Key to the Lichen Genera of the Guianas

by Harrie Sipman, Botanical Museum Berlin-Dahlem

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The key deals with c. 190 genera known from or expected in the three Guianas (Guyana, Surinam, French Guiana). Included are all genera known from literature or from recent, unpublished collections. Genera in " " concern provisional identifications or taxa of uncertain or provisional taxonomic position. Genera in [ ] are known from surrounding areas and expected for the Guianas.

The genera Cladia, Cladina, and Cladonia may now be keyed to species using the Key to the Cladoniaceae of the Guianas, by Ted Ahti and Harrie Sipman, 1997.

Basic knowledge of lichens is required for use of the key. For easier use a simplified terminology is applied. e.g., all interascal filaments are called paraphyses.

Although the key is principally meant for the Guianas, it is likely to be of use throughout the Amazon basin, and genera recorded from that area are included as much as possible.

N.B. The number series of the couplets is incompletely used, because numbers are reserved for future extensions. Interrupted sites are marked by three blank lines.

The following persons are gratefully acknowledged for contributions: R. C. Harris (1986), L. Brako (1986) , J. Knoph (1986), A. Aptroot (1996). Errors are my own responsibility!

Additions, corrections, recommendations are very welcome! Please contact Harrie Sipman, who would appreciate such cooperation very much. E-mail: **h.sipman@bgbm.org**. Please address inquiries about the presentation of this key and about the Smithsoniam Institution's Biological Diversity of the Guianas Program to Sara Alexander by E-mail: **alexandersar@si.edu**.

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la Thallus fruticose, i.e. with free-standing or hanging, terete or flattened, often branched lobes, which may measure a few mm to several dm in length, and which are affixed only at their base, rather uniformly colored on all sides; in addition, squamulose or crustose thallus may be present

2

b Thallus foliose, i.e. forming a flat plate, measuring usually several cm in diam., more or less deeply divided into lobes, which grow usually parallel to their substrate, usually rather closely appressed to it, often attached by tomentum or rhizines on the lower side, so that the whole thallus can usually be lifted off easily; the lower side mostly differing markedly in color

from the upper side, often brownish or black
20

c Thallus squamulose, i.e. at first sight seeming crust-like, but composed of flat, generally separate lobes, rarely exceeding 1-2 mm in length, which grow more or less parallel to the substrate, attached to it by their base or by their underside, not by rhizines, so that the thallus cannot be lifted off without breaking into separate lobes; their lower side usually differing markedly in color from the lower side, often whitish
80

d Thallus crustose, i.e. forming a layer which covers the substrate and is affixed to it with its whole lower side, in such a way that it cannot be lifted off, sometimes penetrating into the substrate or even developed inside the substrate (e.g. endophloeodic: growing inside the (outer) bark cells)
100

2a (fruticose) Thallus branches with central cavity
3

b Thallus branches solid, with arachnoid or more compact central tissue
8

3a Thallus surface glossy, pale brown to brown, with usually frequent perforations; terrestrial, occasionally on mossy tree trunks
Cladia

b Thallus surface dull, usually whitish, greenish or greyish; perforations in most species absent, in some species present in axils of ramifications (rarely more frequent, than thallus yellowish)
4

4a Thallus branches with squamules, especially at the base
Cladonia

b Thallus without such appendages
5

5a Rare epiphytic species, known only from Mt. Roraima at c. 2000 m (widespread and common in the Andes)
Oropogon

b Widespread terrestrial species, mostly on white sand, occasionally on decaying tree stumps
6

6a Thallus surface slightly felty, without cortex (*Cladonia signata* would also key out here)
Cladina

b Thallus surface smooth, with thin cortex
Cladonia

8a Thallus branches with tough central stand, which becomes visible between the breaking outer layer by moderate tension
Usnea

b Thallus branches without tough central strand, breaking completely by tension
9

9a Epiphytic species, occasionally on decorticated wood
10
b Saxicolous species, occasionally on thin soil cover on rock
15

10a Lobes applanate, over two times wider than thick
11
b Lobes more or less terete
12

11a Thallus greenish grey, over 2 cm long when full-grown, often pendant
Ramalina
b Thallus whitish, c. 1 cm long when full-grown, erect
Siphula

12a Thallus, at least in part, yellow, reaction K+ purple
Teloschistes
b Thallus bluish grey or greenish to whitish yellow, K-
13

13a Thallus bluish grey to black, basal branches sometimes whitish; branches more or less terete; with bluegreen algae
14
c Thallus whitish yellow; branches flattened, composed of chains of apothecia; with green algae
Polystroma

14a Richly branched; main branches over 0.1 mm wide, with more or less scattered tomentum; no apothecia; with multilayered cortex; algae *Nostoc* in glomerules, not gelatinous
Dendriscocaulon
b Richly branched; main branches up to 0.1 mm wide, without tomentum; apothecia common (upland); cortex composed of a single cellular layer; algae *Scytonema*, gelatinous
Polychidium
c Sparingly branched; main branches over 0.1 mm wide, without tomentum; apothecia common; no cellular cortex; algae *Nostoc* in chains, gelatinous
Lempholemma

15a Fruticose thallus with granular or squamulose appendages; with green algae
Stereocaulon
b Fruticose thallus without such appendages; algae bluegreen or green
16

16a On rock; thallus composed of brownish to blackish, fruticose parts only; ascomycetes, though rarely fruiting
17
c On soil; fruticose thallus yellowish, without algae; in addition, crustose, algiferous, dark green thallus

present; basidiomycete
Multiclavula

17a On temporarily submersed rocks in streams; thallus gelatinous, black; rare species
18
b On mostly dry rock faces on land; thallus not gelatinous, white or grey; common species
19

18a Lobes flat, little branched, over 1 cm long
Jenmania
b Lobes rounded and richly branched, forming cushions less than 1 cm thick
Lichina?

19a Thallus dark brown to black; algae bluegreen; on granite
Peltula
b Thallus white to pale grey; algae green; on sandstone (cf. also Toninia, with thallus composed of rounded, sometimes rather elongated, warts; recognizable by dark grey color and frequent presence of apothecia)
Siphula

20a (1, foliose) Lobes with thread-like appendages (rhizines) on lower side; algae green
21
b Lobes with tomentum on lower side, at least on part of it; algae mostly bluegreen
41
c Lobes with naked lower side; algae various
61

21a Thread-like appendages on the margins of the lobes (cilia), sometimes also on underside (rhizines)
22
b Thread-like appendages not on the margins of the lobes, only on underside (rhizines)
31

22a Cilia with inflated base
23
b Cilia without inflated base
24

23a Upper side of thallus yellowish green, usnic acid present
Relicina
b Upper side of thallus whitish grey, atranorin present
Bulbothrix

24a Rhizines white or grey, sometimes black, but then usually with perpendicular side branchlets; lower side often without cortex, felty; spores biloculate, dark
Heterodermia
b Rhizines black; lower side always with cortex, smooth;

spores uniloculate, colorless
25

25a Rhizines one or more times dichotomously branched
Hypotrachyna
b Rhizines mostly unbranched, or in part irregularly branched
26

26a Thallus lobes elongate, mostly under 2 mm wide
Parmelinopsis
b Thallus lobes short and wide, mostly over 5 mm wide
27

27a Underside near lobe tips without rhizines, naked in a several mm wide zone
Parmotrema
b Underside rhizinate to the margin
28

28a Underside near margin brown, with scattered rhizines of variable length
Rimelia
b Underside near margin pale, with dense, short rhizines mixed with scattered longer ones (not yet known from the Guianas)

Rimeliella
31a Rhizines absent from marginal zone; thallus lobes wide, often over 10 mm wide
Parmotrema
b Rhizines present till lobe margins; thallus lobes usually up to 2 mm wide, rather narrow and deeply dissected
32

32a Rhizines frequently dichotomously branched
Hypotrachyna
b Rhizines mostly unbranched or a few times irregularly branched
33

33a Apothecia completely black, without grey thalline margin when well developed
Pyxine
b Apothecia with grey thalline margin
34

34a Spores biloculate, grey to brown; lower side whitish or black, sometimes without cortex
35
b Spores uniloculate, hyaline; lower side brown to black, always with cortex
37

35a Thallus applanate; cortex composed of periclinally arranged hyphae
36
b Thallus more or less ascendant; cortex composed of longitudinally arranged hyphae, surface slightly

longitudinally striate
Heterodermia

36a Apothecia with pale hypothecium; thallus without divaricatic acid, with dull, black or pale, lower cortex
Physcia
b Apothecia with dark hypothecium; thallus of Guianan species always with divaricatic acid, with glossy, black lower cortex
Dirinaria

37a Epiphytic or epilithic; thallus whitish grey, without usnic acid
38
b Epilithic; thallus yellowish green, with usnic acid
Xanthoparmelia

38a Lower surface pale brown to brown; spores less than 10 µm long
Pseudoparmelia
b Lower surface dark brown to black; spores over 10 µm long
Canoparmelia

41a Thalli with small, rarely over 5 mm wide, lobes, usually closely appressed; algae always bluegreen
42
b Thalli with usually large, over 5 mm wide lobes, not or loosely appressed; algae bluegreen or green
46

42a Upper surface tomentose; tomentum on lower side often restricted to marginal patches; uncommon
Erioderma
b Upper surface glabrous; tomentum on lower side usually spread over most of the thallus
43

43a Cortex composed of longitudinally arranged hyphae; thallus often with concentric ridges; apothecia without thalline margin
Coccocarpia
b Cortex not composed of longitudinally arranged hyphae; thalli without concentric ridges
44

44a Thallus closely appressed to substrate
45
b Thallus loosely appressed with ascending margins; uncommon
Leioderma

45a Thallus without distinct prothallus; apothecia always with thalline margin
Pannaria
b Thallus with distinct, often tomentose, prothallus;

apothecia with or without thalline margin
Parmeliella

46a Thallus with small, sharply delimited, raised or immersed white or yellow, tomentum-free spots on lower side
47
b Thallus with larger, not sharply delimited, pale, tomentum-free areas on lower side
Lobaria

47a White spots on lower side, with prominent, raised margin (cyphellae)
Sticta
b Yellow spots on lower side, with margin hardly raised above the center (pseudocyphellae)
Pseudocyphellaria

61a Thallus of felty structure
62
b Thallus compact, usually with differentiated cortical layer
63
62a With bluegreen algae, without ascocarps (basidiolichen); thallus usually growing parallel to substrate

Dictyonema
b With *Trentepohlia* algae, apothecia sometimes present; thallus often growing at right angles to substrate
Coenogonium

63a Thallus scarcely dissected, lobes + hemispherical; basidiolichens without ascocarps
64
b Thallus strongly dissected, lobes usually much longer than wide; apothecia often present
65

64a Thallus concentrically ridged, with bluish color
Dictyonema
b Thallus smooth with raised margin, with dark greenish
Corella

65a Thallus bluegrey to black, gelatinous; algae *Nostoc* in chains; no cellular cortical layer
Collema
b Thallus bluegrey to black, gelatinous; algae Nostoc in chains; cortical layer one cell thick
66
c Thallus whitish grey to greenish grey, not gelatinous; algae green; cortex well developed, several cells thick
67

66a Spores septate; thallus often under 0.5 mm thick
Leptogium

b Spores simple; thallus over 0.5 mm thick
Physma

67a Spores dark, biloculate and ovate; underside black, with cortex
68
b Spores colorless, pluriloculate and bacillar; underside white, without cortex
Physcidia

68a Apothecia, at least when well developed, without thalline margin
Pyxine
b Apothecia with persistent thalline margin
69

69a Apothecia with dark hypothecium; thallus lobes elongate and laterally confluent
Dirinaria
b Apothecia with pale hypothecium; thallus lobes not laterally confluent
Hyperphyscia

80a (1, squamulose) Perithecia present; spores muriform; algae present in hymenium
Endocarpon
b Perithecia (rarely) present; spores transversely septate: no algae in hymenium
Normandina
c Apothecia present, or fruitbodies absent
81

81a Squamules + rounded, whitish with raised margin, ca. 1 mm diam.; fruitbodies unknown (parasitic (?) perithecia sometimes present; spores transversely septate; no algae in hymenium)
Normandina
b Squamules usually elongated and greenish, without raised margin
82

82a Squamules on a felty layer of hyphae (prothallus)
83
b Squamules directly on substrate, sometimes with prothallus penetrating into the substrate, but not forming a layer over the substrate
91

83a Algae bluegreen
84
b Algae green
85

84a Thallus without prothallus; apothecia always with thalline margin
Pannaria
b Thallus with distinct, often tomentose, prothallus; apothecia with or without thalline margin
Parmeliella

85a Hymenium IKI+ orange
[Opegraphaceae]
(probably undescribed genus, known so far from Neblina, Venezuela)
b Hymenium IKI+ blue
86

86a Upper surface of squamules byssoid, lacking cortex and woolly by free hyphae
Crocynia
b Upper surface of squamules more or less smooth, sometimes pruinose, cortex present
87

87a Squamules with an upper and lower cortex comprised of a thin layer of cubic cells
Eschatogonia
b Squamule cortex otherwise, lower cortex usually absent
88

88a Spores generally over 25 µm, transversely multiseptate
Squamacidia
b Spores generally under 25µm, 1-2-loculate
Phyllopsora

91a Algae bluegreen
Peltula
b Algae green
92

92a Squamules greenish above, whitish below, usually elongate (primary thallus squamules of *Cladonia* may key out here)
"Biatora"
b Squamules whitish grey on both sides, elongate and erect
Siphula
c Squamules whitish grey on both sides, usually roundish
93

93a Apothecia stalked and raised above the squamules, usually on branched pseudopodetia
Stereocaulon
b Apothecia sessile between the squamules
Toninia(s.l.)

100a (1, crustose) Foliicolous species, found on living leaves
101
b Corticolous, terrestrial or saxicolous species
200

101a (foliicolous) Thallus with dish-like, stalked isidia; ascocarps unknown *Porina* (*Phyllophiale*)
b Thallus naked or with somewhat hair-like hypophores with flattened tips, producing conidia
102

c Thallus with c. 0.1-2 mm long, sterile bristles/hairs
170

102a Apothecia present, rounded
103
b Lirellae present, elongate with black, distinctly carbonaceous labiae
Opegrapha
c Perithecia present
150
d Ascocarps absent, but conidangia present
180
e Black-rimmed goniocystangia resembling ascocarps, but producing goniocysts, present *Opegrapha* gr. *lambinoni*

103a Ascocarps (seemingly) without excipular tissue, without visible margin
104
b Ascocarps with clearly differentiated margin
110

104a Fruitbodies white, with asci scattered in loose, hyphal tissue; spores muriform
105
b Fruitbodies usually colored, compact, with asci in distinct, gelatinous hymenium
106

105a Spores muriform
Cryptothecia
b Spores transversely septate only
Stirtonia

106a Paraphyses straight; spores transversely septate; asci with I+ blue tholi; hymenium I+ blue
Byssolecania
b Paraphyses branched and anastomosing; asci with I-negative tholi; hymenium I+ red or blue
107
c Paraphyses branched and anastomosing; asci with I-negative tholi; hymenium I-negative
110

107a Spores transversely septate
108
b Spores muriform
Arthothelium

108a Conidia filiform, over 50 µ m long, produced in elongate pycnidia with lateral pore
Eremothecella
b Conidia bacillar, under 20 µ m long, produced in rounded pycnidia with apical pore
Arthonia

110a Apothecia immersed in the thallus, disc

level with thallus surface, sometimes surrounded by a raised thalloid margin
111
b Apothecia adnate to sessile, often constricted at the base; disc above thallus surface
115

111a Thallus with cortical layer of quadratic, rectangular or rounded cells, one cell-layer thick
112
b Thallus without cortical layer or with a cartilaginous cortical layer
113

112a Spores transversely septate; epithecial algae absent
Asterothyrium
b Spores muriform; epithecial algae present
Gyalectidium

113a Paraphyses simple; with splitting, erect or recurved, thalline margin
Chroodiscus
b Paraphyses branched and anastomosing; without thalline margin
114

114a Spores bicellular; hyphophores stalked
Echinoplaca
b Spores at least 3-septate; hyphophores without stalk, consisting of a sessile, gelatinous ball
Actinoplaca

115a Hymenium I+ blue, at least near the asci; asci I+ blue, usually in the tholus, at least along the outside
116
b Hymenium I+ reddish; asci I-negative
Mazosia
c Hymenium and asci I-negative or very pale blue
135

116a Spores simple
117
b Spores transversely septate only
118
c Spores muriform
126

117a Thallus smooth, containing green algae; apothecia with pronounced margin *"Lecidea"* gr. *piperis*
b Thallus granular, containing bluegreen algae; apothecia soon convex and immarginate "aff. *Leprocollema*?"

118a Excipulum formed externally by loose, felty hyphae, which surround the apothecia as a thin circle
Byssoloma

b Excipulum compact, also externally
119

119a Asci with a I+ blue tubular structure in the tholus
120
b Asci without tubular structure, with or without a I+ blue axial mass
121

120a Apothecia usually over 0.5 mm wide, flat; I-positive tubular structure in ascus apex distinctly stained over its whole length; excipulum usually filled with crystals
Badimia
b Apothecia mostly under 0.5 mm side, soon convex; I-positive tubular structure in ascus apex most distinctly stained in its basal part; excipulum not filled with crystals
Fellhanera

121a Campylidia never present; asci with conical or rounded, I+ pale blue axial mass
122
b Campylidia (usually) present; asci without I+ pale blue axial mass
123

122a Asci with conical axial mass; excipulum prosoplectenchymatic
Bacidia
b Asci with rounded axial mass; excipulum paraplectenchymatic *Woessia* (incl. *Bacidina*)

123a Hypothecium purplish; apothecia black, sometimes with white pruina
Tapellaria
b Hypothecium usually not purplish; apothecia variously colored
124

124a Ascospores 3-septate, fusiform
125
b Ascospores 7-septate, bacillar; campylidia as in Calopadia
"Tapellariopsis"
c Ascospores multiseptate, over 10-septate, acicular; no campylidia
Bapalmuia

125a Campylidia producing flask-shaped, c 20 µm long conidia
Barubia
b Campylidia producing ovoid, c. 10 µm long conidia
Loflammia

126a Margin of apothecium with long, stiff hairs
Lasioloma
b Margin of apothecium without such hairs
127

127a Epithecial algae present
Sporopodium
b Epithecial algae absent
128

128a Apothecia black, sometimes with white pruina, with flat disc; hypothecium purplish
Tapellaria
b Apothecia dark brown, with flat disc
Calopadia
c Apothecia red to carmine, with flat disc
Loflammia
d Apothecia yellowish, soon convex
Logilvia

135a Apothecia elongate to angular or round, not constricted at base, margin formed by a dark tissue which originally covers the disc
Aulaxina
b Apothecia round to slightly irregular, margin not formed by a dark tissue which originally covers the disc
136

136a Apothecia proliferating on their margins; mainly on leaf margins
Polystroma
b Apothecia not proliferating on their margins
137

137a Paraphyses simple, straight
138
b Paraphyses branched and anastomosing
139

138a Apothecia yellow; spores bicellular in cylindrical asci (NB: for species determination it is important to look for the pyncidia, which are often found on separate plants)
Dimerella
b Apothecia variously colored; spores variously septate in clavate asci
Gyalidea

139a Excipulum thinly spreading laterally over the thallus
Echinoplaca
b Excipulum not spreading, forming a prominent margin
140

140a Without bristle-like hyphophores
Gyalideopsis
b With bristle-like hyphophores
Actinoplaca

150a Thallus subcuticular, very glossy (incl. *Phylloporis*, *Raciborskiella*)
Strigula
b Thallus epicuticular, forming a usually dull sheet

over the cuticula of the leaf
151

151a Perithecia smooth
154
b Perithecia with warts, bristles or a disc-like expansion around the pore; spores transversely septate or muriform
152

152a Perithecia whitish, with a disc-like extension around the pore or with more scattered scales
Aspidothelium (included in *Thelenella*)
b Perithecia reddish or black, with bristle-like extensions, usually in a whirl around the pore
153
153a Asci bitunicate; spores 14-17 x 3-4 µm, 3-septate
Lyromma
b Asci thinwalled; spores usually over 18 µm long
Porina

154a Spores pale grey-brown, transversely 3-septate
Microtheliopsis
b Spores colorless, transversely septate or muriform
155

155a Spores two-celled
156
b Spores transversely pluriseptate
157
c Spores muriform
158

156a Spores under 30 µm long
Anisomeridium
b Spores over 50 µm long
Musaespora

157a Ascocarps solitary
Porina
b Ascocarps grouped in raised thallus parts
"Flavobathelium"

158a Perithecia with outer wall containing dark-brown pulveraceous masses, often irregularly shaped
Phyllobathelium
b Perithecia with outer wall without such masses, regular
159

159a Spores lumbricoid, with few longitudinal cells
Phylloblastia
b Spores oval, with numerous longitudinal cells
Thelenella

170(101) (Sterile, hairy plants cannot be identified with certainty; they are arranged artificially under

Tricharia melanothrix Fée, with black hairs, and *T. leucothrix* Fée, with white hairs)

a Apothecia immersed, disc level with thallus surface, sometimes surrounded by a raised, rim-like thallus area
171

b Apothecia sessile, often constricted at the base
178

171a Hairs white. often over 1 mm long
172

b Hairs brown to black, short, under 0.2 mm
177

172a Perithecia present; hairs tiny, on the perithecia
Porina

b Apothecia present; hairs mostly on the thallus
173

173a Hairs tiny, dense, forming tomentose areas on the thallus and thalloid apothecial margins
Mazosia

b Hairs larger, often over 1 mm long, bristle-like
174

174a Thallus with cortical layer of quadratic, rectangular or rounded cells, one cell-layer thick
175

b Thallus without cortical layer or with a cartilaginous cortical layer
176

175a Spores transversely septate; epithecial algae absent
Asterothyrium

b Spores muriform; epithecial algae present
Gyalectidium

176a Ascocarps surrounded by a raised thalloid rim
Calenia

b Ascocarps without raised thalloid rim, with a more or less distinct excipulum
Echinoplaca

177a Ascocarps without black proper margin
Caleniopsis

b Ascocarps with black proper margin
Aulaxina

178a Excipulum laterally spreading over the thallus, thus apothecia seemingly immarginate
Echinoplaca

b Excipulum not laterally spreading, apothecia distinctly marginate
Tricharia

180a campylidia present: greyish or yellowish ear-like structures which are strongly raised on one side, and produce conidia: various species of *Badimia, Loflammia,*

Sporopodium, not identifiable without apothecia; artificially arranged in the genus *Pyrenotrichum*
181

b hygrophores or other brush-like conidiogenous structures
186

c immersed or slightly exserted conidangia, black or concolorous with thallus
188

181a Campylidia producing ovoid, pyriform, simple or uniseptate conidia
182

b Campylidia producing flask-shaped, non-septate conidia
Barubia

c Campylidia producing filiform, septate, sometimes branched conidia
184

182a Campylidia producing uniseptate conidia with unequal cells; usually found with ascomata
Byssoloma

b Campylidia producing simple conidia
183

183a Campylidia short, on top of a thalloid cylinder; algae between the conidiophores
Sporopodium

b Campylidia not on thalloid cylinder; no algae between the conidiophores (*Loflammia* and *Logilvia* have similar campylidia, but are unlikely to be found without ascomata)

Musaespora

184a Campylidia with branched, somewhat star-shaped conidia
Lasioloma

b Campylidia with unbranched conidia
185

185a Campylidia with cylindrical, to c. 40 µm long conidia without appendages
Arthonia

b Campylidia with cylindrical, c. 100 µm long conidia with appendages
Badimia

c Campylidia with tapering, c. 50 µm long conidia without appendages (genera to be separated by ascoma characters)

Calopadia/Tapellaria

186a True hyphophores present, producing conidia in a free-hanging gelatinous ball
Echinoplaca

b Conidia not produced in a free-hanging gelatinous ball, but in a conidangium inside the brush-like structure
187

187a Conidangia brown to black, star-like branched; on leaf

upper surface
Lyromma
b Conidangia pale brown, simple; on leaf margin
Woessia

188a Conidangia black
189
b Conidangia pale, inconspicuous
Dimerella

189a Conidia simple
Anisomeridium
b Conidia septate
190

190a Conidangia separate
Strigula
b Conidangia in groups of c. 10-30 in elevated thallus areas
Phyllobathelium

200a (100, crustose, non-foliicolous lichens) Ascocarps present
201
b Ascocarps and conidangia absent; usually sterile crustose lichens; only a selection of common and characteristic species treated
401
c Ascocarps absent, conidangia present
450

201a Ascocarps rounded, with open disc (apothecia), immersed, sessile or stalked
202
b Ascocarps closed, with porus (perithecia), immersed or sessile
300
c Ascocarps elongate, with open or slit-like disc (lirellae), immersed or sessile
350

202a Apothecia covered by powdery, staining masses of spores ripening in a layer above the asci (mazaedia); apothecia sessile or sometimes on long, thin stalks (Caliciales)
203
b Apothecia not covered by spore masses, not staining, releasing spores from each ascus separately, immersed or sessile, rarely stalked
210

203a Apothecia pin-shaped, with up to 2 mm long, thin stalk; spores simple, pale brown
204
b Apothecia sessile
205

204a Apothecia black; spores two-celled, dark brown
Calicium

b Apothecia brownish; spores simple, pale brown

Chaenotheca

205a Apothecia without thalline margin
206
b Apothecia with thalline margin
207

206a Spores two-celled
Pyrgidium
b Spores four-celled
Pyrgillus

207a Spores two-celled
Tylophoron
b Spores four-celled
Schistophoron
210a Hymenium I+ blue, at least near asci; asci I+ blue, at least along their outside, and usually also in their tips; paraphyses usually straight and unbranched, except near the tips, rarely branched and anastomosing; spores simple or variously septate, with rather equal cells (Lecanorales)
211
b Hymenium I+ red or blue; asci I-negative, except sometimes for a small, I+ blue ring around the ocular chamber; paraphyses densely branched and anastomosing; spores variously-septate but not simple, often with a single, much larger cell terminally or (sub)medially (Opegraphales, Arthoniales)

260
c Hymenium I-negative, rarely pale blue; asci I-negative or very pale blue throughout; paraphyses straight and unbranched, except sometimes near the tips, rarely branched and anastomosing; spores variously septate but not simple, with rather equal cells (terminal spore parts may still lack septation in young spores) (Gyalectales, Graphidales)
280

211a Spores grey to brown, at least when old, usually bicellular
212
b Spores persistently hyaline, various
214

212a Spore septa thin, lumina cubical; pycnidia bacillar, up to 5.5 µm long
Buellia
b Idem; pycnoconidia filiform, curved, up to 30 µm long
[*Amandinea*]
c Spore septa thickened, lumina rounded or more complicated
213

213a Apothecial margin without algae, concolorous with the disc; spores with thin-walled, rather pointed poles
Hafellia
b Apothecial margin with algae, usually concolorous with thallus; spores usually with thickened polar walls, not pointed

Rinodina

214a Spores simple
215
b Spores transversely septate only
230
c Spores muriform
250

215a Apothecial margin lecanorine, of same color as thallus, with algal layer
216
b Apothecial margin lecideine or biatorine, of same color as disc, without algal layer, or apothecia without distinct margin
220

216a Spores under 20 µm long
217
b Spores over 30 µm long
218

217a Spores 8/ascus
Lecanora
b Spores many/ascus
Maronina

218a Disc often punctiform, ascocarps often in compound groups immersed in warts; spores thick-walled and generally over 50 µm long
Pertusaria
b Disc open, apothecia separate; spores under 50 µm long
Ochrolechia

220a Apothecial disc bright red, K+ purplish
Pyrrhospora
b Apothecial disc not bright red, usually brown or black, K-
221

221a Spores more than 16 per ascus, small and globose

Piccolia
b Spores fewer than 16 per ascus, never globose
222

222a Paraphyses anastomosing; exciple absent or indistinct; apothecia soon convex and globular
[*Micarea*]
b Paraphyses not anastomosing; exciple present, usually obvious in young apothecia at least; apothecia often flat
223

223a Algae bluegreen; thallus slightly gelatinous; on periodically inundated rock
"Psorotichia"

b Algae green; thallus not gelatinous; substrate various
224

224a Asci with strongly I+ blue tholus, in which a paler axial mass may be present
225
b Asci with weakly I+ blue tholus, in which an I+ blue central tube may be present *"Lecidea"* gr. *piperis*

225a Apothecia dark brown to black; thallus whitish or greenish, often K+ yellow or C+ orange; mostly on tree bark [*Lecidella*]
b Apothecia pink or brownish to blackish discolored; thallus gray, granular, K-, C+ red; on burnt or decaying worked wood *Trapeliopsis*
c Apothecia variously colored; thallus reactions different; mostly on tree bark *Biatora* s.l.

230a Apothecia with distinct margin of same color as thallus, with algae
231
b Apothecia with margin of different color as thallus, usually of same color as disc, or without distinct margin
234

231a Apothecia sessile with constricted base, with entire or crenulate margin; disc red, K+ purplish
232
b Apothecia immersed, with lacerate, erect margin; disc grey to pale brown, often white-pruinose *Phlyctella*

232a Spore septa thickened, about as thick as lumina; spores ovoid to fusiform, less then 5 times as long as wide
233
b Spore septa thin; spores bacillar, over five times as long as wide *Haematomma*

233a Spores two- to four-celled *Caloplaca*
b Spores more than four-celled *Letrouitia*

234a Apothecia without distinct margin, very soon globose [*Micarea*]
b Apothecia with a distinct margin, at least when young
235

235a Spores 2-loculate
236
b Spores 3- or more-loculate
240

236a Spores 2/ascus, over 40 µm long
Lopezaria
b Spores 8/ascus, under 30 µm long
237

237a Asci with ocular chamber surrounded by I+ weakly staining, rounded axial mass (*Lecanora*-type); spores halonate; exciple with well-defined cortical and medullary parts, but lacking algae
"Megalaria"
b Asci without rounded, I+ weakly staining axial mass around ocular chamber; spores not halonate; exciple compact
238

238a Ascus tholus containing a conical, I+ weakly staining axial mass around ocular chamber *Biatora* s.l.
b Ascus tholus containing a tubular, I+ strongly staining structure; apothecia yellowish "*Catillaria*" s.l.

240a Spores extremely large, broad ellipsoid, 70-140 x 25-35 µm, 1/ascus
Megalospora
b Spores smaller or long fusiform or filiform, usually 8/ascus
241

241a Apothecia with weak, soon inapparent margin; apothecia soon convex to globose; paraphyses branched
[*Micarea*]
b Apothecia with prominent, rather persistent margin; disc more or less flat; paraphyses unbranched for most of their length, rarely (in *Fellhanera*) branched
242

242a Ascus tholus containing a more or less conical, I+ weakly staining axial mass around ocular chamber
243
b Ascus tholus containing a tubular, I+ strongly staining structure
245

243a Spores acicular, generally more than 5 times as long as wide
244
b Spores fusiform, less than 5 times as long as wide *Biatora* s.l.

244a Excipulum paraplectenchymatic; asci with rounded axial mass *Woessia* (*Bacidina*)
b Excipulum prosoplectenchymatic; asci with conical axial mass
Bacidia

245a Excipulum with byssoid outer layer

Byssoloma

b Excipulum smooth outside

246

246a Apothecia usually over 0.5 mm wide, flat; I-positive tubular structure in ascus apex distinctly stained over its whole length

Badimia

b Apothecia mostly under 0.5 mm side, soon convex; I-positive tubular structure in ascus apex most distinctly stained in its basal part

Fellhanera

250a Apothecia yellow, K+ dark purple

251

b Apothecia not yellow, K-

252

251a Thallus white

Brigantiaea

b Thallus green suffused more or less with yellow

Letrouitia

252a Ascus tholus containing a tubular I+ strongly staining structure; no campylidia present; paraphyses little branched

Lopacidia

b Ascus tholus without tubular, I+ structure, often with wide ocular chamber; usually campylidia present; paraphyses strongly branched

253

253a Campylidia consisting of a thalloid tube and a short, brownish "ear"; excipulum paraplectenchymatic

Sporopodium

b Campylidia consisting of a large, greyish "ear" sitting directly on the thallus; excipulum paraplectenchymatic

Calopadia

260a Ascocarps compound, with several, often punctiform discs in raised areas concolorous with the thallus or differently colored (stromatoid); spores transversely septate only

261

b Ascocarps simple, with single disc, at age sometimes deformed (not stromatoid); spores transversely septate or muriform

270

261a Thallus felty, greenish

Dichosporidium

b Thallus with compact upper layer

262

262a Discs arranged in lines, often loosely accumulated

263

b Discs not arranged in lines, densely accumulated in roundish groups

264

263a Discs in whitish fields differing from the thallus; thallus greenish to yellowish; spores 4-celled, c. 15-20 x 5 µm *"Leucodecton" seriale*

b Discs in fields not differing from the thallus: thallus whitish, dull; spores variously septate *Enterographa*

264a Ascocarp discs wider, pruinose, in rounded groups [*Syncesia*]

b Ascocarp discs punctiform, blackish 265

265a Spores bacillar, 3-8-septate, widest above the middle and gradually tapering towards both ends; no red pigment in medulla *Chiodecton*

b Spores biclavate, 4-7-septate, with a larger and a smaller swollen part; often with spotted red pigment in medulla *Erythrodecton*

270a Ascocarps without margin, adnate over their whole width; asci broad-clavoid to globose, with thick apical dome with large ocular chamber (*Arthonia*-type); spores variously septate, often macrocephalic (with one terminal cell much larger than the others) 271

b Ascocarps with distinct, thalloid or lecideine margin; asci elongate, with thin apical dome with small ocular chamber, often surrounded by small I+ blue ring (Opegraphaceae-type); spores transversely septate only, never macrocephalic (terminal cells not larger than the others) 274

271a Hymenium gelatinous, not byssoid; ascocarps clearly distinct 272

b Hymenium byssoid, not gelatinous; ascocarps sometimes scarcely distinct from thallus 273

272a Spores transversely septate only (when discs punctiform and more or less grouped, see Enterographa) *Arthonia*

b Spores muriform *Arthothelium*

273a Spores transversely septate only *Stirtonia*

b Spores muriform *Cryptothecia*

274a Apothecial margin carbonized throughout, black 275

b Apothecial margin not carbonized externally, whitish

or thalloid
276

275a Ascospores acicular, 3-45-septate; disc permanently black
[*Bactrospora*]
b Ascospores fusiform, 3-19-septate; disc often yellow-pruinose
Cresponea

276a Apothecia with thalloid margins covering a dark excipulum, not constricted at base
Mazosia
b Apothecial margin not thalloid, without algae; often constricted at base
277

277a Ascospores 3-septate; apothecia appressed and large, often over 2 mm diam.
Sagenidiopsis
b Ascospores 5-7-septate; apothecia sessile with constricted base, not over 1.5 mm wide
Lecanactis

280a Spore lumina rounded at maturity by abundant endospore
281
b Spore lumina cubical, at most with lightly rounded edges, without or with scarce endospore
290

281a Hymenium separated from the surrounding apothecium margin by a split; in dry state seemingly with a double margin
Thelotrema
b Hymenium not separated from the margin
282

282a Margin not carbonized, apothecia immersed in the thallus
283
b Margin at least partly carbonized and black; apothecia more or less exserted
284

283a Apothecial margin round; discs tiny, rarely over 0.5 mm wide
Myriotrema
b Apothecial margin lacerate, forming slips which cover the disc in part; discs often several mm wide *"Thelotrema"* pr.p.

284a Apothecia with raised thalline margin, discs visible through thallus splits, pale, often white-pruinose
Ocellularia
b Apothecia exserted above thallus, without thalloid margin; discs brownish
285

285a Apothecia compound, with several, often elongated discs

level with the margin; spores hyaline, transversely septate *Glyphis*

b Apothecia simple; margin raised above the disc; spores grey, muriform *Gyrostomum*

c Apothecia simple; margin not exserting the disc, sometimes with thalline fragments; spores grey, bacillar *Phaeographis* pr.p.

290a Paraphyses branched and anastomosing throughout *Gyalideopsis*

b Paraphyses unbranched, except sometimes near the tips 291

291a Terrestrial; spores grey, muriform *Diploschistes*

b Epiphytic, rarely on rock; spores various 292

292a Apothecia immersed or level with thallus, often over 1 mm large; margin lacerate or not 293

b Apothecia sessile with constricted base, mostly under 1 mm large; margin entire or crenate 294

293a Margin lacerate *"Thelotrema"* (perhaps better included in *Chroodiscus*)

b Margin entire or inapparent *Cyclographina*

294a Apothecia proliferating from their margins and thus forming coralloid-branched structures, greenish; on twigs or leaf margins; spores 6-8-celled; hymenium usually absent *Polystroma*

b Apothecia not proliferating, pale yellow to orange; on various substrates; spores bicellular *Dimerella*

c Apothecia not proliferating, with carbonized excipulum more or less covered by pale pruina or thallus; on mosses or decaying bark or wood; spores muriform *Ramonia*

300a (201) Spores simple 301

b Spores septate 302

301a Spores thickwalled, spherical; paraphyses persistent *Monoblastia*

b Spores thinwalled, elongate; paraphyses disappearing in an early stage [*Verrucaria*]

302a Spores (finally) brown
303
b Spores persistently colorless
314

303a Spore septa thin
304
b Spore septa seemingly thick, due to thickened endospore
305

304a Spores with 1-3 transverse septa; ascomata simple
Mycomicrothelia
b Spores muriform; ascomata multilocular by lateral fusion of separate ostioles
Mycoporum

305a Spores muriform
Anthracothecium
b Spores transversely septate only, with 3 or more septa
306
d Spores uniseptate
307

306a Spores three- or more-septate, under 50 µm long when three-septate
Pyrenula
b Spores three-septate, over 70 µm long
Architrypethelium

307a Spores without pigment granules in endospore
Distopyrenis
b Spores with pigment granules in endospore
[*Granulopyrenis*]

314a Spores septa seemingly thick, due to thick endospore layer, causing rounded lumina; ascomata often compound, in extensive pseudostromata
315
b Spore septa thin; ascomata usually simple
323

315a Spores muriform
316
b Spores transversely septate only
319

316a Ostiole apical
317
b Ostiole lateral, free or fused
318

317a Ascomata in brown, usually shiny pseudostromata containing yellow or orange pigments, K- or K+ red; pseudostroma wall composed of brown, jigsaw puzzle-like hyphae
Bathelium
b Ascomata not in brown pseudostromata, or wall not

composed of brown, jigsaw puzzle-like hyphae
Laurera

318a Ostioles free
[*Campylothelium*]
b Ostioles fused to other ostioles to form compound ascomata
Cryptothelium

319a Thallus poorly developed, indicated by a whitish patch on bark; ascomata naked at maturity, never aggregated in pseudostromata
Pseudopyrenula
b Thallus well developed; ascomata immersed in thallus or in pseudostromata
320

320a Ostioles free, apical
321
b Ostioles fused to form a compound ascoma
Astrothelium

321a Paraphyses branched and anastomosing; ascus apex with narrow ring surrounding a small ocular chamber; wall thickening of spores most pronounced in the edges of the septae
Trypethelium
b Paraphyses unbranched; ascus apex with a wide apical ring and wide ocular chamber; wall thickening of the spore more equal (incl. *Plagiotrema lageniferum*)
Lithothelium

323a Ascus tip thin and uniform, truncate; ascomal wall often bright colored (Trichotheliaceae); paraphyses unbranched
324
b Ascus tip more or less thickened with an apical indentation, rounded; paraphyses often branched
327

324a Ascomata with a subapical whorl of stiff black hairs
Trichothelium
b Ascomata without hairs
325

325a Spores transversely septate; asci with chitinoid apical ring (incl. *Trichothelium* sensu Harris 1995 pr.p., *Pseudosagedia*)
Porina
b Spores muriform; asci without chitinoid apical ring, with slight subapical constriction
326

326a Medulla white or pale yellowish
Clathroporina
b Medulla yellow to orange or brownish
Myeloconis

327a Paraphyses mostly unbranched; macroconidia usually present, cylindrical, septate
Strigula
b Paraphyses branched, especially above level of asci; macroconidia more or less globose or lacking
328

328a Ascomata multilocular, chambers laterally fused with separate ostioles
329
b Ascomata simple
330

329a Spores with 1-3 transverse septa only
[*Tomasellia*]
b Spores muriform
Mycoporum

330a Spores muriform
331
b Spores transversely septate
335

331a Asci with indistinct apical thickening; spores usually 8/ascus; (following Harris 1995 with inclusion of *Aspidothelium*, with an apical disc-like expansion or subapical scales on the perithecia)
Thelenella
b Asci with pronounced apical thickening with strong ocular chamber (*Arthopyrenia*-like), spores 2/ascus in neotropical species
Julella

335a Spores fusiform, 3-11-septate, over 4 µm wide; asci and paraphyses as in *Trypethelium*
Polymeridium
b Spores filiform, 5->10-septate, 1.5-2 µm wide
Celothelium
c Spores ovoid-fusiform, 1-septate, rarely 3-septate in old age
336

336a Lower spore cell usually the shorter; lichenized; microconidia globose to ellipsoid; macroconidia often present, simple, globose to ellipsoidal; ostiole often lateral
Anisomeridium
b Lower spore cell usually the longer; mostly non-lichenized; microconidia rod-shaped; macroconidia lacking; ostiole always apical
337

337a Paraphyses slender, without refractive bodies near the septa; asci clavate
Arthopyrenia
b Paraphyses short-celled, with refractive bodies near

the septa; asci obpyriform
Naetrocymbe

350a (201) Paraphyses branched and anastomosing; hymenium I+ red or blue; spore lumina not rounded, at most with slightly rounded edges; asci with rather thin apical dome with small ocular chamber often surrounded by a small I+ blue ring
351
b Paraphyses unbranched except sometimes near the tip; hymenium I-, rarely pale blue; spore lumina often rounded, more or less lentiform; asci usually with distinct apical dome, completely I-negative
355

351a Ascocarp walls (labiae) conspicuous and carbonized, at least internally
353
b Ascocarp walls indistinct, not carbonized
354

353a Spores with transverse septa only; excipulum externally carbonized;
Opegrapha
b Spores muriform; excipulum with outer thalline cover; ascocarps often short lirelliform to rounded
Helminthocarpon

354a Spores muriform
Arthothelium
b Spores transversely septate only
Arthonia

355a Ascocarps in stellate or rounded clusters
356
b Ascocarps single
360

356a Spores muriform, colorless
Medusulina
b Spores transversely septate only
357
357a Spores colorless; merocarps with rounded ends
Glyphis
b Spores grey to brown;merocarps with pointed ends
Sarcographa

360a Spores biloculate, with cubical lumina
Melaspilea
b Spores pluriloculate, mostly with lenticular lumina (when mature)
361

361a Spores transversely septate only, with lenticular lumina (when mature)
362

b Spores muriform
363

362a Spores colorless
Graphis
b Spores brown
Phaeographis

363a Spores colorless, with or without lenticular lumina (when mature)
364
b Spores grey to brown, with lenticular lumina (when mature)
Phaeographina

364a Paraphyses unbranched, also at the tips; spore lumina lenticular when mature
Graphina
b Paraphyses branched and anastomosing in the epithecium only, parallel below; spore lumina persistently cubical
Cyclographina

401a (200, sterile, crustose) Thallus leprose, consisting only of soredia
402
b Thallus byssoid, of woolly appearance while without cortex and entirely composed of very loose hyphae
403
c Thallus not leprose or byssoid. Here many usually sorediate or isidiate species would key out, belonging to various groups like *Pertusaria, Thelotremataceae, Porina*. Only a selection is included here
406

402a Thallus bright yellow, fine-grained
Chrysothrix
b Thallus shades of grey
Lepraria

403a Thallus zoned, i.e. with a differentiated marginal zone, of a paler color and gradually thinning out
404
b Thallus not zoned, usually with an abrupt border, often lobed
Crocynia

404a Thallus margin whitish; thallus greenish, with felty isidia
Dichosporidium
b Thallus margin blackish; thallus pinkish, without isidia
Sagenidiopsis
c Thallus margin whitish; thallus bluegreen, without isidia
Dictyonema

406a Medulla with conspicuous color, yellow, orange or reddish
407
b Medulla white
415

407a Medulla completely or partly red or pink; sorediate or isidiate
408
b Medulla orange or yellow; sorediate
409

408a Medulla with scattered red spots; thallus surrounded by black prothallus and with soralia *Erythrodecton*
b Medulla pink throughout; with glossy, short, clavate isidia; with hypoprotocetraric acid *Ocellularia rhodostroma*

409a Thallus greenish, glossy, with scattered soralia-like, yellow spots *Myeloconis*
b Thallus grey, dull, with raised, often dense, yellow soralia *Megalospora "chlorites"*

415a With soralia
416
b With schizidia; forest undergrowth species
420
c With isidia
425

416a Thallus C+ red; on well-lit sites *Pertusaria velata*
b Thallus C-; on tree trunks in forest
417

417a Soredia fine; with stictic acid (P+ orange, K+ orange) *"Thallotrema"*
b Soredia coarse, in part corticate; with hypoprotocetraric acid (P-, K-) *Myriotrema neofrondosum*

420a Schizidia accumulated in groups, which may look soralium-like and may be raised or shortly stalked; with hypoprotocetraric acid (P-, K-) *Myriotrema neofrondosum*
b Schizidia arising single, leaving scattered scars on the thallus
421

421a Thallus bluegrey-pruinose; with unknown substance *Myriotrema* sp.
b Thallus greenish, not pruinose; with various substances
422

422a Schizidia small, less than 0.2 mm wide; with protocetraric acid (P+ red) *Myriotrema parvidiscum*
b Schizidia 0.5-0.6 mm wide
423

423a With psoromic acid (P+ yellow, K-) *Ocellularia berkeleyana*
b With stictic acid (P+ orange, K+ orange) *Myriotrema* sp.?
c With cinchonarum unknowns (P+ red) *Myriotrema* sp.?

425a Forest undergrowth species with large, greenish, glossy thalli
426
b Various habitats, thallus different not treated

426a Isidia cylindrical; with psoromic acid (P+ yellow) *Myriotrema hartii*
b Isidia flagellate, gradually tapering from the base to the tip, with basal constriction and easily falling off; no lichen substances (P-) *Thelotrema brasiliensis*

450a (200) Conidangia campylidia, with "ear"-shaped, grey or brownish, geotropically directed extension (see also couplet 181 f.f.) *"Pyrenotrichum"*,
451
b Conidangia hyphophores, brush-like with widened tip carrying a gelatinous "drop"; usually immixed with longer, sterile hairs *Echinoplaca*
c Conidangia immersed not treated

451a Campylidia producing simple, pyriform or short-bacillar conidia
452
b Campylidia producing septate, filiform conidia
453

452a "Ear"-shaped part short, on top of a short, thalloid cylinder *Sporopodium*
b "Ear"-shaped part large, directly on thallus *Musaespora*

453a Campylidia grey, producing conidia without appendages *Calopadia*
b Campylidia brown, producing conidia with appendages *Badimia*