



A key to the parmelioid lichens of northern Thailand

Printable field guide

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images by HARRY TAYLOR et al. (species) and ANDREA MORO (characters)



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Introduction

This is a still provisional guide to parmelioid lichens occurring in northern Thailand, which will be tested in the field during an excursion on the occasion of the 7th Congress of the International Association of Lichenology. The species included here are based on specimens seen by the first and last two authors in the herbaria BM, CMU, TNS, and RAMK. This research was undertaken between 1990-2004 by Wolseley, Aguirre-Hudson, and Saipunkaew, and first presented at an IAL meeting in Kunming in 2002. Since that time there have been many changes in Parmeliaceae concepts as well as further research on this group in Thailand. We have also included some foliose 'cetrarioid' species such as *Cetreliaopsis*, *Cetrelia*, and *Nephromopsis* (the latter 2 still under study), which brings the number of infrageneric taxa to 99.





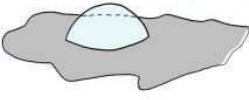
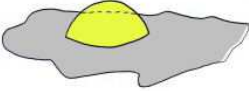

Following testing of the key and discussion at IAL7, we would like to enlarge the key to include more recent literature and further records.








The main aim of this key is to provide simple descriptions of species and key characters to enable identification of this conspicuous group of lichens in SE Asia by both professional and non-professional lichenologists. Chemistry that can be elucidated using spot tests is included in the key. Differences between similar and/or closely related species in the region are mentioned in the text. The key was generated in Italy, at the University of Trieste. It has two query interfaces: 1) an illustrated dichotomous interface, 2) a multi-entry query interface. The dichotomous key is available in different versions for different media: a) internet, b) CD-Rom, c) printable (pdf), d) for mobile devices (PDAs, iPhone, iPad, and iPod touch).





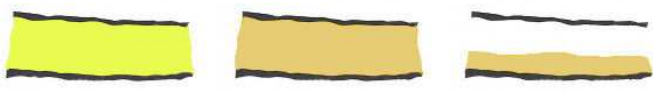


For references and other details we refer to the online version and to the annotated printable version.

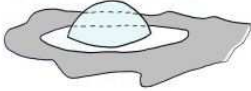


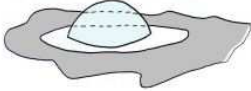


Acknowledgements





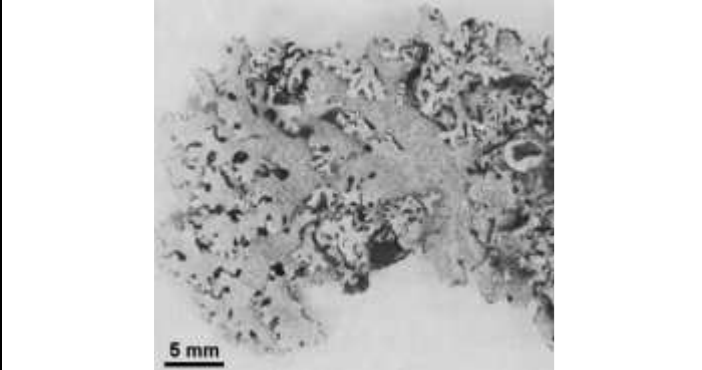
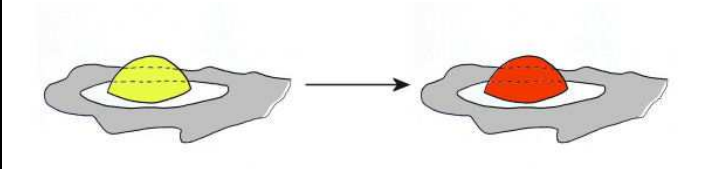
The Leverhulme trust funded the original research in Thailand by Pat Wolseley and Beğona Aguirre-Hudson and a grant from the Royal Society allowed Wanaruk Saipunkaew to continue her research at the Natural History Museum. Thailand Research Fund is also acknowledged for funding. We are grateful to the Department of Biology, Faculty of Science, Chiang Mai University for additional support and to the Department's staff and students for assistance. The software used for the generation of the key was developed in the framework of the European project KeyToNature, funded under the *eContentplus programme* (Contract no. ECP-2006-EDU-410019) and coordinated by the University of Trieste. We are grateful to Stefano Martellos (Trieste) who has set up the multi-entry query interface, to Elena Pittao (Trieste) who checked carefully the text, and to Rodolfo Riccamboni (Trieste), who developed the application for the iPhone. Andres Saag (Tartu) is acknowledged for the pictures of *Cetreliaopsis thailandica*, Kawinnat Buaruang (Ramkhamhaeng University) for the pictures of *Parmelinella chozoubae* and *Parmelinopsis microlobulata*, André Aptroot and Laurens Sparrius for the permit of using some of their pictures from <http://www.tropicallichens.net/>.







1	Thallus with conspicuous white pseudocyphellae on the upper and/or lower surface		2
1	Thallus without pseudocyphellae		7
2	With soredia or isidia		3
2	Without soredia or isidia		4
3	Thallus with soredia		Cetrelia cf. olivetorum (Nyl.) W.L. Culb. & C.F. Culb.
3	Thallus with isidia		Cetrelia cf. braunsiana (Müll. Arg.) W.L. Culb. & C.F. Culb.
4	Upper surface K-		5
4	Upper surface K+ yellow (atranorin)		6
5	Pseudocyphellae on the lower surface only. Apothecia abundant. Medulla P-		Nephromopsis pallescens (Schaer.) Y. S. Park var. pallescens



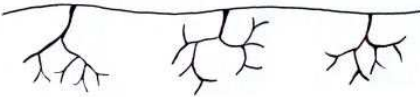


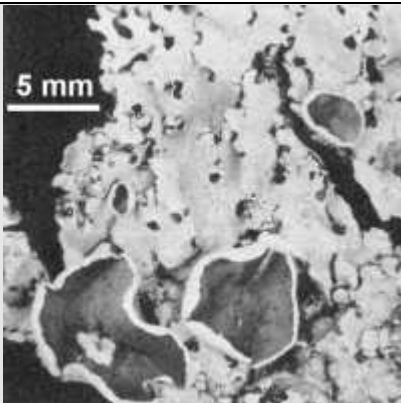
5	Pseudocyphellae on both surfaces. Apothecia rare. Medulla P+ orange		Cetreliaopsis thailandica Elix & M.J. Lai
6	Lobes not fringed by branched lobules. Apothecia frequent		Cetrelia cf. nuda (Hue) W.L. Culb. & C.F. Culb.
6	Lobes fringed by branched lobules. Apothecia rare		Cetrelia cf. japonica (Zahlbr.) W.L. Culb. & C.F. Culb.
7	Without soredia or isidia, often with apothecia		8
7	With soredia or isidia, often without apothecia		44
8	Lobes linear, with parallel margins, attached only at base		9
8	Lobes rounded to linear, but attached from lower surface		11


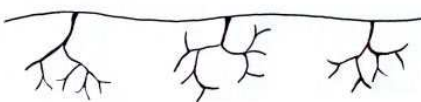




9	Medulla K-. Lobes flattened		Everniastrum scabridum Elix & Pooprang
9	Medulla K+ yellow turning red. Lobes distinctly channelled		10
10	Rhizines only marginal		Everniastrum cirrhatum (Fr.) Hale ex Sipman
10	Rhizines marginal and laminal, abundant		Everniastrum nepalense (Taylor) Hale ex Sipman
11	Medulla bright yellow to ochraceous yellow at least in lower part		12
11	Medulla white throughout		17
12	Thallus dimorphic with numerous lobules developing from the lobes		Myelochroa xantholepis (Mont. & Bosch) Elix & Hale
12	Thallus without such lobules		13


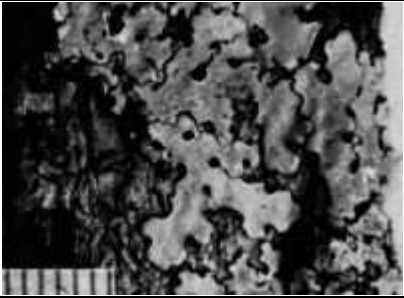





13	Medulla P-, without galbinic acid		14
13	Medulla P+ orange, with galbinic acid		16
14	Medulla KC+ red (alectoronic and α -collatolic). Lobes 8-20 mm wide		Parmotrema corniculans (Nyl.) Hale
14	Medulla KC- (zeorin). Lobes 2-5 mm wide		15
15	Medulla yellow, exposed through flaking cortex. Older parts strongly wrinkled and ridged		Myelochroa entotheiochroa (Hue) Elix & Hale
15	Medulla pale yellow to white. Older parts becoming foveolate		Myelochroa irrugans (Nyl.) Elix & Hale



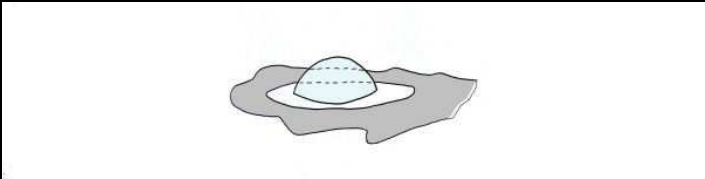

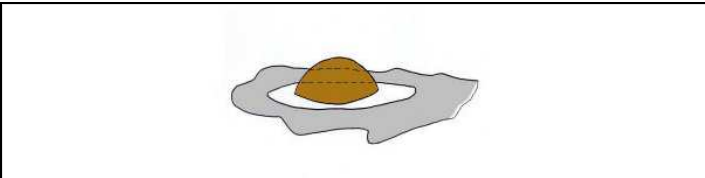

16	Medulla K-, KC-		Myelochroa siamea Kurok.
16	Medulla K+, KC+ orange		Myelochroa subaurulenta (Nyl.) Elix & Hale
17	Lobes with marginal black cilia which are swollen at the base		18
17	Lobes without cilia, or with simple, eyelash-like cilia (not swollen at the base)		21
18	Medulla K-. Rhizines branched		Bulbothrix bulbochaeta (Hale) Hale
18	Medulla K+ yellow turning red (salazinic). Rhizines simple		19



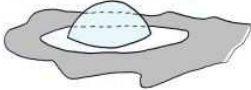
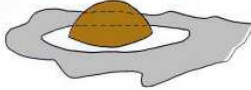
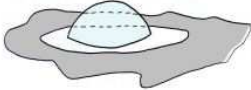

19	Lower surface dark brown to black		<p>Bulbothrix meizospora (Nyl.) Hale</p>
19	Lower surface pale brown		20
20	Upper surface not maculate		<p>Bulbothrix setschwanensis (Zahlbr.) Hale</p>
20	Upper surface maculate		<p>Bulbothrix hypocraea (Vain.) Hale</p>
21	Lower surface rhizinate to margins		22
21	Lower surface with a broad marginal zone without rhizines		31
22	Medulla K- (or K+ dirty brown)		23





22	Medulla K+ yellow turning red		26
23	Rhizines simple to squarrosely branched. Medulla KC-		Myelochroa irrugans (Nyl.) Elix & Hale
23	Rhizines dichotomously branched. Medulla KC+ orange		24
24	Medulla P+ orange-red, KC- (protocetraric)		Hypotrachyna adducta (Nyl.) Hale
24	Medulla P-, KC+ orange (barbatic)		25
25	Lobes 2-6 mm wide		Hypotrachyna physcioides (Nyl.) Hale
25	Lobes 1-2 mm wide		Hypotrachyna chlorobarbatica Elix & Pooprang








26	Rhizines simple or weakly and irregularly branched		27
26	Rhizines richly and dichotomously branched		29
27	Lobes 5-8 mm wide, with cilia along the margins		Parmotrema subcaperatum (Kremp.) Hale
27	Lobes 1-5 mm wide, with sparse cilia confined to the axils		28
28	Rhizines all simple. Spores 5-7 x 4 micron		Parmelinella simplicior (Hale) Elix & Hale
28	Some rhizines forked. Spores 9-17 x 5-12 micron		Parmelinella chozoubae (Singh & Sinha) Elix & Pooprang
29	Upper surface pustulate		Hypotrachyna kingii (Hale) Hale
29	Upper surface not pustulate		30




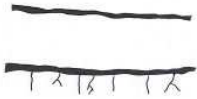


30	Medulla KC+ red. Without norstictic acid		<p>Hypotrachyna corneola Kurok. & K.H.Moon</p>
30	Medulla KC-. With norstictic acid		<p>Hypotrachyna masonhalei Patw. & Prabhu</p>
31	Medulla K+ yellow turning red (salazinic)		32
31	Medulla K- or K+ dirty brown		33
32	Thallus not strongly maculate and cracked		<p>Parmotrema latissimum (Fée) Hale</p>
32	Thallus strongly maculate and cracked		<p>Parmotrema cetratum (Ach.) Hale</p>
33	Lobes without cilia along the margins		34




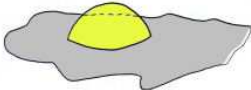

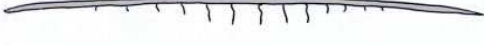
33	Lobes with ciliate margins (sometimes sparse)		37
34	Medulla C+ red (lecanoric). Upper surface maculate		Parmotrema andinum (Müll.Arg.) Hale
34	Medulla C-. Upper surface not maculate		35
35	Medulla K-		Parmotrema pancheri (Hue) Hale
35	Medulla K+ brownish (protocetraric)		36
36	Medulla UV-		Parmotrema platyphyllum (Vain.) Elix


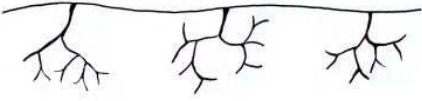


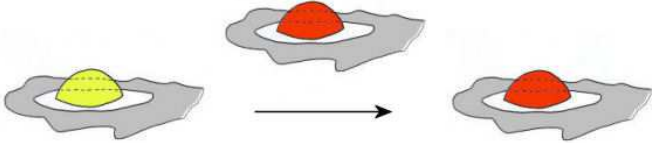
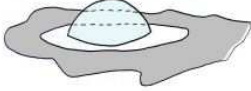

36	Medulla UV+ blue-white (alectoronic)		Parmotrema thailandicum Elix & Pooprang
37	Medulla C+ red (gyrophoric)		Parmotrema eunetum (Stirt.) Hale
37	Medulla C-		38
38	Medulla K+ dirty brown, P+ brick red (protocetraric)		39
38	Medulla K-, P-		40
39	Thallus with dentate to laciniate margins. Spores 24-26 μ m long (rarely larger). Conidia not seen		Parmotrema merrillii (Vain.) Hale








39	Thallus with rounded lobes or lobules. Spores 18-22 μm long. Conidia sublageniform		Parmotrema overeemii (Zahlbr.) Elix
40	Medulla UV- (norlobaridone)		Parmotrema abessinicum (Kremp.) Hale
40	Medulla UV+ blue-white (alectoronic, α -collatolic)		41
41	Upper surface strongly white-maculate. Thallus often blackened		Parmotrema nilgherrense (Nyl.) Hale
41	Upper surface emaculate or only faintly maculate. Thallus rarely blackened		42
42	Thallus membranaceous to coriaceous. Spores 29-35 μm long. Conidia filiform		Parmotrema corniculans (Nyl.) Hale
42	Thallus coriaceous. Spores 12-26 μm long. Conidia sublageniform		43



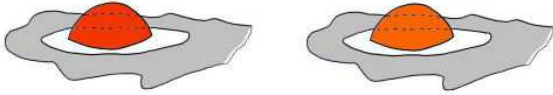
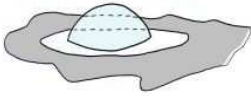



43	Apothecia perforate		Parmotrema maclayanum (Müll.Arg.) Hale
43	Apothecia imperforate		Parmotrema procerum (J. Steiner & Zahlbr.) Hale
44	Thallus with soredia (sometimes mixed with isidioid outgrowths)		45
44	Thallus with isidia		75
45	Lobes inflated, hollow inside. Rhizines absent		46
45	Lobes thin, not hollow inside. Rhizines present		48
46	Soralia ring-shaped. Medulla KC-		Menegazzia terebrata (Hoffm.) A.Massal.
46	Soralia not ring-shaped. Medulla KC+ red		47





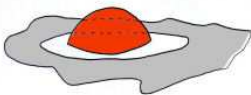
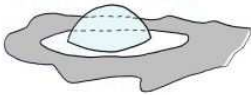
47	Soralia laminal		Hypogymnia pseudobitteriana (D.D. Awasthi) D.D. Awasthi
47	Soralia lip-shaped		Hypogymnia vittata (Ach.) Parrique
48	Medulla yellow to ochraceous yellow at least in the upper or lower part		49
48	Medulla white throughout		52
49	Lobes 0.5-2 mm wide		Myelochroa aurulenta (Tuck.) Elix & Hale
49	Lobes >3 mm wide		50
50	Thallus yellowish grey (usnic). Medulla K+ dirty brown, KC-, P+ orange-red (protocetraric)		Parmotrema dilatatum (Vain.) Hale
50	Thallus grey. Medulla K-, KC+ pink or red, P-		51


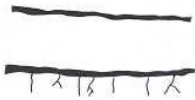




51	Lobes with sparse cilia which are 2-4 mm long. Medulla C+ red (gyrophoric)		Parmotrema permutatum (Stirton) Hale
51	Lobes with dense cilia which are 3-6 mm long. Medulla C- (alectoronic, α -collatolic)		Parmotrema rampoddense (Nyl.) Hale
52	Thallus K+ faint yellow, yellowish green, with 0.5-1 mm wide lobes and laminal maculiform soralia		Parmeliopsis ambigua (Wulfen) Nyl.
52	Thallus K+ bright yellow, not as above		53
53	Lower surface rhizinate to margins		54
53	Lower surface with a broad marginal zone without rhizines		60





54	Rhizines simple		<p>Parmotrema subsumptum (Nyl.) Hale</p>
54	Rhizines dichotomously branched		55
55	Soralia laminal. Upper surface UV+ golden yellow		<p>Hypotrachyna ossealba (Vain.) Y.S. Park & Hale</p>
55	Soralia capitate on lobe ends. Upper surface UV-		56
56	Medulla K+ red or K+ yellow turning red		57
56	Medulla K-		58
57	Thallus dull, often pruinose. Medulla with salazinic acid		<p>Hypotrachyna brevirhiza (Kurok.) Hale</p>


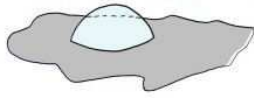
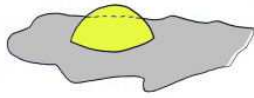



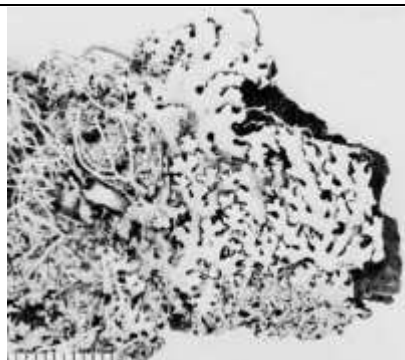
57	Thallus glossy. Medulla with norstictic acid		Hypotrachyna granulans K.H. Moon & Kurok.
58	Medulla C-, KC+ rose. Soredia not arising from pustules		Hypotrachyna immaculata (Kurok.) Hale
58	Medulla C+ orange, KC+ deep orange (barbatic). Soredia arising from pustules		59
59	Pustules eroding to expose black lower cortex. Echinocarpic acid present		Hypotrachyna adjuncta (Hale) Hale
59	Pustules erumpent, not eroding to expose black lower cortex. Echinocarpic acid absent		Hypotrachyna exsecta (Taylor) Hale
60	Medulla K+ yellow turning red (salazinic)		61
60	Medulla K- or K+ yellow		62



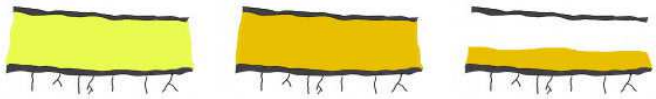



61	Upper surface maculate and cracked		Parmotrema reticulatum (Taylor) M. Choisy
61	Upper surface not maculate and cracked		Parmotrema cristiferum (Taylor) Hale
62	Medulla P+ orange to red		63
62	Medulla P-		66
63	Medulla K+ bright yellow (stictic)		Parmotrema perlatum (Huds.) M. Choisy
63	Medulla K- (or K+ dirty yellow-brown), (protocetraric)		64
64	Cilia conspicuous, more or less dense, > 2 mm long		Parmotrema subarnoldii (Abbayes) Hale
64	Cilia sparse,		65






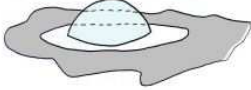


	sometimes restricted to lobe axils and damaged margins only, to 1.5 mm long		
65	Upper surface yellowish (usnic). Medulla with a yellowish pigment below upper cortex		Parmotrema dilatatum (Vain.) Hale
65	Upper surface grey-green. Medulla white throughout		Parmotrema gardneri (C.W. Dodge) Sérus.
66	Soralia laminal, initially somewhat pustulate		Canoparmelia texana (Tuck.) Elix & Hale
66	Soralia marginal, not pustulate		67
67	Medulla C+ red		68
67	Medulla C-		70



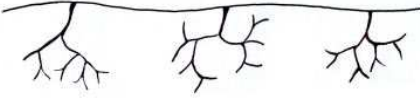
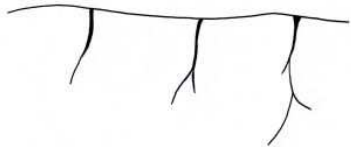
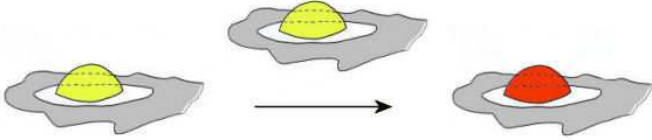
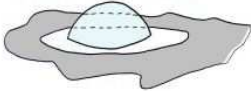


68	Medulla white in upper part and yellowish below		Parmotrema permutatum (Stirton) Hale
68	Medulla white throughout		69
69	Soredia farinose. Medulla with gyrophoric acid		Parmotrema sancti-angelii (Lynge) Hale
69	Soredia granular. Medulla with lecanoric acid		Parmotrema cooperi (J.Steiner & Zahlbr.) Sérus.
70	Medulla KC-		Parmotrema praesorediosum (Nyl.) Hale
70	Medulla KC+ (fleeting) red		71

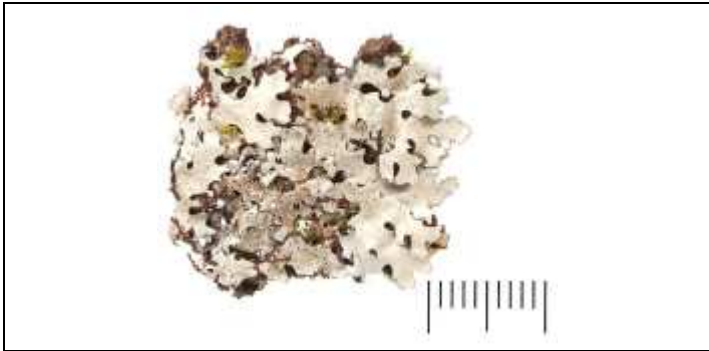




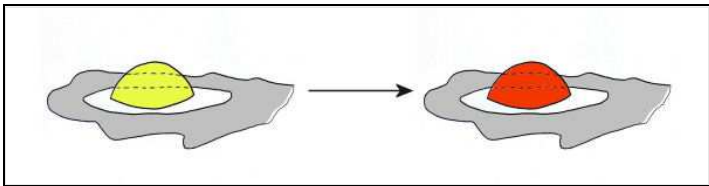
71	Thallus with isidioid marginal outgrowths which become soreciate		Parmotrema mellissii (C.W.Dodge) Hale
71	Thallus without isidioid marginal outgrowths		72
72	Lobes with sparse marginal cilia. Medulla with protolichesterinic acid, UV-		Parmotrema hababianum (Gyelnik) Hale
72	Lobes with dense marginal cilia. Medulla with alectoronic/ α -collatolic acids, UV+ blue-white		73
73	Upper surface strongly white-maculate. Medulla (fleeting) C+ red		Parmotrema lobulascens (J.Steiner) Hale
73	Upper surface emaculate or faintly maculate. Medulla C-		74
74	Cilia to 3 mm long. Medulla white throughout. Lobes 10-20 mm wide		Parmotrema poolii (C.W. Dodge) Krog & Swinscow







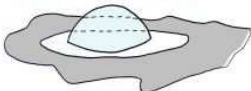
74	Cilia 3-6 mm long. Medulla pigmented in lower layers. Lobes 5-15 mm wide		Parmotrema rampoddense (Nyl.) Hale
75	Upper cortex K- (usnic acid)		76
75	Upper cortex K+ yellow (atranorin)		80
76	On rock		77
76	On bark or wood		78
77	Isidia epicorticate, eroding		Xanthoparmelia congestis (Stein) Hale
77	Isidia slender to slightly inflated, not eroded		Xanthoparmelia mougeotina (Nyl.) D.J. Galloway
78	Lobes with marginal black cilia which are swollen at the base		Relicina planiuscula (Kurok.) Hale


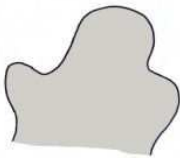


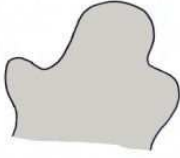
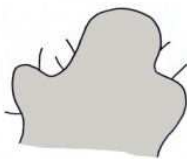

78	Lobes without cilia		79
79	Medulla KC+ yellow (barbatic)		Relicinopsis rahengensis (Vain.) Elix & Verdon
79	Medulla KC- (protocetraric)		Relicinopsis malaccensis (Nyl.) Elix & Verdon
80	Medulla yellow to orange at least in part		81
80	Medulla white		82
81	Lobes 6-11 mm wide. Rhizines simple. Medulla P- (vulpinic)		Parmotrema sulphuratum (Nees & Flot.) Hale
81	Lobes 1.5-5 mm wide. Rhizines simple to dichotomously branched. Medulla P+ orange-red (salazinic)		Hypotrachyna ramkhamhaengiana Elix & Pooprang



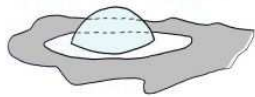
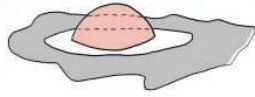


82	Lobes linear, with parallel margins, attached only at base		Everniastrum vexans (Zahlbr. ex W.Culb. & C.Culb.) Hale ex Sipman
82	Lobes rounded to linear, but attached from lower surface		83
83	Lobes with marginal black cilia which are swollen at the base		84
83	Lobes without cilia, or with simple, eyelash-like cilia (not swollen at the base)		87
84	Medulla K+ yellow turning red (salazinic). Rhizines simple or weakly and irregularly branched		85
84	Medulla K-. Rhizines dichotomously branched		86
85	Lower surface dark brown to black		Bulbothrix tabacina (Mont. & Bosch) Hale
85	Lower surface pale brown		Bulbothrix isidiza (Nyl.) Hale



86	Lower surface pale brown. Medulla C+red (gyrophoric)		Bulbothrix goebelii (Zenker) Hale
86	Lower surface black. Medulla C-		Bulbothrix cf. pigmentacea (Hale) Hale
87	Rhizines richly and dichotomously branched		88
87	Rhizines simple or weakly and irregularly branched		93
88	Medulla K+ yellow or K+ yellow turning red		89
88	Medulla K-		91
89	Medulla K+ yellow (stictic)		Hypotrachyna crenata (Kurok.) Hale
89	Medulla K+ yellow turning red		90

90	Upper surface maculate. Lobes 1-5 mm wide		Hypotrachyna ramkhamhaengiana Elix & Pooprang
90	Upper surface not maculate. Lobes 5-10 mm wide		Hypotrachyna awasthii Hale & Patwardhan
91	Upper surface maculate		Hypotrachyna imbricatula (Zahlbr.) Hale
91	Upper surface not maculate		92
92	Thallus 1-5 cm wide. Echinocarpic acid present		Hypotrachyna addita (Hale) Hale
92	Thallus 5-12 cm wide. Echinocarpic acid absent		Hypotrachyna orientalis (Hale) Hale
93	Medulla K+ yellow turning red (salazinic)		94

93	Medulla K- or K+ dirty brown		95
94	Thallus without marginal cilia. Lobes 3-5 mm wide		Canoparmelia salacinifera (Hale) Elix & Hale
94	Thallus with marginal cilia in the axils of lobes. Lobes 5-10 mm wide		Parmelinella wallichiana (Taylor) Elix & Hale
95	Lower surface with a broad marginal zone without rhizines. Lobes 4-20 mm wide		96
95	Lower surface rhizinate to margins or with a narrow marginal zone without rhizines. Lobes 0.5-4(-5) mm wide		99
96	Medulla C+ red (lecanoric)		Parmotrema tinctorum (Nyl.) Hale
96	Medulla C-		97

97	Lobes with marginal cilia. Medulla K-, UV+ blue-white (alectoronic and α -collatolic)		Parmotrema nanfongense (Kurok.) DePriest & B.Hale
97	Lobes without marginal cilia. Medulla K+ dirty brown, UV- (protocetraric)		98
98	Isidia thin, fragile		Parmotrema saccatilobum (Taylor) Hale
98	Isidia robust, not fragile		Parmotrema incrassatum Hale ex DePriest & B.W. Hale
99	Lobes without marginal cilia. Medulla UV+ white (divaricatic)		100
99	Lobes with sparse marginal cilia. Medulla UV-		102
100	On rock		Canoparmelia owariensis (Asah.) Elix
100	On bark and wood		101

101	Thallus yellowish green (usnic acid). Lobes 2-3 mm wide		Canoparmelia ecaperata (Mull.Arg.) Elix & Hale
101	Thallus grey green (atranorin). Lobes 3-6 mm wide		Canoparmelia concrescens (Vain.) Elix, Johnston & Verdon
102	Medulla KC-		103
102	Medulla KC+ rose/red (gyrophoric)		104
103	Isidia thin, cylindrical, not lobulate		Parmelinopsis expallida (Kurok.) Elix & Hale
103	Isidia becoming flattened and lobulate		Parmelinopsis microlobulata (D.D. Awasthi) Elix & Hale

104	Isidia ciliate		<p>Parmelinopsis horrescens (Taylor) Elix & Hale</p>
104	Isidia not ciliate		<p>Parmelinopsis minarum (Vain.) Hale & Elix</p>

