reddish H. nodakensis

- 9. Medulla P+ red(protocetraric acid present) 10
 - 10. Lobes are usually subdivided into many lobules; isidia well developed, almost cover the whole upper surface H. kokuensis
 - 10. Lobes not subdivided into lobules 11
- 11. Lobes sublinear, 1-3mm wide H. consimilis
- 11. Lobes subirregular, 4-10mm wide H. koyaensis

H. pseudoformosana not included in the Key.

Lasallia

From Wei & Jiang (1993).

- 1. Apothecia usually absent 2
- 1. Apothecia usually present 6
 - 2. Lower surface of the thallus black or purple-brown around black umbo 3
 - 2. Lower surface pale brown 4
- 3. Lower surface black L. asiae-orientalis
- 3. Lower surface purple-brown, black around umbo L. xizangensis
- 4. Upper surface sorediate or sorediate with a few isidia; pustules fenestrate L. pertusa x
- 4. Upper surface not sorediate, only isidiate; pustules whole 5
- 5. Pustules sparse, weakly convexed; isidia granulated, plane-compressed L. sinorientalis
- 5. Pustules numerous, strongly convexed; isidia cylindrical or bacilliform and granulated (L. pustulata)
- 6. Lower surface light to brownish, hymenium sometimes with a reddish pigment L. papulosa
- 6. Lower surface dark, black, dark brown or purple-brown 7
- 7. Lower surface of thallus dark brown or purple-brown, only black around umbo 8
- 7. Lower surface dark brown to sooty black or pure black; hymenium never with a reddish pigment 9
 - 8. Upper surface of thallus brown, neither granulated nor reticulated; lower surface dark brown, only black around umbo L. daliensis var. daliensis
 - 8. Upper surface gray-brown to purple-brown going to being covered with thick pruina, weakly granulated or reticulated; lower surface brownish and dark brown, black around umbo L. daliensis var. caengshanensis
- 9. Apothecia with gyrose disks, on bark L. mayebarae

9. Apothecia with plane and smooth disks, on rock 10
10. Apothecia adnate; upper surface usually without pruina, but with recurved squamules; lower surface black, grossly granular L. pensylvanica
10. Apothecia more or less stipitate; upper surface of thallus covered with pruina and appanate squamules; lower surface dark brown, never black, delicately granulated L. rossica

Leprocaulon

1. Pseudopodetia minute, 0.3-1.0cm high, white; medulla K+ yellow, P+ yellow (atranorin, psoromic, or thamnolic acid) 2
1. Pseudopodetia coarse, more than 1.0 cm high, brownish or grey, dendroid 3
2. Thallus with a yellowish cast (usnic acid) L. microscopicum
2. Thallus without a yellowish cast L. albicans
3. Thallus K+ brownish or K-, P+ orange red to miniate red (atranorin, physodalic and protocetraric acids present) L. arbuscula
3. Thallus K+ intense yellow or K-, P+ yellow then orange red, or P- (thamnolic and squamatic acids present) L. pseudoarbuscula

Leptogium

1. Thallus isidiate 2
1. Thallus lacking isidia 7
2. Thallus tomentose on lower surface; upper surface more or less smooth 3
2. Thallus not tomentose on lower surface 4
3. Isidia granular, rarely coralloid; lobes 5-15mm wide, thallus dark olive-green to olivaceous-black L. saturninum
3. Isidia cylindrical, usually coralloid branched; lobes 10-15mm wide; thallus bluish-grey to brown L. burnetiae
4. Isidia granular to cylindrical 5
4. Isidia squamuliform, up to 2mm wide, never cylindrical; upper surface smooth L. denticulatum
5. Thallus with sharp raised wrinkles; simple to coralloid isidia abundant on wrinkles and margins L. isidiosellum
5. Thallus without wrinkles 6
6. Thallus thinner, lead grey, margin isidiate and lobulate, isidia concolorous with thallus L. cyanescens
6. Thallus thick, lead grey to dark grey, margin entire to isidiate, isidia cylindrical,

- blackish L. pichneum
7. Thallus surface wrinkled 8
7. Thallus surface smooth 12
8. Thallus tomentose on lower surface 9
8. Thallus not tomentose on lower surface 10
9. Thallus margin slightly downturned, reddish brown on upper surface; apothecia exciple smooth L. hildenbrandii
9. Thallus margin not downturned, pale to dark grey on upper surface, thallus soft, only slightly wrinkled; apothecia exciple sometimes with hyphal hairs L. delavayi
10. Lobes tufted, erect, corniculate at apices; apothecia small L. corniculatum
10. Lobes not corniculate at apices 11
11. Thallus margin with lobules, thallus thin L. lichenoides
11. Thallus margin without lobules, lobes anastomosing, greenish grey to black . L. chloromelum
12. Thallus tomentose on lower surface, apothecia exciple with dense tomentose or wrinkled 13
12. Thallus not tomentose on lower surface 15
13. Exciple wrinkled, with sparse whitish stiff trichomes, thallus bluish grey L. arisanense
13. Exciple with dense tomentose 14
14. Dense tomentose on exciple; thallus grey-brown to brown-black L. trichophorum
14. Without dense tomentose on exciple L. menziesii
15. Thallus thick, lobe tips thicken and ascending; apothecia exciple corticate L. plicatile
15. Thallus thinner, lobe tips not thicken or ascending 16
16. Lobes up to 3.5mm wide; thallus thinner, lead grey; apothecia up to 1.2mm diam. L. moluccanum
16. Lobes 5-10mm wide; thallus thicker, lead grey to dark grey; apothecia up to 2.5mm diam. L. azureum

Species not included:

L. splendens

Lethariella

1. Thallus shrubby, up to 10cm long 2
1. Thallus filamentose, hair-like, up to 26cm long 4
2. Thallus curved, sparsely branched, reticulated ridges indistinct in the upper

- surface L. flexuosa
2. Thallus not curved, branches numerous, upper surface with distinct reticulated ridges; usually sorediate in the upper part 3
3. Thallus ascending, up to 5cm tall, branches dichotomous, rounded, apices obtuse, yellow-orange in upper part, and pale grey at base; thallus C+ red (gyrophoric acid present) L. cashmeriana
3. Thallus usually decumbent, 3-5(-10)cm long, branches tapering, longitudinally ridged and grooved, orange to orange-grey, thallus C-, P+ orange(psoromic and norstictic acids present) L. cladonioides
4. Upperside with obvious reticulated ridges L. sinensis
4. Upperside without reticulated ridges L. zahlbruckneri

Lobaria

From Wei et al., 1986.

1. Soredia present; thallus reticulately ridged, margins and ridges more or less sorediate; algae green; medulla KC-, stictic, constictic, and norstictic acids present L. pulmonaria
1. Isidia and/or lobules present 2
1. Soredia, isidia, and lobules absent 9
2. Thallus reticulate-ridged 3
2. Thallus not reticulate-ridged, lobules present, gyrophoric and congyrophoric acids present L. crassior
3. Medulla K+, P+ 4
3. Medulla K-, P- 6
4. Thallus with green algae 5
4. Thallus with blue green algae; medulla KC-, triterpenoids present L. isidiosa
5. Medulla KC+, gyrophoric and norstictic acids present L. isidiophora
5. Medulla KC-, stictic, constictic, and norstictic acids present L. meridionalis
6. Thallus with green algae; medulla KC+, gyrophoric acid present 7
6. Thallus with green or blue green algae; medulla KC-, gyrophoric acid absent 8
7. Congyrophoric acid present L. tuberculata
7. Congyrophoric acid absent L. spathulata
8. Thallus with green algae L. kazawaensis
8. Thallus with blue green algae L. retigera
9. Thallus with green algae 10

9. Thallus with blue green algae 15
10. Thallus reticulately ridged 11
10. Thallus not reticulately ridged 14
11. Medulla K+, P+ 12
11. Medulla K-, P- 13
12. Medulla KC+, gyrophoric acid present L. orientalis
12. Medulla KC-, gyrophoric acid absent L. chinensis
13. Medulla KC+, gyrophoric acid present L. gyrophorica
13. Medulla KC-, gyrophoric acid absent L. yunnanensis
14. Thallus scrobiculate L. ferax f. stenophyllodes
14. Thallus not scrobiculate L. discolor f. inactiva
15. Medulla K+, P+ L. pseudopulmonaria
15. Medulla K-, P- L. kurokawae

Lopadium

1. Apothecia black; epithecium K+ dark brown L. pezizoideum
1. Apothecia reddish; epithecium K+ red violet L. ferrugineum

Mazosia

1. Thallus verrucose or radiately ridged 2
1. Thallus smooth 3
2. Thallus with white verrucae, yellow green or grey green M. melanophthalma
2. Thallus with numerous gentle and thin radiate ridges, yellowish green with olive green tint M. rotula
3. Spores 3-septate, fusiform, microcephalic, one of the median cells larger M. phyllosema
3. Spores (4-)7-septate, acicular, microcephalic with rather acute ends M. paupercula

Megalospora

1. Apothecial disks pruinose; hymenium K+ yellow; asci with 8 spores, spores one-septate M. marginiflexa
1. Apothecial disks epruinose; hymenium K-; asci with 1 spore, spores 5-7 septate M. tuberculosa

Melanelia

Thallus brownish, dark brown, greenish brown or (rarely black)

- 1. Thallus isidiate 2
- 1. Thallus lacking isidia 5
 - 2. Medulla C+ red or rose, KC+ rose-red 3
 - 2. Medulla C-; no lichen substance 4
- 3. Thallus and isidia with fine hairs M. subverruculifera
- 3. Thallus usually smooth; thallus and isidia lacking hairs M. fuliginosa (M. glabratula)
 - 4. Isidia arising as small conical to hemispherical papillae with (sometimes obscure) white spots at the tip, when mature often with small lateral branches M. incolorata (M. elegantula)
 - 4. Isidia arising as small spherical to hemispherical papillae without white spots at the tip, when mature simple or more or less isotomically branched M. exasperatula
- 5. Medulla K+ yellow turning orange-red or red, P+ orange yellow; lobes mostly 5-11mm broad, usually with a greenish color M. acetabulum
- 5. Medulla K-; lobes smaller 6
 - 6. On rocks; thallus dark brown, lobes about 1mm across M. stygia
 - 6. On bark; thallus brown, greenish brown to dark brown or ashy grey; lobes 2-6mm across 7
- 7. Medulla C-, P+ orange red M. olivacea
- 7. Medulla C+ red, P- 8
 - 8. Upper surface not wrinkled and ridged, often with lobules; lower surface black M. huei
 - 8. Upper surface with wrinkles or ridges; lower surface pale to brownish M. glabra

Menegazzia

- 1. Pores in the upper surface protruding; soralia terminal; medulla K-, P- M. ashahinae
- 1. Pores in the upper surface not protruding; soralia laminal, capitate; medulla K+ yellow, P+ M. terebrata

Mycoblastus

- 1. Asci with two spores; hypothecium not colored M. affinis
- 1. Asci with one spore 2

2. Hypothecium red with crystal deposits M. sanguinarius
 2. Hypothecium not red M. alpinus

Myriotrema

1. Spores hyaline, transversely 3-septate, P- M. album
 1. Spores hyaline, muriform, 1 per ascus, P+ red M. microstomum

Notes. M. album was placed on Ocellularia and M. microstomum was placed in Thelotrema by Wei (1991).

Both were placed in Myriotrema by Hale (1981).

Neofuscelia

Thallus dark gray or brown, K-, HNO₃+ blue or violet

1. Thallus sorediate; medulla KC- N. sorediosa
 1. Thallus lacking soredia; medulla KC+ red N. delisei

Nephroma

1. Lobes without soredia or isidia 2
 1. Lobes with soredia, isidida or marginal lobules, no tubercles 3
2. Lobes with tubercles below; lower surface with abundant tomentum N. resupinatum
 2. Lobes without tubercles; lower surface without tomentum N. bellum
3. Soredia present 4
 3. Soredia absent, isidia may be present 5
4. Soredia marginal; no reticulate ridges above N. parile
 4. Isidiate soredia laminal; with reticulate ridges N. isidiosum
5. Marginal lobules flat, thin; no isidia N. sp.
 5. Marginal lobules terete or thick; isidia present, terete N. helveticum var. sipeanum

Notes:

N. helv. var. sipeanum needs to be reevaluated; sinense may belong here also.

Species not included:

- N. javanicum
N. mooszii
N. sinense

Ochrolechia

- 1. Thallus sorediate or isidiate 2
 - 1. Thallus lacking soredia or isidia 4
 - 2. Thallus sorediate, soredia in more or less discrete soralia; thallus and apothecia margins C+ red; UV-(or pale white) O. androgyna
 - 2. Thallus distinctly isidiate, or with isidia breaking down into granules 3
 - 3. Isidia cylindrical, coarse; apothecia disk pruinose, medulla C-, cortex C+ red; on bark and on rock O. yasudae
 - 3. Isidia granular; apothecia disk epruinose; on bark O. akagiensis
 - 4. Apothecia margin cortex or medulla C+ red; contains gyrophoric acid, sometimes also contains variolaric acid 5
 - 4. Apothecia margin cortex or medulla C-; contains variolaric acid 8
 - 5. Apothecia margin medulla C+ red, cortex C-, apothecia disk pruinose; thallus UV+ or UV- O. africana (O. hamandii)
 - 5. Apothecia margin medulla C-, cortex C+ red; thallus UV- 6
 - 6. Apothecia disk C+ red, 4-8mm in diam.; thallus and apothecia thick and shiny O. tartarea
 - 6. Apothecia disk C- 7
 - 7. Algae mainly confined to lateral parts of apothecia margins, but sometimes also below hypothecium; lacking olivetoric and 4-O-demethylmicrophllic acids; apothecia with low rugose to verrucose margins O. trochophora (O. rosella)
 - 7. Algae layer continuous below hypothecium, and often in the lateral margin as well; usually contains olivetoric and 4-O-demethylmicrophllic acids; apothecia with smooth, even, prominent margins O. subpallascens
 - 8. Apothecia disk C+ red; thallus C- O. pallescens
 - 8. Apothecia disk C- O. parella
- O. chondriocarpa not included.

Pannaria

- 1. Thallus with soredia or lobules 2
- 1. Thallus without soredia or lobules 4
 - 2. With squamule-like soredia; upperside scabrid or slightly pruinose, P+ orange P. conoplea

- 2. With lobules 3
- 3. Flattened lobules becoming elongated; on ground; thallus thick .. Fuscopannaria praetermissa (P. praetermissa)
- 3. Lobules cylindrical; on rocks and tree barks; thallus thinner P. stylophora
 - 4. Thallus squamulose 5
 - 4. Thallus foliose 7
- 5. White felted-tomentose conspicuous both on lobe margins and apothecia margins Fuscopannaria leucosticta (P. leucosticta)
- 5. White felted-tomentose absent 6
 - 6. On rocks; squamules larger, imbricate ... Fuscopannaria leucophaea (P. leucophea)
 - 6. On trees; squamules tiny (0.1-0.2mm across), not imbricate P. adpressa
- 7. Lobes long and radiating; underside with dense black prothallus P. mariana
- 7. Lobes short and non-radiating; underside without dense black prothallus; P+ orange 8
 - 8. Upper surface wrinkled; lobes 2-4mm wide; thallus brownish, loosely adnate P. lurida
 - 8. Upper surface not wrinkled; lobes 1-2mm wide; thallus brown to dark brown, closely adnate P. rubiginosa

Parmelia group

- 1. Upper surface with distinct white dots or lines 2
- 1. Upper surface lacking white dots or lines 4
 - 2. Thallus yellow or yellowish green Flavopunctelia (2)
 - 2. Thallus not yellow or yellowish green 3
- 3. Upper surface with white lines and dots, often forming a coarse white reticulum; a black lower surface with simple, furcate or squarrose rhizines; cylindrical to weakly bifusiform conidia; salazinic acid and protocetraric acid; most common in temperate-boreal and austral regions Parmelia (29)
- 3. Upper surface with white dots Punctelia (3)
 - 4. Thallus with bulbate cilia along the margin of lobes 5
 - 4. Thallus lacking bulbate cilia along lobe margin; simple cilia present or absent 6
- 5. Atranorin in upper cortex Bulbothrix (4)
- 5. Usnic acid present in cortex Relicina (8)
 - 6. Thallus ciliate 7
 - 6. Thallus not ciliate 8

7. Lobes broad(2-5cm wide), rotund; rhizines in the central part of thallus, simple; apothecia often perforated Parmotrema (33)
7. Lobes narrow; rhizinae simple or squarrosely branched; apothecia imperforateParmelina (19)
8. Thallus yellow green(usnic acid present) 9
8. Thallus white or gray(atranorin present) 10
9. Lichenin present in cell wall; lower cortex black or brown, rhizinate throughout; spores, if present, usually less than 14u long Xanthoparmelia (26)
9. Lichenin absent; lower cortex black in center; rhizines abundant in center but not extending into the brown zone; spores, if present, usually more than 14um longFlavoparmelia caperata
10. Thallus white or light gray 11
10. Thallus dark gray or brown, K- 14
11. Medulla K-; atranorin and divaricatic acid with associated unknowns present; thallus isidiate-pustulate, the isidia coarse, short; cortex K+ yellow Pseudoparmelia owariensis
11. Medulla K+ yellow; divaricatic acid lacking 12
12. Rhizines distinctly dichotomous Hypotrachyna (13)
12. Rhizines not dichotomous 13
13. Lobes linear and angled, lacking cilia, with abundant fine isidia Parmelia (Canoparmelia) amazonica
13. Lobes broad and rotund, usually ciliate;lobe tips reticulately maculate, becoming cracked along the maculae Parmelia (Rimelia) reticulata
14. Thallus HNO₃+ blue or violet Neofuscelia (2)
14. Thallus HNO₃-; thallus lobes 0.4mm wide or greater, medium brown; spores if present, colorless and non-septateMelanelia (9)

Parmelia sensu stricta

Upper surface with distinct white dots and lines, often forming a coarse white reticulum.

1. Thallus sorediate or isidiate 2
1. Thallus lacking soredia or isidia 11
2. Thallus sorediate 3
2. Thallus isidiate 5
3. With white dots, only on lobe edges P. isidioclada
3. Mainly with white lines, on lobe surface and/or margins 4
4. Soredia pustular, mostly laminal; cortex deeply fissured P. erumpens

4. Soredia powdery, marginal or along ridges on surface; cortex not deeply cracked; medulla K+ yellow turning red (salazinic) P. sulcata
5. Medulla K-(protocetraric acid) 6
5. Medulla K+ yellow turning red(salazinic acid) 7
6. Lower surface black, rhizines squarrosely branched, on the whole lower surface P. infirma
6. Lower surface brown towards the margins, rhizines simple, only in the center P. ikomae
7. Isidia produced only along lobe margins P. isidioclada
7. Isidia produced mostly on lobe surface or along ridges on lobe surface 8
8. Upper surface with fine white dots P. meiophora
8. Upper surface with larger white lines more than 0.5mm wide 9
9. Lobes 5-10mm wide, isidia brownish or dark grey P. scorteae
9. Lobes 1-5mm wide 10
10. Rhizines simple to furcate P. saxatilis
10. Rhizines squarrosely branched P. squarrosa
11. With white dots, on lobe edges P. laevior
11. With white lines, laminal and/or marginal 12
12. White lines marginal as a white rim around lobes 13
12. White lines laminal and marginal, not forming a conspicuous marginal rim 15
13. Saxicolous; cortex C+ rose(gyrophoric acid) P. shinanoana
13. Corticolous; cortex C-(atranorin only) 14
14. Lobes subirregular, apically rotund P. cochleata
14. Lobes sublinear, apically obtuse P. niitakana
15. Rhizines squarrosely branched 16
15. Rhizines simple to furcate 17
16. White lines less than 0.3mm long, appearing as fine white maculae P. submutata
16. White lines distinct, up to 1mm long, mostly marginal; lobes sublinear P. fertilis
17. White lines mostly marginal; apothecia numerous, to 2mm in diameter P. ricasoliodes
17. White lines mostly laminal 18
18. White lines separate, less than 0.5mm long P. marmariza
18. White lines separate or fusing into a network, to 1mm long 19

- 19. Upper surface conspicuously cracked with age; white lines mostly laminal P. adaugescens
- 19. Upper surface not cracking conspicuously; white lines marginal, forming a nearly continuous rim 20
- 20. Spores about 30um long P. niitakana
- 20. Spores about 15um long P. cochleata

P. centriasiatica, P. flexilis, P. muliensis and P. urceolata(this species has soredia) are not included. The rest are no longer included in the Parmelia sensu stricta.

Parmelina

Thallus ciliate, lobes narrow; rhizinae simple or squarrosely branched

- 1. Thallus lacking isidia, soredia and pustules 2
- 1. Thallus isidiate, sorediate or pustulate 10
 - 2. Medulla more or less completely yellow to yellow-orange (pigmented mostly below the apothecia in P. galbina) 3
 - 2. Medulla entirely white 9
- 3. Upper surface heavily rugose P. rhytidodes
- 3. Upper surface more or less plane 4
 - 4. Lobes are usually subdivided into lobules, lobe tips crenulate medulla K+ deep yellow P. crenulata
 - 4. Lobes usually not subdivided into lobules 5
- 5. Upper cortex very fragile, flaking away over extensive areas; medulla deep yellow P. entotheiochroa
- 5. Upper cortex entire and continuous 6
 - 6. Lower half of medulla darker reddish orange P. amagiensis
 - 6. Lower half of medulla not darkly pigmented 7
- 7. Lobes narrow and sublinear, 1-2mm wide Myelochroa
- 7. Lobes broader, subirregular, 2-4mm wide 8
 - 8. Thallus coarse, about 250um thick; leucotylin present; black below P. crassata
 - 8. Thallus thin, about 150um thick; leucotylic acid present; rhizines simple; lower surface black P. irrugans
- 9. Medulla K+ yellow turning red Myelochroa galbina
- 9. Medulla K-, C+ red Parmelina quercina
- 10. Thallus pustulate 11

10. Thallus isidiate or sorediate	13
11. Lobes rather broad, subirregular, 2-4mm wide	12
11. Lobes narrow and sublinear, less than 2mm wide; medulla C+ rose, pigmented very faint yellow	<u>P. spumosa</u>
12. Pustules forming in capitate masses	<u>P. leucotyliza</u>
12. Pustules irregular, intermixed with wrinkles	<u>P. rhytidodes</u>
13. Thallus isidiate	14
13. Thallus sorediate	16
14. Medulla yellow to pale orange-yellow; thallus with lobules; isidia cylindrical	<u>P. perisidians</u>
14. Medulla white	15
15. Medulla K+ yellow turning red (salazinic); lobes subirregular, crowded, apically rotund; lower surface black	<u>P. wallichiana</u>
15. Medulla K- or faintly yellow, C-, P-; lower surface brown to blackening in part	<u>P. expallida</u>
16. Medulla entirely white, C+ rose(gyrophoric acid); rhizines simple ...	<u>Canoparmelia cryptochlorophaea</u>
16. Medulla entirely or partially yellow to yellow-orange (at least pigmented below the soralia)	17
17. Upper cortex flaking off without formation of soredia	<u>P. entotheiochroa</u>
17. Upper cortex entire	18
18. Lobes 2-4mm wide; medulla P-	<u>Myelochroa aurulenta</u>
18. Lobes less than 2mm wide; medulla P+ orange	<u>P. metarevoluta</u>

Parmotrema

Thallus large, lobes rotund to subrotund, 6-20mm wide, with or without marginal cilia, mostly with a distinct bare zone near margin on lower surface, rhizinae sparse, simple, usually in central part of thallus, apothecia often perforated.

1. Thallus isidiate, sorediate or pustulate	2
1. Thallus lacking isidia, soredia or pustules	24
2. Thallus isidiate	3
2. Thallus sorediate or pustulate	14
3. Margins of lobes smooth, without cilia	4
3. Margins of lobes distinctly ciliate	6
4. Thallus yellowish green; usnic acid present; isidia to 1mm high,	

laminal	<u>P. conformatum</u>
4. Thallus mineral gray to buff, usnic acid lacking	5
5. Medulla C+ red(lecanoric acid)	<u>P. tinctorum</u>
5. Medulla C-, P+ red(protocetraric acid)	<u>P. saccatiloba</u>
6. Medulla deep lemon yellow, K- (vulpinic)	<u>P. sulphuratum</u>
6. Medulla white or pigmented, pigment K+ purple	7
7. Thallus yellowish green, usnic acid present	8
7. Thallus mineral or ashy gray to buff, usnic acid lacking	9
8. Lower surface pale, short rhizinate or papillate to the margin, K+ r, P+ or (salazinic)	<u>P. subtinctorium</u>
8. Lower surface jet black, the margins naked; medulla K+ red or brown or K-; P+ red (protocetraric and fumarprotocetraric acid)	<u>P. conformatum</u>
9. Isidia coralloid, marginal, 1-5mm high; medulla K-, KC+ purple, UV+ (alectoronic acid)	<u>P. mellissii</u>
9. Isidia simple to moderately branched, to 1mm high	10
10. Isidia in part granular or sorediate	11
10. Isidia normal, cylindrical	12
11. Medulla P+ red (protocetraric acid)	<u>P. subcorallinum</u>
11. Medulla P-, KC+ purple, UV+ (alectoronic acid)	<u>P. mellissii</u>
12. Lower surface uniformly brown, short rhizinate to the margin, med. K+r, P+or. (salazinic)	<u>P. subtinctorium</u>
12. Lower surface jet black, the margins more or less naked	13
13. Medulla K+ persistent yellow (stictic acid), UV-	<u>P. crinitum</u>
13. Medulla K+ red, P+ or., UV+ yellow (salazinic, lichexanthone)	<u>P. ultralucens</u>
14. Margins of lobes smooth, without cilia	15
14. Margins of lobes ciliate	18
15. Medulla K+ yellow or turning red, P+ orange	16
15. Medulla K- or K+ brownish	17
16. Medulla K+ yellow, P+ or. (stictic)	<u>P. chinense</u>
16. Medulla K+ red, P+ or. (salazinic)	<u>P. cristiferum</u>
17. Medulla C-, KC-, P- (caperatic acid)	<u>P. praesorediosum</u>
17. Medulla C+, (lecanoric acid)	<u>P. austrosinensis</u>

18. Medulla C+ rose (gyrophoric acid); soralia farinose, linear; lower surface black or mottled at margin; pantropical	<u>P. sancti-angelii</u>	19
18. Medulla C-		19
19. Cortex maculate or with fine cracks		20
19. Cortex emaculate		22
20. Medulla K+ red (salazinic)	<u>Rimelia reticulata</u>	
20. Medulla K-		21
21. Lower surface with a broad ivory zone; medulla KC+ purple, UV- (norlobaridone)	<u>P. hababianum</u>	
21. Lower surface dark brown at the margins, medulla UV+ (alectoronic)	<u>P. pseudonilgherrensis</u>	
22. Medulla UV-, K-, KC- (protolichestic acid), lower surface dark at the margin	<u>P. grayanum</u>	
22. Medulla UV+, K-, KC+ pink or purple (alectoronic)		23
23. Soredia submarginal; sorediate lobes revolute	<u>P. arnoldii</u>	
23. Soredia terminal; sorediate lobes involute	<u>P. rampoddense</u>	
24. Margins of lobes lacking cilia		25
24. Margins of lobes ciliate		29
25. Medulla K+ red	<u>P. latissima</u>	
25. Medulla K- or K+ brownish		26
26. Medulla P+ red or orange red		27
26. Medulla P-, C+ red, KC+ red	<u>P. crinitoides</u>	
27. Medulla P+ orange-red; lower surface brown at the margin, smooth and shining; protocetraric	<u>P. zollingeri</u>	
27. Medulla P+ red; lobe margins usually lobulate; lower surface not smooth and shining at the margin		28
28. Lower surface brownish to brown, only black in the center	<u>P. myriolobulatum</u>	
28. Lower surface black	<u>P. subtropicum</u>	
29. Medulla, at least in part, pigmented yellow or orange yellow; C+ red (gyrophoric), UV+, KC+ purple (alectoronic)	<u>P. nilgherrensis</u>	
29. Medulla white, pigments lacking		30
30. Apothecia disc perforate	<u>P. perforatum</u>	
30. Apothecia disc usually imperforate		31
31. Medulla K-, P-	<u>P. subrugatum</u>	
31. Medulla K+ yellow or red, P+ orange		32

32. Medulla K+ red (salazinic) Rimelia cetrata
 32. Medulla K+ yellow (stictic) P. eciliatum

Species not included:
P. incrassatum

Peccania

From Magnusson (1940)

1. Groups of branches resembling verrucose squamules, lobes short; spores 30-50 per ascus, on dust covered rocks P. polyspora
 1. Groups of branches discrete to surface, sterile, on soil P. terricola

Peltigera

1. Algae green 2
 1. Algae blue green 5
2. Lobes small (≤ 2 cm), simple, attached at one side; apothecia on upper surface; cephalodia on lower surface P. venosa
 2. Lobes larger (> 2 cm). divided, broadly attached; apothecia on tips of lobes; cephalodia on upper surface 3
3. Lower surface without distinct veins (malaceoid); backs of apothecia often corticate P. apthosa
 3. Lower surface with distinct veins 4
4. Veins broad and dark; apothecia vertical P. leucophlebia
 4. Veins narrow and somewhat dark; apothecia horizontal P. nigripunctata
5. Lower surface with distinct narrow veins 6
 5. Lower surface with broad low veins or thick felty mat 14
6. Upper surface smooth and shining, entirely lacking tomentum P. degenii
 6. Upper surface with matted tomentum 7
7. Isidia, soredia or lobules present 8
 7. Isidia or soredia absent 11
8. Soredia present in round spots on upper surface of lobes P. didactyla
 8. Isidia or lobules present, soredia absent 9

9. True isidia absent, regeneration squamules from cracks or damaged upper surface or margins P. praetextata
9. True isidia present, without regeneration squamules 10
10. Isidia short, globose; thallus generally gray; lobes over 3 cm long P. evansiana
10. Isidia coarser, peltate; thallus generally brown, lobes less than 3 cm long
 P. lepidophora
11. Lobes broad and long, margins downturned 12
11. Lobes short or narrow; margins upturned 13
12. Thallus thin, slight ridges on upper surface showing from veins, algae often showing through to lower surface P. membranacea
12. Thallus thicker, no ridges on upper surface; algae not showing from below P. canina
13. Lobes broad and short, frequently with vertical apothecia; veins strongly anastomosing
P. didactyla
13. Lobes narrow and long; apothecia uncommon; veins below mostly parallel; thallus with many cracks P. rufescens
14. Soredia present on lobe margins P. collina
14. Soredia absent 15
15. Upper surface of lobe ends scabrose but without hairs 16
15. Upper surface of lobes shiny 17
16. Lower surface with thick, dark felty mat (malaceoid); veins indistinct or absent; few bundles of rhizines P. malacea
16. Lower surface with broad low pale veins; many bundles of rhizines almost to the margins P. scabrosa
17. Apothecia black, vertical; lower surface with broad dark veins with elongated lighter areas between; on tree bases P. neckeri
17. Apothecia brown or absent; on mossy logs and soil 18
18. Lower surface with dark felty mat (malaceoid), no distinct veins; thallus with abundant regeneration squamules; apothecia horizontal P. elisabethae
18. Lower surface with distinct broad veins 19
19. Apothecia horizontal; upper surface rarely with regeneration squamules P. horizontalis
19. Apothecia vertical; upper surface frequently with regeneration squamules; lobes long and broad 20

- 20. Thallus with numerous squamules along the margins P. microphylla
- 20. Thallus without numerous squamules on margins 21
- 21. Upper surface often in part pruinose P. pruinosa
- 21. Upper surface epruinose 22
 - 22. Rhizines simple; thallus thin; more common in tropical regions P. dolichorrhiza (meridiana, P. polydactyla var. dolichorrhiza)
 - 22. Rhizines usually fasciculate 23
- 23. Veins reticulated, strong and coarse; thallus loosely tufted P. neopolydactyla (P. polydactyla var. neopolydactyla)
- 23. Veins indistinct (malaceoid); thallus not tufted P. lactucifolia (P. polydactyla var. hymenia)

Peltula

- 1. Thallus sorediate 2
- 1. Thallus not sorediate 5
 - 2. Thallus large; margin smooth; soredia most the way around edge P. euploca
 - 2. Thallus small or margin indented 3
- 3. Thallus margin undulate 4
- 3. Thallus smooth, not undulate; surface not pruinose; soredia in spots on margin P. ch sp 4
 - 4. Upper surface pruinose P. euploca
 - 4. Upper surface not pruinose P. bolanderi
- 5. Thallus swollen and inflated, subfruticose 6
- 5. Thallus thin, not inflated 8
 - 6. Lobes tall and greatly swollen, not flat on top P. applanata
 - 6. Lobes short, slightly swollen at top, top sometimes flattened 7
- 7. Squamules very small, in places slightly placodiform..... P. placodizans
- 7. Squamules larger, never placodiform P. marginata
 - 8. Growing directly on rock 9
 - 8. Growing on soil or soil in rock cracks, attached by hyphae See Heppia
- 9. Thallus strongly undulating and convex (appearing swollen), margin downrolled; apo sunken P. ch sp 6
- 9. Thallus +- flat but slightly undulating, not appearing swollen 10

- 10. 1 apothecium per squamule, broadly open disk, no cellular cortex P. obscurans
- 10. Several apothecia per squamules 11
- 11. Squamules undulating, margin notched; many squamules composing thallus; good cellular lower cortex of palisade cells P. ch sp 2
- 11. Squamules not undulating, margin notched; squamules isolated; lower cortex of irregular cells P. omphaliza

Phaeophyscia

- 1. Thallus with soredia, isidia or lobules 2
- 1. Thallus without soredia, isidia and lobules 10
 - 2. Medulla bright red or orange, K+ purple P. rubropulchra
 - 2. Medulla white 3
- 3. Thallus with erect lobules; upperside shiny or becoming white pruinose in part; underside whitish toward lobe tips P. imbricata
- 3. Thallus without lobules 4
 - 4. Soredia isidioid or granular 5
 - 4. Soredia fine, not granular or isidioid 7
- 5. Soredia granular, not isidioid P. limbata
- 5. Soredia coarse and isidioid 6
 - 6. Thallus dark to blackish mineral gray; lobes narrow (0.3-1mm), closely adnate P. sciastra
 - 6. Thallus not dark; lobes broader (1.5-3mm); loosely attached P. exornatula
- 7. Soralia terminal; underside white or pale 8
- 7. Soralia laminal or submarginal 9
 - 8. Thallus light gray; lower cortex poorly developed P. chloantha
 - 8. Thallus dark gray brown; lower cortex cellular P. nigricans
- 9. Soralia laminal; underside dark brown to black P. orbicularis
- 9. Soralia submarginal, capitate; dense rhizines projecting out along the margins P. hispidula
 - 10. Medulla orange-red, K+ purple 11
 - 10. Medulla white 13
- 11. Thallus gray or grayish brown; lobes about 1mm wide; on bark or mosses .. P. erythrocardia
- 11. Thallus brown; lobes narrower (mostly <.5mm); on rock 12

12. Apothecia with lobules on margins; pachyosporia-type spores; distributed more in the south P. endococcinoides
12. Apothecia with crenulate or lobulate margin; physcia-type spores P. endococcinea
13. Lower surface white to pale tan; on moss and plants; lower surface pale P. constipata
13. Lower surface dark brown to black 14
14. Lobes broad (3-7mm), distinctly concave 15
14. Lobes narrow (up to R1.5mm), flat to more or less convex, apothecia with cortical hairs 17
15. Apothecia abundant P. primaria
15. Apothecia scarce 16
16. Rhizines white; apothecia with tiny, often downturned, pointed lobules on margins P. trichophora
16. Rhizines black; apothecia without lobules P. hispidula
17. Lobe tips, with fine hairs, lobes contiguous P. hirtuosa
17. Lobe tips without cortical hairs, lobes not overlapping P. ciliata

Phylliscum

1. Thallus small(1-2mm), rounded, dark blue-gray, brown or black in color; medulla absent P. demangeonii
1. Thallus larger(about 2cm in diam.), ridged, dark reddish brown; lobes radially dichotomous; medulla present P. japonica

Physcia sens. lat.

1. Thallus or medulla K+ yellow; thallus gray; conidia cylindrical, over 4 μm Physcia (22)
1. Thallus and medulla K. 2
2. Thallus very closely attached (almost crustose); rhizines few; conidia filiform, over 10 μm Hyperphyscia (2)
2. Thallus more loosely attached; rhizines evident; conidia not filiform 3
3. Thallus usually heavily pruinose; rhizines squarrose Physconia (9)
3. Thallus not heavily pruinose; rhizines not squarrose Phaeophyscia (16)

Physcia

1. Lobes with marginal cilia	2
1. Lobes without marginal cilia	4
2. Soredia absent	<u>P. semipinnata</u>
2. Soredia present	3
3. Lobe tips helmet-shaped; on trees	<u>P. adscendens</u>
3. Lobe tips flat; usually on rocks	<u>P. tenella</u>
4. Soredia or isidia present	5
4. Soredia and isidia absent	10
5. Thallus isidiate, isidia becoming sorediate	6
5. Thallus sorediate, not isidiate	7
6. Medulla K-; lobe tips crenulate; soralia marginal	<u>P. crispa</u>
6. Medulla K+ yellow; lobe tips not crenulate; soralia apical	<u>P. clementii</u>
7. Upper surface with white spots, soralia capitate	<u>P. caesia</u>
7. Upper surface without white spots	8
8. Medulla K+ yellow; soralia laminal, capitate	<u>P. tribacoides</u>
8. Medulla K-	9
9. Lobes narrow (0.5-1mm); sorediate tips often turning up	<u>P. dubia</u>
9. Lobes broader; tips not upturned	<u>P. tribacia</u>
10. Upper surface with white spots or white pruinose	11
10. Upper surface epruinose or lacking white spots	16
11. Thallus white pruinose	12
11. Thallus without white spots	13
12. Apothecia common; on trees	<u>P. biziana</u>
12. Apothecia generally rare; often on rock	<u>P. knasuensis</u>
13. Medulla K-	<u>P. albinea</u>
13. Medulla K+ yellow	14
14. Lobes less than 1mm wide, tips truncate; thallus fragile	<u>P. alba</u>
14. Lobes 1-2mm wide, tips not truncate; thallus not fragile	15
15. Growing on bark; white spots distinct	<u>P. aipolia</u>
15. Growing on rocks; white spots less distinct	<u>P. phaea</u>
16. Upper surface often with lobules	<u>P. integrata</u>

16. Upper surface without lobules 17
17. Medulla K-; upper cortex shiny; apothecia more or less blackish to white
pruinose P. stellaris
17. Medulla K+ yellow; upper cortex not shiny; apothecia epruinose P. hupehensis

Notes: There are still four species in Wei's book excluded from this key.

1. P. nipponica Asahina has both cortex and medulla K- according to the original description (Jour. Jap. Bot. 21:6-7. 1947) so it belongs to Phaeophyscia or Physconia.
2. P. obscurella Magn. has K- cortex and brown soredia (Magn. Lich. Central Asia, p59-60. 1944) so it is Phaeophyscia or Physconia.
3. P. caesiopicta has K+ cortex and K- medulla and a brown hypothecium, on rock and is a Dirinaria. (also listed there by Wei)
4. P. stenophyllina Jatta has lobes white, rhizines black, apothecia brownish black but the description is inadequate to put it in the key (Jatta, Nuov. Giorn. Bot. Ital., nov ser. 9:473. 1902).

Physconia

1. Soredia or isidia present 2
1. Soredia and isidia absent 6
 2. Isidiate sorediate; underside whitish 3
 2. Sorediate 4
3. Rhizines black and long; thallus with lobules, loosely adnate P. grumosa
3. Rhizines whitish and short; thallus without lobules, fairly closely adnate P. grisea
 4. Underside whitish at lobe tips; lobes in central parts ascending with lip-shaped soralia P. perisidiosa
 4. Underside black or brownish at lobe tips; lobes in central part not ascending with lip-shaped soralia 5
5. Soredia yellow; medulla yellowish, K+ yellow P. enteroxantha
5. Soredia bluish; medulla white. K- P. deterosa
 6. Apothecia without lobules on margins but with white pruina P. tentaculata
 6. Apothecia with lobules on margins 7
7. Underside white; thallus small; lobes narrow P. venusta
7. Underside black; thallus middle-sized to large; lobes broad 8

8. Mainly on trees; lobes tending to be convex; thallus large P. pulverulenta
 8. Growing on ground; lobes tending to be concave; thallus middle-sized P. muscigena

Pilophorus

Modified from Jahns (1981)

1. Horizontal thallus an pseudopodetia clearly sorediate; pseudopodetia unbranched, at most 1 cm high; apothecia without columella P. cereolus
 1. No soredia present, at most slightly granulose 2
 2. Apothecia elongated (at least twice as long as broad), gradually tapering to pseudopodetium at base, pseudopodetia unbranched P. clavatus
 2. Apothecia globose or several in a cluster, abruptly joining pseudopodetia, pseudopodetia frequently branched P. acicularis

Note. The report of P. cereolus may be in error and needs to be confirmed.

Platismatia

1. Thallus with soredia or isidia 2
 1. Thallus without soredia or isidia 3
 2. Thallus isidiate, lower surface black, distinctly with white spots, only upper surface reticulately ridged P. erosa
 2. Thallus sorediate, soredia in part isidiate, lower surface brown to mottled white and brown, without white spots, upper surface plane to ridged P. glauca
 3. Lower surface black, distinctly white-spotted, only upper surface reticulately ridged P. formosana
 3. Lower surface white and black or brown mottled, without white spots; apothecia common; medulla P+ red 4
 4. Thallus with sharp and distinct ridges; medulla only contains fumarprotocetraric acid P. lacunosa
 4. Thallus without sharp, distinct ridges, mineral gray to whitish, suberect; protolichesterinic acid also present in the medulla P. tuckermanii

Pseudocyphellaria

1. Algae green; medulla yellow 2

- 1. Algae blue green 3
 - 2. Soredia present, yellow, marginal P. aurata
 - 2. Soredia absent P. berberina
- 3. Pseudocyphellae yellow, soredia yellow, marginal and laminal P. crocata
- 3. Pseudocyphellae white 4
 - 4. Soredia & isidia absent; with marginal lobules P. cinnamomea
 - 4. Soredia or isidia present 5
- 5. Upper surface with pseudocyphellae; isidiate; medulla C+ pink P. argyracea
- 5. Upper surface without pseudocyphellae; sorediate; medulla C- P. intricata

Psoroma

- 1. Thallus foliose, with marginal lobules; underside brown; on bark P. sphinctrinum
- 1. Thallus squamulose, without lobules; underside pale P. sinense

Punctelia

Upper surface with white dots

- 1. Thallus isidiate; C+ red P. rudecta
- 1. Thallus sorediate 2
 - 2. Thallus brown below, with reticulate white spots above; on bark; C+ red (gyrophoric)
 - .. P. borrieri
 - 2. Thallus pale below; on bark and rocks P. dubia

Pyxine

- 1. Thallus sorediate or isidiate 2
- 1. Thallus non-sorediate, non-isidiate 8
 - 2. Isidia; tips of isidia breaking into soredia; medulla yellow, K- P. coralligera
 - 2. Only soredia present 3
- 3. Medulla yellow 4
- 3. Medulla white 6
 - 4. Medulla K+ yellow, upperside with spotted pruina P. sorediata
 - 4. Medulla K- 5

5. Rarely spotted pruina; soredia granular; lobe margins white maculate P. subcinerea
5. Pruina continuous; soredia granular, marginal, linear P. connectens
6. Thallus pruinose, soralia punctiform, closely adnate P. cocoes
6. Thallus epruinose, soralia not punctiform 7
7. Soralia laminal, soredia fine and powdery, lobes 0.3-0.7mm wide P. copelandii
7. Soralia marginal, lobes 1.25-1.75 mm wide P. limbulata*
8. Medulla yellow, apothecia numerous, black disks distinctly raised P. berteriana
8. Medulla white 9
9. Medulla K+ P. margaritacea
9. Medulla K- 10
10. Thallus tiny, lobes 0.2-0.5mm wide, apothecia 0.4-0.7mm across P. microspora
10. Thallus small to middle-sized, lobes 0.5-1.4mm wide, apothecia 1-4 mm
across P. philippina

* In Wei's book P. limbulata and P. subolivacea are the same species. However, according to Zahlbruckner (1930), P. subolivacea is non-sorediate and thallus color is more or less olive; but as Muller (1899) described, P. limbulata is sorediate on lobe margins.

Relicina

Usnic acid in cortex; thallus foliose, with bulbate cilia along the margin, lobes linear to sublinear, grey, greyish brown to yellowish.

1. Thallus isidiate or isidiate-lobulate 2
1. Thallus lacking isidia 5
2. Isidia distinct, cylindrical 3
2. Isidia becoming lobulate R. schizospatha
3. Lower surface pale brown; rhizines simple R. sydneyensis
3. Lower surface black 4
4. Medulla K+ red R. abstrusa
4. Medulla K- R. planiuscula
5. Lower surface tan to pale brown; rhizines simple R. limbata
5. Lower surface black 6
6. Medulla K+ red R. subabstrusa

RHIZOPLACA

1. Apothecia pink; thallus strongly umbilicate ----- R. chrysoleuca
1. Apothecia greenish yellow or tan ----- 2
2. Thallus stipitate ----- Lecanora opiniconensis
2. Thallus umbilicate ----- 3
3. Thallus blue below at margins, more umbilicate, monophyllous -----
----- R. melanophthalma
3. Thallus tan below, more monophyllous ----- R. subdescrepans

- 6. Medulla K- 7
- 7. Apothecia present, coronate; lobes narrow and appressed, 0.5-1.0 mm wide R. relicinula
- 7. Apothecia ecoronate or lacking; medulla P+ orange red; fumarprotocetraric acid present R. malesiana

Rhizoplaca

After Wei, 1984

- 1. Disk greenish, green-yellowish, brownish, dark brown to black, but never orange 2
- 1. Disk orange R. chrysoleuca
- 2. Disk brownish, but never black; thallus below coarse, containing zeorine R. peltata
- 2. Disk greenish, green-yellowish, brown to black; thallus below not coarse; lacking zeorin 3
- 3. Thallus polyphyllous, cushion R. melanophthalma
- 3. Thallus monophyllous, peltate R. huashanensis

Sarcogyne

Modified from Magnusson (1944)

- 1. Spores cylindric, 5-6 x 1.5-1.7 μm . Apothecia dispersed, 0.5-1 mm, pitch black, margin thick, smooth, prominent. Only exciple surface dark reddish brown S. picea
- 1. Spores ellipsoid 2
- 2. Apothecia gyrose 3 *Polysporina*
- 2. Apothecia not gyrose 4
- 3. Exciple colorless. Epithecium brownish yellow. Spores 4-5 x 2-2.5 μm S. gyrocarpa
- 3. Exciple surface blackish brown. Epithecium black. Spores 5-7 x 2.5-3 μm . Apothecia 0.5 mm diam. S. sinensis var. complicata
- 4. Apothecial disks or margins pruinose S. regularis
- 4. Apothecia not pruinose 5
- 5. Apothecia 0.1-0.35 mm diam., scabrid or umbonate. Exciple surface blackish brown, carbonaceous. Epithecium blackish, carbonaceous. Thallus areolate or absent. Spores 5-7 x 2.5-3 μm S. sinensis
- 5. Apothecia 1-1.5 mm diam., umbilicate. Exciple pale, Epithecium yellowish brown. Spores 4-5 x 1.7 μm S. solitaria

Note. Some of these may belong in the genus Polysporina.

Solorina

- 1. Apothecia flush with thallus, not sunken; 4nae S. platycarpa
- 1. Apothecia sunken 2
 - 2. Thallus coarsely granular; asci x nae S. spongiosa
 - 2. Thallus continuous and smooth 3
- 3. Asci 2nae S. bispora
- 3. Asci with 4 or 8 spores 4
 - 4. Asci with 4 spores S. saccata
 - 4. Asci with 8 spores S. octospora

Not included: S. sinensis

Sphaerophorus

- 1. Thallus hollow in the center, dichotomously branched, branches cylindrical; sphaerophoric and stictic acid complex present; apothecia absent S. diplotypus
- 1. Thallus solid in the center 2
 - 2. Thallus flattened, shrubby branched, without isidia-like lateral branches; on bark of trees Bunodophoron melanocarpus
 - 2. Thallus cylindrical at the base, though more or less flattened in the upper, with isidia-like lateral branches; on tree base S. formosanus

Species not included:

- S. digitatus
- S. taiwanensis
- S. yangii

Sporastatia

- 1. Thallus pruinose, without blackish prothallus S. asiatica
- 1. Thallus not pruinose, with black prothallus S. testudinea

Stereocaulon

- 1. Thallus sorediate 2
- 1. Thallus non-sorediate 3

2. Pseudopodetia short, less than 2cm tall; medulla P+ yellowish; primary thallus persistent	<u>S. pileatum</u>
2. Pseudopodetia long, 3-9cm tall; medulla P-; cephalodia sacculate	<u>S. sorediiferum</u>
3. Phyllocladia apical, foliose or digitate squamulose	4
3. Phyllocladia lateral, not foliose or digitate squamulose	5
4. Phyllocladia foliose, more or less lobed, large, 5-8mm long, 3-5mm wide	<u>S. apocalypticum</u>
4. Phyllocladia digitate squamulose to foliose, smaller	<u>S. foliolosum</u>
5. Phyllocladia P+ red	6
5. Phyllocladia P+ yellowish	9
6. Cephalodia protosacculate, small; pseudopodetia 2.5-7cm tall, simple or irregularly branched; phyllocladia numerous, cylindrical.....	<u>S. pomiferum</u>
6. Cephalodia sacculate to protosacculate; phyllocladia cylindrical to squamulose.....	7
7. Cephalodia sacculate; phyllocladia up to 2mm long, usually unilateral	<u>S. piluliferum</u>
7. Cephalodia sacculate to protosacculate	8
8. Phyllocladia short, cylindrical	<u>S. japonicum</u>
8. Phyllocladia flattened at the base, granular towards the apices, squamulose	<u>S. vesuvianum</u>
9. Pseudopodetia with tomentum	10
9. Pseudopodetia without tomentum	12
10. Apothecia terminal and large; tomentum thin; phyllocladia all cylindric-coralloid .	<u>S. dactylophyllum</u>
10. Apothecia lateral; tomentum thick; phyllocladia digitate or palmate	11
11. Cephalodia large and black; tomentum more appressed	<u>S. myriocarpum</u>
11. Cephalodia small, concealed in the thick tomentum	<u>S. tomentosum</u>
12. Pseudopodetia short, less than 2cm tall	13
12. Pseudopodetia long, more than 3cm tall	17
13. Primary thallus persistent	14
13. Primary thallus absent	15
14. Phyllocladia digitate; cephalodia dark brown, concealed in the scale-like primary thallus; on soil	<u>S. condensatum</u>
14. Phyllocladia short, cylindrical or verrucose; cephalodia grey to brown, lateral and	

四 人才培养

IV-1 本学科点 1999 年以来所获得的省部级以上教学(材)成果奖数				
序号	项目名称	获奖人	获奖名称、等级、时间	
1	高等学校通用教材“地衣学”	阿不都拉·阿巴斯	国家教育部“优秀教材一等奖” 2000 年 2 月	
IV-2 本学科点 1999 年以来出版的主要教材(教学用书)				
序号	教材(教学用书)名称	作者	出版日期	出版单位
1	地衣学	阿不都拉·阿巴斯	1999.2 月	新疆大学出版社
2	资源植物学	索菲亚	2002.10 月	新疆人民出版社

granular; on rock	<u>S. octomerellum</u>
15. Phyllocladia digitate	<u>S. saviczii</u>
15. Phyllocladia granular to cylindrical or verrucose	16
16. Spores 8-celled	<u>S. octomerum</u>
16. Spores 4-6 celled	<u>S. verruculigerum</u>
17. Phyllocladia granular or squamulose	18
17. Phyllocladia papitate or cylindrical	21
18. Phyllocladia granular; apothecia rare	19
18. Phyllocladia squamulose, apothecia common and lateral; cephalodia small	<u>S. sasakii</u>
19. Phyllocladia becoming flattened at base; cephalodia black and usually small; on soil	<u>S. alpinum</u>
19. Phyllocladia not becoming flattened at base	20
20. Cephalodia large, black; pseudopodetia curved	<u>S. fastigiatum</u>
20. Cephalodia small, numerous and spherical; pseudopodetia not curved	<u>S. paschale</u>
21. Cephalodia sacculate; apothecia terminal	22
21. Cephalodia granular	23
22. Apothecia terminal on short and lateral branches of pseudopodetia ...	<u>S. massartianum</u>
22. Apothecia terminal on pseudopodetia; phyllocladia cylindrical to cylindrical-coralloid; on soil	<u>S. ramulosum</u>
23. Pseudopodetia pendulous, simple and grey	<u>S. pendulum</u>
23. Pseudopodetia erect, shrubby with much branches	24
24. Lower layer of asci colorless	<u>S. exutum</u>
24. Lower layer of asci brown	<u>S. nigrum</u>

Sticta

1. Thallus stipitate	2
1. Thallus non-stipitate	7
2. With isidia or marginal lobules	3
2. Without isidia or marginal lobules	5
3. With marginal squamules, green algae, medulla C+ red	<u>(C) praetextata</u>

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Bryoria

3. Without marginal squamules 4

4. Lobe margins with dense black hirsute cilia S. duplolibata

4. Lobe margins not hirsute; isidia teretiform to glomuliferous, marginal to submarginal; cyphellae cup-shaped S. pulvinata

Bryocaulon

5. Thallus repeatedly dichotomously branched, lower surface lacking tomentum S. neocaledonica

5. Thallus not dichotomously branched, stiff, fan-shaped; lower surface with tomentum 6

6. Lobes narrow, 5-8mm wide S. gracilis

6. Lobes ~~over~~^{wid}, 10-15mm wide S. flabelliformis

Biatora

7. Thallus sorediate or isidiate 8

7. Thallus lacking soredia or isidia 13

8. Thallus isidiate 9

8. Thallus sorediate 11

Bacidia

9. Thallus with globose marginal lobules on margins and surface, fan-shaped, lobes round; tomentum below abundant S. submarginifera

9. Thallus lacking marginal lobules, not fan-shaped 10

10. Upper surface smooth; isidia only marginal; exciple proper S. weigelii

10. Upper surface scrobiculate; isidia abundant over upper surface, digitate or coralloid-branched; exciple thalline; thallus monophyllous, more or less thin or membranous S. fuliginosa

Aspicilia

11. Medulla KC+ pink; thallus with dense tomentum S. formosana

11. Medulla KC- 12

12. Soredia yellow; with cyphellae S. mooreana

12. Soredia not yellow, granular to isidia-like, marginal; also with cyphellae .. S. limbata

Anapychia

13. Upper surface smooth, shining 14

13. Upper surface not smooth, not shining 16

14. Medulla KC+ pink to red S. nylanderiana

14. Medulla KC- 15

Amandinea

15. Thallus sinuately lobed; apothecia large, thalline exciple acicular; cyphellae saucer shaped S. henryana

15. Thallus laciniate lobate; apothecia small, exciple not acicular; cyphellae cup-shaped

S. sinuosa

Allantoparmelia

Acarospora

Acarospora

Allantoparmelia

Amandinea

Anaptychia

Aspicilia

Bacidia

Biatora

Bryocaulon

Bryoria

Buellia

Calicium

Caloplaca

Candelaria

Candelariella

16. Thallus marginally granulose and tomentose; cyphellae saucer shaped; thalline exciple acicular S. platyphylloides
 16. Thallus not marginally granulose or tomentose S. wrightii

Strigula

Modified from Santesson (1952)

1. Lobes or margin of thallus bordered by a thin, black line; perithecia 0.45-0.7 mm diam. Spores usually with acute ends and constricted at septum, 14-22 x 3-5 μ m. Lobes almost free. S. melanobapha
 1. Lobes or margin of thallus not bordered by black line 2
 2. One spore cell considerably larger than the other. Thallus rather thick, usually pale bluish green. Perithecia partly immersed in thallus, lacking pale, radiating lines S. subelegans
 2. Both spore cells about equal. Thallus bright green to grayish green, no bluish tinge. Perithecia at least partly covered by thallus tissue. 3
 3. Perithecia 0.25-0.4 mm diam. S. elegans
 3. Perithecia 0.5-1.1 mm diam. S. macrocarpa

Sulcaria

1. Thallus short and broad; apo common S. sulcata
 1. Thallus longer and narrow; apo rare or absent S. virens

Teloschistes

1. Thallus sorediate 2
 1. Thallus not sorediate 3
 2. Growing on ground; no hairs on lobes T. flavicans
 2. Growing on trees; hairs on lobes T. ch sp. 1
 3. Lobes with abundant long fibrils T. exilis
 3. Lobes without fibrils 4
 4. Lobes broad and inrolled; tips coarsely granular, veins inside T. lacunosus
 4. Lobes short, thick and broad; many big apo T. ch sp. 2

第十届全国人民代表大会代表推荐人选登记表

姓 名		阿不都拉·阿巴斯		性 别	男	民 族	塔塔尔族
出生年月		1951年10月10日		出生地	乌鲁木齐	籍 贯	新 疆
党 派		中共党员		入党时间	1990年3月	参加工作时间	1976年9月
学历学位	全日制教育	是		毕业院系及专业	新疆大学生物系生物专业		
	在职教育			毕业院系及专业			
现任(或原任)职务		现任新疆大学生命科学与技术学院副院长(负责研究生工作及科研工作)					
职 称		教 授			联系电话	0991 - 8583275 (LB)	
通讯地址		乌鲁木齐市天山区胜利路14号			邮政编码	830046	
职业构成					行业构成		
身份构成		中国公民	毕业院系及专业	否	毕业院系及专业	否	
是否归侨		侨 眷	是否九届全国人大代表	否	同任何级人大代表	否	
简 历							

Notes: Sp¹ may be brevior

Thamnolia

- 1. Thallus UV+; cortex K+ yellowish, P+ yellow; thallus deeply wrinkled T. subuliformis
- 1. Thallus UV-; cortex K+ deep yellow, P+ orange red; thallus usually smooth T. vermicularis

Thelotremataceae

- 1. Exciple carbonized, carbonized columella often present, periphysoids absent [Ocellularia]
- 1. Exciple not carbonized, no parts carbonized 2
 - 2. Columella present, no periphysoids Myriotrema album
 - 2. Columella absent, periphysoids present Thelotrema

Note: Myriotrema album is listed as Ocellularia alba in Wei (1991) but Hale (1981) places it in Myriotrema.

Thyrea

- 1. Thallus with white powder in the upper surface, brown or dark green; isidiate; 8 spores per ascus; spores 9-14 x 5-7 μ ; on calcareous rocks T. pulvinata
- 1. Thallus without white powder in the upper surface, black; asci polysporous; spores globose, 5 μ ; on non-calcareous rocks on river banks T. hondoana

Note: T. mongolica not included: 8 spores per ascus; spores subglobose, 9-12 x 7-8 μ ; not isidiate?; on calcareous rock

Tylophoron

- 1. Thallus C+ red; ascocarps .6-1.2mm diam. T. protrudens
- 1. Thallus C-; ascocarps 0.4-0.8mm diam. T. moderatum

Umbilicaria

Adapted from Wei & Jiang, 1993

- 1. Thallus with rhizones or fine rhizoid fibrils 2
- 1. Thallus without rhizines, occasionally with sparse rhizines..... 23
 - 2. Apothecia usually present 3

九 预期建设情况

VIII-1 申请建设项目及经费投入		
序号	建设项目	申请经费
	植物区系与系统分类学重点实验室	180.00 万元
	植物生物技术重点实验室	210.00 万元
	植物资源生态与保护植物学重点实验室	150.00 万元
	植物生物学中试基地及组织培养实验室	110.00 万元
	经费总计	650.00 万元

2. Apothecia usually absent 17
3. Apothecia with gyrose disks 4
3. Apothecia with smooth disks having sterile columns or fissures 14
4. Apothecia immersed to adnate, never stipitate 5
4. Apothecia adnate to stipitate 8
5. Apothecia rounded, on rocks 6
5. Apothecia irregularly triangulate to quadrilateral, usually on trees, lower surface black, with
kinky hair-fine and richly branched black rhizines U. yunnana
6. Rhizines cylindrical 7
6. Rhizines absent or very sparse, and short, stubby, ligulate, irregularly papillate,
capitate U. tylorhiza
7. Lower surface of thallus black, plane, with numerous rhizines of short, very thin and simple
form U. badia
7. Lower surface of thallus pale, bullate to lacunose, with sparse rhizines U. herrei
8. Apothecia stipitate (lower surface of thallus light colored to pink, with rhizines of same
color U. cylindrica auct.
8. Apothecia adnate 9
9. Disk margins with lots of perpendicular and slight cracks; lower surface of thallus brown,
weakly granulate like that in U. rigida, without or occasionally with individual
rhizines U. pseudocinerascens
9. Disk margins without the perpendicular cracks 10
10. Lower surface more or less granulate to verrucose 11
10. Lower surface smooth 12
11. Lower surface strongly granulate to verrucose, with sparse and richly branched rhizines, dense
marginally U. subumbilicarioides
11. Lower surface weakly granulate, with dense rhizines U. thamnoides
12. Lower surface with rich and black brown rhizines, ascospores simple and
hyaline U. indica
12. Lower surface without rhizines, or occasionally with sparse or individual
rhizines
..... 13
13. Lower surface of thallus red-yellow to purple-red U. hypococconeae
13. Lower surface of thallus brown-gray to black-brown U. proboscidea auct.

wrong place
has no rhizines

八. 经费投入

VIII-1-1 本学科近三年内获得建设经费情况

	投入经费数量 (万元)	经费投入部门	经费使用情况及产生效益
2000 年	35.00 万元	“211 工程”	相关实验室建设并投入使用
	8.30 万元	国家基金课题经费	相关实验室建设并投入使用
2001 年	232.00 万元	“211 工程”	相关实验室建设并投入使用
	5.56 万元	国家基金课题经费	相关实验室建设并投入使用
	16.40 万元	企业投入	相关实验室建设并投入使用
2002 年	28.00 万元	“211 工程”	相关实验室建设并投入使用
	3.20 万元	国家基金课题经费	相关实验室建设并投入使用

14. Disks usually plane and smooth and sometimes with a single fissure U. virginis
 14. Disks with columns or fissures 15
15. Disks with fissures, upper surface of thallus elevated, with folds and weak ridges in center, margins laciniate; lower surface dark around umbo, without rhizines, usually near margin with individual gross bristle like rhizines, along perforation rim often with individual flat bristles U. formosana
 15. Disks with domed columns 16
16. Upper surface of thallus without conspicuous ridges and folds in the center; lower surface black, partly densely rhizinous U. spodochroa
 16. Upper surface of thallus with conspicuous ridges and folds in the center; lower surface pale gray to rose-colored with concolorous rhizines, ascospores simple and hyaline U. altaiensis
17. Lower surface of thallus black 18
 17. Lower surface of thallus brown with some rose color, with long and thick rhizines of the same color as the underside U. hirsuta
18. Rhizines capitate U. tylorhiza
 18. Rhizines not capitate 19
19. Rhizines richly branched 20
 19. Rhizines sparsely branched 21
20. Rhizines numerous, very thin and short, richly branched; thallus weakly leathery; upper surface red-brown and dull U. esculenta
 20. Rhizines sparse, richly branched; thallus cushion-shaped, thin, membranous to fragile; upper surface brownish dull to subshiny U. caroliniana
21. Rhizines long and thick but swollen on the base caused by covering with black thalloconidia and/or mixed with stubby ones covered with thalloconidia; upper surface of thallus without squamules; apothecia gyrose U. vellea
 21. Rhizines short and very thin 22
22. Upper surface of thallus with squamules, lower surface lacking thalloconidia; apothecia gyrose U. squamosa
 22. Upper surface of thallus lacking squamules, lower surface covered with thalloconidia; apothecia with disks having columns or fissures, rhizines gray-white to gray-brown, not swollen on the base U. aprina
23. Lower surface of thallus with lamellae or trabeculae 24
 23. Lower surface of thallus without lamellae or trabeculae 25
24. Apothecia radially gyrate and lack a common margin, thallus foliose, over 3 cm diam. U. muehlenbergii

七 学术交流

VII-1 1999 年以来本学科点举办的主要国际国内学术会议			
学术会议名称	举办时间	参加人数	
		总人数	海外人员参加人数
新疆首届药用植物学国际研讨会	2002.8.19 日	95 人	日本 19 人, 美国 2 人, 哈萨克斯坦 1 人 .
新疆 2002 年生物学研讨会	2002.11.22 日	56 人	
全国微生物学研讨会	2000.8.2 日	62 人	
新疆新生物进化论研讨会	1999.10.5 日	106 人	
VII-2 1999 年以来本学科教师 (或研究生) 在国外著名大学讲学或在重要国际会议上做报告情况			
讲学或报告人员姓名	国外大学名称或国际会议名称	讲学或报告时间	讲学或报告名称
阿不都拉 . 阿巴斯	国际地衣学第四次研讨会 (在西班牙巴塞罗那)	2000.9 月	新疆地衣研究历史回顾
阿不都拉 . 阿巴斯	日本北海道第三次药用植物学探讨会(日本北海道)	2001.8 月	新疆维吾尔医药研究历史
阿不都拉 . 阿巴斯	新疆首届药用植物学国际研讨会 (新疆乌鲁木齐)	2002.8 月	新疆药用地衣的研究
VII-3 1999 年以来本学科点承担的国际交流合作项目			
国际交流合作项目名称	起始时间	合作对象	
新疆阿勒泰山地衣的研究	1999-2000	俄罗斯科学院圣比德堡植物研究所	
新疆昆仑山植被调查	2000-2001	美国科学院 Missouri 植物园	
新疆地衣的研究	2002-2003	美国 Harvard 大学	
新疆壳状地衣的研究	2003-2004	美国 Minnisota 大学	

24. Apothecia with gyrose disks	<u>U. torrefacta</u>
25. Upper surface of thallus with folds	26
25. Upper surface of thallus without folds	31
26. Upper surface of thallus with elevated ridges and folds in the center or only irregularly rugose or strongly vermiform	32
26. Upper surface of thallus with fine reticulate folds	30
27. Apothecia with disks having columns or fissures, margins of thallus irregularly lacinate, often perforate and with bristles marginally and along perforation rims	<u>U. formosana</u>
27. Apothecia with gyrose disks	28
28. Upper surface of thallus with cap-like elevation in the center covered with white pruina	<u>U. proboscidea</u> auct.
28. Upper surface of thallus without white pruina	29
29. Apothecia usually absent (lower surface of thallus smooth, sooty-black caused by covering with thalloconidia	<u>U. nylanderiana</u>
29. Apothecia usually present, thallus thin (<350 µm); lower surface brown, gray-brown or gray-black, sometimes weakly granulate	<u>U. exasperata</u>
30. Apothecia with disks having columns or fissures; upper surface of thallus dark gray with some olive-brown color; the reticulate folds are radiating near the margins and the ridges of them blunt	<u>U. decussata</u>
30. Apothecia with plane and smooth disks; upper surface of thallus almost dark without conspicuously olive-brown color; the reticulate folds are extending up to margins and the ridges of them acute	<u>U. lyngei</u>
31. Thallus isidiate and squamulose	<u>U. (flocculosa)</u> <i>desista</i>
31. Thallus not isidiate and squamulose	32
32. Apothecia usually present	33
32. Apothecia usually absent	39
33. Thallus of medium size, more than 10 mm diam.	34
33. Thallus of small size, about 5 mm diam.	37
34. Apothecia with plane and smooth disks, lower surface of thallus brown, granular and papillate around umbo	<u>U. rigida</u>
34. Apothecia with gyrose disks	35
35. Apothecia concentrically gyrose with some perpendicular and slight cracks	<u>U. pseudocinereascens</u>
35. Apothecia not concentrically gyrose without perpendicular cracks	36

IV-7 本学科点近三年毕业硕士生就业情况

毕业硕士生姓名	导师姓名	毕业时间	是否在职	毕业后就业单位名称
李刚	黄培佑	2000.7月	否	新疆铁路公安处
陈朋	潘晓玲	2000.7月	否	南京大学博士生
杨勇	阿不都拉 ·阿巴斯	2002.7月	否	新大生科院分子生物学重点实验室
谢丽琼	李冠	2002.7月	否	乌鲁木齐国际实业公司
葛屹松	李冠	2002.7月	否	上海工作
李群	李冠	2000.7月	否	北京农业大学读博士

36. Apothecia more or less immersed, sometimes aggregate and sometimes single, lower surface smooth, whitish to pinkish, occasionally with single rhizines U. nepalensis
36. Apothecia adnate, thallus on lower surface yellow-reddish to purple-reddish U. hypococcinea
37. Lower surface of thallus black, near margins with thick and black rhizines and rhizoid cilia U. nanella
37. Lower surface of thallus whitish to brownish 38
38. Lower surface of thallus brownish without rhizines; margins of thallus not rising upwards; apothecia weakly immersed, spores subrounded U. minuta
38. Lower surface of thallus white to lightly rosette with rhizines of the same color; margins of thallus rising upwards like teaspoon in miniature; apothecia adnate, spores ellipsoidal to pine nut form U. taibaiensis
39. Upper surface of thallus uneven, with radiate lines U. subglabra
39. Upper surface of thallus smooth, without radiate lines 40
40. Thallus of small size, usually no larger than 15 mm, elevated near margins but the margins are rolling down; upper surface red-brown, dull; lower surface black, not granulated U. kisovana
40. Thallus of medium size, usually larger than 20 mm diam. 41
41. Upper surface black-brown; lower surface black, around umbo weakly granulated or weakly reticulated by slight cracks U. cinerascens
41. Upper surface brown to red-brown; lower surface entirely or partly pitch black U. polyphylla

Xanthoparmelia

1. Thallus sorediate or isidiate 2
1. Thallus lacking soredia or isidia 10
2. Thallus sorediate, very tightly adnate with an areolate center; lobes 0.2-0.5mm wide X. mougeotii
2. Thallus isidiate 3
3. Lower surface brown 4
3. Lower surface black 6
4. Medulla distinctly and quickly K+ yellow or yellow turning red X. mexicana
4. Medulla K- 5

V-5 可用于本学科点研究生培养的专业文献资料情况及获取资料的技术手段

<p>植物学报 植物病理学报 植物生理学报 植物生态学报 植物生理通讯 微生物学报 生物学通报 植物杂志 遗传学报 实验生物学报 生化与生物物理学报 生物技术通报 西北植物学报 国外医药-植物药分册 植物分类学报 植物研究 生态学杂志 生态学报 生物工程进展 生物多样性 遗传 生化与生物物理进展 植物保护学报 生态学报 应用生态学报 植物资源与环境 干旱区农业研究 植物学通报 Biological Abstract Plant Physiology The Biochemistry of plants Biochemistry Annual review of Biochemistry American Journal of Botany Annual Review of Plant Physiology & Plant Molecular Biology Chemistry Abstract Experimental Botany Annual review of physiology Molecular cell Research Biochem:cell Biol Genetics Cell Biology</p>	<p>还有较多的俄文资料可供查阅(俄罗斯植物志全套 35 部, 俄罗斯地衣志全套 13 部,)。中国植物志(全套 72 部), 中国高等植物图鉴全套 10 部), 中国大百科全书(全套), 简明不列颠百科全书, 英汉科技大词典(全套)中国植物文献目录(1-5 册)等。</p>
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5. Isidia globose, short and usually unbranched, less than 0.2-0.3mm high, usually hollow and often erumpent with pale tips; thallus saxicolous X. scabrosa
5. Isidia subglobose(when immature)to cylindrical, relatively tall and becoming branched, usually more than 0.2mm high, the tips often darkening, solid X. subramigera
6. Thallus very tightly adnate, often appearing areolate at the center; lobes 0.2-0.8mm wide; isidia globose, unbranched, in part erumpent..... X. congensis
6. Thallus adnate to loosely adnate, lobate at the center; lobes 0.5-5mm wide 7
7. Upper surface uniformly white maculate X. xizangensis
7. Upper surface continuous 8
8. Salazinic acid present X. tinctina
8. Norstictic acid present 9
9. Stictic acid present X. conspersa
9. Stictic acid lacking; isidia tall(to 0.3mm high)and densely branched, black-tipped
X. neotinctina
10. Thallus terricolous 11
10. Thallus not terricolous 18
11. Thallus free growing, often breaking apart into separate lobes or remaining intact; lobes moderately to strongly convoluted, sometimes forming tubes X. camtschadalis
11. Thallus forming intact, usually orbicular colonies or rosettes loosely attached on pebbles or compacted soil, in part becoming free-growing; lobes plane below, canaliculate or weakly convoluted 12
12. Lobes canaliculate; lower surface pale yellow to brown with sparse long brown to black rhizines; stictic acid present; center of thallus becoming densely terete-laciniate
X. molliuscula
12. Lobes plane, flattened to weakly convoluted; lower surface pale brown to black with sparse to moderate concolorous rhizines..... 13
13. Thallus pale brown to brown below 14
13. Thallus black below 16
14. Upper surface white-maculate; terete laciniae present on old lobes X. durietzii
14. Upper surface emaculate 15
15. Secondary laciniae usually present, plane; thallus usually terricolous X. taractica
15. Secondary laciniae absent or poorly developed; thallus saxicolous X. sublaevis

non ind

V-3 可用于本学科点研究生培养的专业实验室情况					
实验室名称	实验室归属	实验室面积(m ²)	实验室人员配备(人)	设备(台、件)	
				合计	万元以上
1.资源生物学重点实验室	校“211”办	394 (m ²)	9	38 台	362.1 万元
2.植物生理生化与分子生物学实验室	校“211”办	166 (m ²)	7	26 台	178.9 万元
3.地衣学研究室	新大生科院	90 (m ²)	6	18 台	58.5 万元
4.苔藓学研究室	新大生科院	54 (m ²)	3	18 台	22.8 万元
5.植物学组织培养室	新大生科院	54 (m ²)	3	12 台	33.6 万元
				12 台	15.0 万元
V-4 可用于本学科点研究生培养的教学实验室情况					
教学实验室名称	教学设备(台、件)		开发及应用的主要教学软件名称及使用情况		
	合计	万元以上			
生物化学实验室	26	86.50			
植物生理学实验室	20	19			
植物解剖学实验室	18	10.60			
食品科学实验室	31	33.40			
植物分类学实验室	15	8.13			
地衣学实验室	21	17.70			
植物学陈列室	53	35.30			

16. Stictic acid present; lower surface with a yellowish rim toward the tips .. X. hypopsila
 16. Salazinic acid present 17
17. Upper surface white-maculate; lobes narrow and elongated, constricted, 0.5-1.5mm wide X. constrictans
17. Upper surface continuous, emaculate; lobes very narrow, less than 0.5mm wide X. eradicata
18. Lower surface pale 19
 18. Lower surface black 23
19. Medulla K+ yellow or yellow turning red 20
 19. Medulla K- 22
20. Surface white-maculate or effigurate-maculate X. somloensis
 20. Surface continuous, emaculate 21
21. Thallus tightly adnate to adnate, collected with rock substrate X. lineola
 21. Thallus adnate to loosely adnate, usually collected without rock substrate; lobes mostly subirregular X. sublaevis
22. Surface white maculate X. protomatrae
 22. Surface continuous, emaculate; thallus more or less areolate at the center; lobes 0.6-1.2mm wide X. novomexicana
23. Thallus effigurate-maculate, lobes 0.6-2mm wide, stiff; medulla P+ orange red, protocetraric acid present; rhizines sparse to moderate X. hypoleia
 23. Thallus continuous, emaculate or white-maculate 24
24. Thallus very tightly adnate to tightly adnate, the center often appearing areolate at the center, always collected with the rock substrate, lobes 0.2-0.8mm wide; chalybaeizans unknown present X. conspersula
 24. Thallus adnate to loosely adnate, the center lobate, collected with or without rock substrate; lobes usually more than 1mm wide 25
25. Stictic acid present as the major metabolite; lower surface faintly canaliculate with a raised yellowish rim at the tips X. hypopsila
 25. Norstictic or salazinic acid present 26
26. Upper surface white-maculate; lobes narrow and constricted, 0.5-1.5mm wide X. constrictans
 26. Upper surface continuous, emaculate; lobes sublinear, 2-5mm wide X. tasmanica
- X. squamaraeformis not included.

rock

五 条件建设

V-1 与本学科点直接相关的国家或省部级重点实验室、研究中心(基地)、人才培养基地情况		
重点实验室、研究中心 (基地)或人才培养基地名称	建立 时间	主管部门
V-2 可用于本学科点研究生培养的大型、精密、贵重仪器设备情况		
仪器设备名称	规格型号	购置时间
电子扫描电镜	LEO1430VP	2001.01
超薄切片机	LKB-5	2001.01
Leica 高级体式显微镜(带图象分析系统)	MZ-12	2000.11
全胶洗脱仪	MINI—WHOLE	1999.01
凝胶成像系统	TM-26	2000.04
紫外分光光度计	U-3010	2000.02
毛细管电泳仪	MDQ	2000.01
高速台式冷冻离心机	AVANT IJ-25	1997.01
DNA 测序仪	PE377	2000.03
冻干机	EZ550Q	1998.01
低温层析柜	CS33SDF	1981.01
气象色谱仪	HP6890	1998.01
薄层色谱仪	CS-930	1985.01
高效液相色谱仪	HP1100	1980.03
荧光分光光度计	RF-540	1988.01
基因交联仪	GS GENEL IN	1999.01
生物层析系统	Boologic lp	1999.01
酶标仪	550 型	1998.01
一次性成像系统	MP4+	1999.01
制冰机	SC55MASEI	1998.01
高速冷冻离心机	J-25	1998.04
液项质谱联用仪	HP1100	1998.01
		1999.04

Xanthoria

- 1. Thallus sorediate 2
- 1. Thallus not sorediate 6
 - 2. Lobes narrow, terminal lobes almost cylindrical X. candelaria
 - 2. Lobes broader, terminal lobes broad 3
- 3. Soredia on surface of lobes near center of thallus; always on rock X. sorediata
- 3. Soredia on lower surface of tips or margins of lobes; usually on bark or wood 4
 - 4. Soralia marginal, granular 5
 - 4. Soralia hood shaped and terminal X. fallax
- 5. Lobes linear, <0.5 mm, soredia under tips of lobes X. fulva
- 5. Lobes broader, ~ 0.5 mm, soredia on lower surface at ends of lobes X. ulophyllodes
 - 6. Thallus squamiform, no long lobes X. lobulata (?)
 - 6. Thallus with long lobes, often placodiform ~~8~~ 7
- 7. Lobes flat, broad, fairly short; on trees 8
- 7. Lobes convex, narrower than long; on rocks 9
 - 8. Rhizines present; common X. hasseana
 - 8. Rhizines absent, attached by hapters; rare, on twigs near water X. polycarpa
- 9. Lobes broader and +- flat at tips; tends to be more yellow X. mandshurica
- 9. Lobes strongly convex at ends; tends to be more often orange X. elegans

IV-8 1999-2002 年间在学研究生发表论文、出版专著情况				
	在国内公开出版学术期刊上发表论文数	在国外学术期刊上发表论文数	收录于 SCI、EI 论文数	出版专著数
博士生				
硕士生	8			
IV-9 1999 年以来本学科点博士、硕士研究生在校期间所取得的重要科研成果(论文、专著、专利等), 以及学位论文获奖情况				
研究生姓名	导师姓名	成果名称	出版、发表、提交(鉴定)单位, 时间, 获奖名称、等级	署名次序
李群	李冠	根癌农杆菌介导的 β -1, 3-葡聚糖酶基因在新疆甜瓜中的转化与表达	中国植物生理学会第八届全国会议学术论文汇编	第一
葛屹松	李冠	新疆甜瓜组培体系的优化及抗病转基因研究	新疆大学学报(自然科学版) 2003, No. 1	第一
葛屹松	李冠	新疆甜瓜的组织培养与植株再生	中国新疆首届药用植物国际研讨会(论文)	第一
谢丽琼	李冠	几种诱导因子在棉花抗黄萎病上的应用	新疆首届研究生学术论文交流集	第一
马东舰	李冠	陆地棉体细胞胚胎的发生和遗传转化条件初探	新疆大学学报(自然科学版) 2003, No. 1	第四
马东舰	李冠	速生杨与钻天杨生理生化特性比较研究	西北植物学报 2001. No. 4	第三
赵晓琴	李冠	1. 生物技术在新疆药用植物中的作用初探 2. 浅探新疆肉苁蓉开发与利用	中国新疆首届药用植物国际研讨会(论文)	第二
杨勇	阿不都拉阿巴斯	Cladonia 中国新记录种	菌物系统, 2003. 1	第一