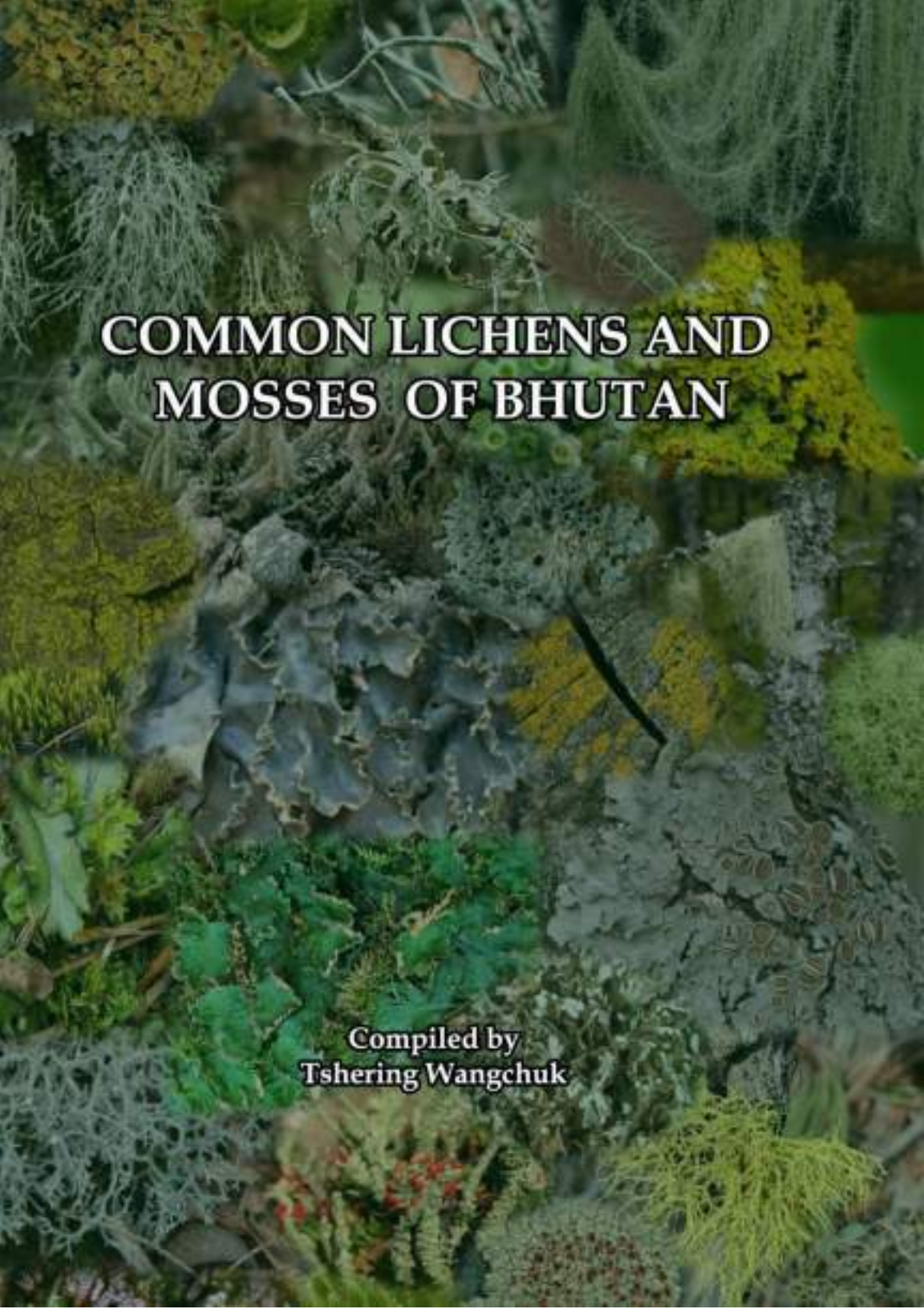

COMMON LICHENS AND
MOSSES OF BHUTAN
Compiled by
Tshering Wangchuk

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INTRODUCTION

In the intricate tapestry of our natural world, there exist tiny but incredibly resilient organisms that often go unnoticed, overshadowed by the grandeur of towering trees, colourful flowers, and charismatic fauna. Yet, their significance is far from inconsequential. In "Common Lichen and Mosses of Bhutan" we embark on a captivating journey to explore the often-overlooked realms of bryophytes and lichen, where extraordinary beauty and biodiversity flourish on a miniature scale. From the velvety textures of moss-covered stones to the symbiotic dance of fungi and algae in lichens, each image tells a story of resilience and adaptation in the microscopic realms. These seemingly modest, understated organisms hold a fascinating secret world that unfolds to those who take the time to observe, appreciate, and understand them. Lichen, those unique organisms that are in a symbiotic partnership between fungi and algae, thrive in environments as diverse as rocky cliffs, old trees, and even the frigid expanses of the alpine regions. Bryophytes, on the other hand, carpet the forest floor, create lush microhabitats in urban environments and lend an enchanting aspect to damp woodlands. Together, lichen and mosses play vital ecological roles, contributing to soil formation and nutrient cycling, and fostering the sustenance of diverse life forms within their habitats. They also serve as indispensable shelters and breeding grounds for a wide array of wildlife, thereby enhancing biodiversity and ecosystem resilience.

There is a significant scarcity of publications and references concerning the mosses and lichens flora of Bhutan. Specifically, only two notable lichenological publications and references are available. The first publication, titled 'Annotated Checklist of the lichens and lichenicolous fungi of Bhutan,' was authored by A. Aptroot and FJ Feijen and published in 2000 and the second publication, 'Mosses of Bhutan II: A checklist of the mosses of Bhutan published in 2013 by D. G. Long, focusing specifically on mosses. These publications represent a limited body of work dedicated to cataloguing and understanding the lichen and moss species present within Bhutan's diverse

ecosystem. Thus, detailed study and documentation are crucially needed to comprehensively explore and understand the diverse array of lichen and moss species inhabiting Bhutan's unique ecosystem. The existing publications, while valuable, only scratch the surface of this intricate botanical landscape. A more extensive and detailed examination is essential to fill the gaps in knowledge, identify new species, understand their ecological roles, and assess their conservation status. This comprehensive approach will not only enrich our understanding of Bhutan's biodiversity but also contribute to global scientific knowledge and aid in the formulation of effective conservation strategies for these delicate organisms.

While a few species like *Dolichousnea longissimi*, *Lobaria oregano* and *Thamnolia vermicularis* are identified and used in Bhutanese Traditional Medicine, many other species are still awaiting thorough documentation and research. The rich biodiversity of lichens and mosses in Bhutan presents a vast alternative resource for traditional medicine, yet much remains to be discovered about their medicinal properties. Further research and exploration are indispensable to fully uncover the pharmacological potential inherent in these organisms. Additionally, comprehensive studies on their ecological significance and population dynamics are also imperative to develop conservation strategies that safeguard these invaluable resources for future generations. This interdisciplinary approach will not only enhance our understanding of traditional medicine but also promote the conservation of Bhutan's rich biodiversity for both medicinal and ecological purposes.

This “Common Lichen and Mosses of Bhutan” is a celebration of these unsung heroes of the natural world and a key to unlocking the hidden treasures of the forest floor, rocky outcrops, and even the urban jungle. It's time to turn your gaze downward and embrace the wonders that thrive beneath our feet.

PREFACE

As we embark on this captivating journey into the world of "Common Lichen and Mosses of Bhutan" I am reminded of a quote by the great naturalist John Muir: "When we try to pick out anything by itself, we find it hitched to everything else in the Universe." These words beautifully encapsulate the essence of this book. It is an exploration of seemingly unassuming organisms that are, in fact, profoundly interconnected with the grand web of life.

In our fast-paced, modern world, we often overlook the intricate and intimate relationships that underlie our natural surroundings. We are drawn to the grand spectacles of nature, the soaring mountains, the charismatic megafauna, and we sometimes forget to crouch down and take a closer look at the world beneath our feet. This guide, "Common Lichen and Mosses of Bhutan", seeks to remedy that oversight by presenting a pictorial illustration of 686 species of bryophytes and lichens occurring between 100 and 5000 masl. It is an invitation to appreciate the extraordinary in the ordinary and to inspire you to pause, observe, and appreciate the subtle beauty that thrives beneath our gaze, waiting to be discovered and celebrated. It is also a testament to the beauty and importance of life at the microscale, which has thrived for millions of years, quietly performing its ecological roles in various ecosystems, contributing to biodiversity, soil health and even climate.

I hope this guide will deepen your appreciation for the intricacies of lichens and mosses, showcasing their role as silent architects of the ecosystems and highlighting the beauty that thrives in the small and often unnoticed corners of our world.

I do not doubt that it will ignite curiosity, inspire conservation efforts and foster a deeper connection with the intricate ecosystems that these organisms call home.

TABLE OF CONTENTS

Sl. No.	Topic	Page Number
1	Introduction	i-ii
2	Preface	iii
3	Colour Plates	1-84
4	Index	85-86
5	References	87

ACAROSPORACEAE



Pleopsidium chlorophanum (Wahlenb.) Zopf



Pleopsidium flavum (Bellardi) Korber.

ALLISONIACEAE



Calycularia crispula Mitt.

AMBLYSTEGIACEAE



Acrocladium auriculatum (Mont.) Mitt.

AMBLYSTEGIACEAE



Amblystegium confervoides (Brid.) Schimp.



Amblystegium serpens (Hedw.) Schimp.

AMBLYSTEGIACEAE



Amblystegium varium (Hedw.) Lindb.



Biantheridion undulifolium (Nees) Konstant. & Vilnet

CALICIACEAE



Calicium tigillare (Ach.) Pers

CANDELARIACEAE



Candelaria concolor (Dicks.) Stein

CANDELARIACEAE



Candelariella aurella (Hoffm.) Zahlbr.



Candelariella medians (Nyl.) H. Magn.

CANDELARIACEAE



Candelariella reflexa (Nyl.) Lettau ·



Candelariella vitelline (Ehrh.) Müll.Arg.

CANDELARIACEAE



Candelariella xanthostigma (Ach.) Lettau

CLADONIACEAE



Cladonia arbuscular (Wallr.) Flot.

CLADONIACEAE



Cladonia cf. *arbuscular* (Wallr.) Flot.



Cladonia arbuscula subsp. *squarrosa* (Wallr.) Flot.

CLADONIACEAE



Cladonia bellidiflora (Ach.) Schaer.



Cladonia cervicornis (Ach.) Flot.

CLADONIACEAE



Cladonia coniocraea (Flörke) Spreng



Cladonia coniocraea var. *ochrochlora* (Flörke) Spreng

CLADONIACEAE



Cladonia fimbriata (L.) Fr.



Cladonia foliacea (Huds.) Willd

CLADONIACEAE



Cladonia furcate (Huds.) Schrad



Cladonia furcata subsp. *furcata* (Huds.) Schrad

CLADONIACEAE



Cladonia gracilis (L.) Willd.



Cladonia macilenta Hoffm.

CLADONIACEAE



Cladonia phyllophora Hoffm.



Cladonia rangiferina (L.) Weber ex F.H.Wigg.

CLADONIACEAE



Cladonia squamosa (Scop.) Hoff.



Cladonia subulate (L.) Weber ex F.H.Wigg.

CLADONIACEAE



Cladonia uncialis (L.) Weber ex F.H.Wigg.



Pilophorus acicularis (Ach.) Th. Fr.

CORTICIACEAE



Marchandiomyces corallinus (Roberge) Diederich & D.Haw.

DIATRYPACEAE



Diatrype bullata (Hoffm.) Fr.

DIATRYPACEAE



Diatrype disciformis (Hoffm.) Fr.



Diatrype stigma (Hoffm.) Fr.

DIATRYPACEAE



Diatrype virescens (Schwein.) Cooke.



Diatrypella favacea (Fr.) Ces. & De Not.

DIATRYPACEAE



Diatrypella quercina (Pers.) Cooke.

DICRANACEAE



Dicranum fulvum Hooker

DICRANACEAE

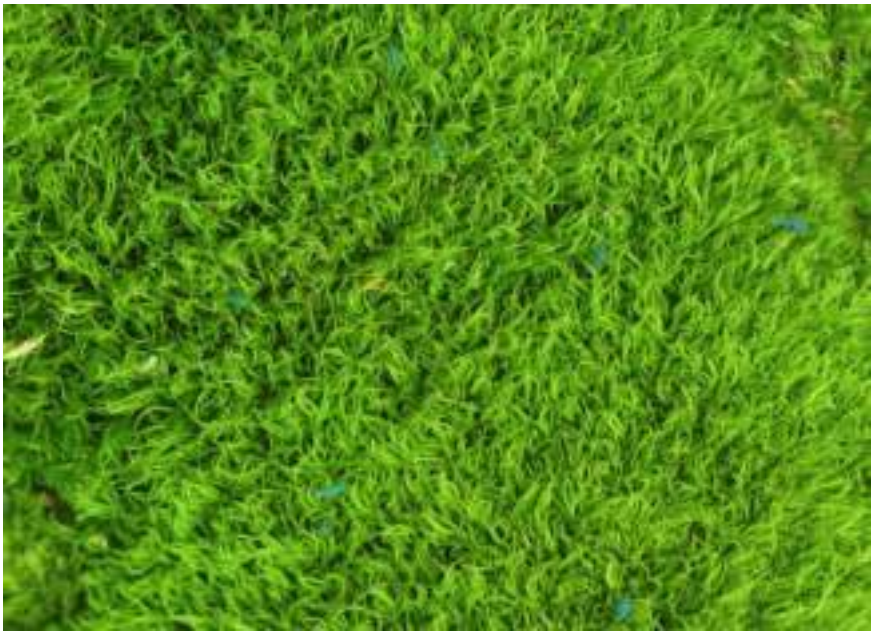


Dicranum fuscescens Turner



Dicranum majus Turner

DICRANACEAE



Dicranum montanum Hedwig



Dicranum polysetum Swartz.

DICRANACEAE



Dicranum scoparium Hedw



Dicranum viride (Sulli. & Lesq.) Lind.

FRULLANIACEAE



Frullania dilatate (L.) Dumort.



Frullania tamarisci (L.) Dumort.

FUSCIDEACEAE



Fuscidea cyathoides (Ach.) V. Wirth & Vezda



Fuscidea intercincta (Nyl.) Poelt

FUSCIDEACEAE



Fuscidea kochiana (Hepp) V. Wirth & Vězda

GRIMMIACEAE



Racomitrium lanuginosum (Hedw.) Brid.

HYPNACEAE



Hypnum cupressiforme Hedw.



Hypnum lacunosum (Brid.) Hoffm. ex Brid.

HYPNACEAE



Hypnum plumiforme Wilson

ICMADOPHILACEAE



Thamnolia vermicularis (Sw.) Schaer.

LOBARIACEAE



Lobaria oregano (Tuck.) Müll. Arg.



Lobaria pulmonaria (L.) Hoffm.

LOBARIACEAE



Lobaria scrobiculata (Scop.) P.Gaertn.

LECANORACEAE



Lecanora caesiosora Poelt

LECANORACEAE



Lecanora campestris (Schaer.) Hue



Lecanora hybocarpa (Tuck.) Brodo

LECANORACEAE



Lecanora muralis (Schreb.) Rabenh.



Lecanora rupicola (L.) Zahlbr.

LECANORACEAE



Lecanora saligna (Schrad.) Zahlbr.

LECIDEACEAE



Lecidea atrobrunnea (DC.) Schaer.

LECIDEACEAE



Lecidea tessellata Flörke



Porpidia cinereoatra (Ach.) Hertel & Knoph

LUNULARIACEAE



Lunularia cruciata L.

LYCOPODIACEAE



Huperzia appressa (Desv.) Á. Löv. & D. Lö.

LYCOPODIACEAE



Lycopodium japonicum Thunb. ex Murray



Lycopodium selago L.

MARCHANTIACEAE



Marchantia polymorpha L.



Marchantia polymorpha subsp *polymorpha* L.

MERULIACEAE

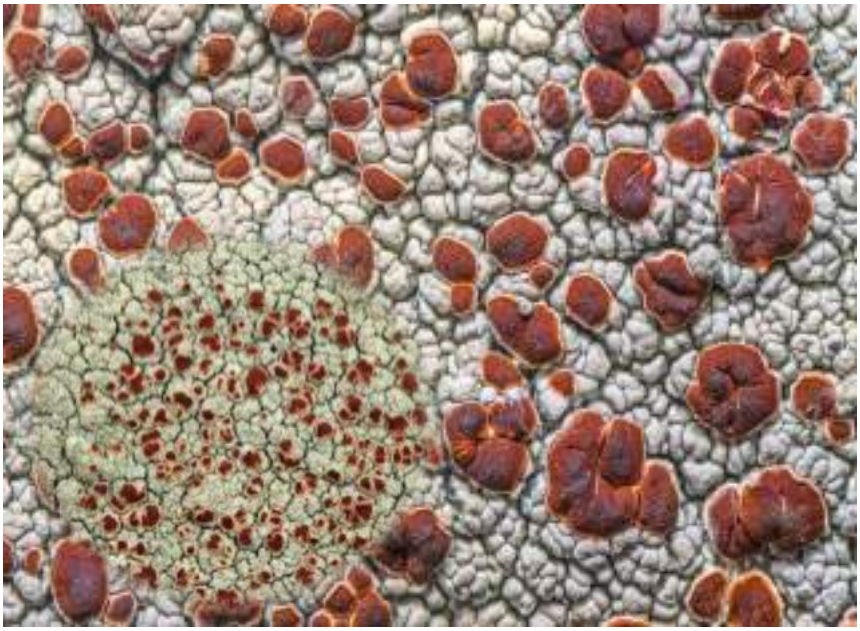


Phlebia coccineofulva Schwein.



Phlebia gigantea (Fries) Donk

OPHIOPARMACEAE



Ophioparma ventosa (L.) Norman

PARMELIACEAE



Alectoria nigricans (Ach.) Nyl.

PARMELIACEAE



Alectoria ochroleuca (Hoffm.) A. Massal.



Alectoria sarmentosa (Ach.) Ach.

PARMELIACEAE



Arctoparmelia centrifuga (L.) Hale



Arctoparmelia incurva (Pers.) Hale

PARMELIACEAE



Cetraria ericetorum Opiz.



Cetraria islandica (L.) Ach.

PARMELIACEAE



Dolichousnea longissimi (Ach.) Articus



Evernia divaricata (L.) Ach.

PARMELIACEAE



Evernia mesomorpha Nyl.



Evernia prunastri (L.) Ach.

PARMELIACEAE



Hypogymnia physodes (L.) Nyl.



Hypogymnia tubulosa (Schaer.) Hav.

PARMELIACEAE



Letharia columbiana (Nutt.) J.W.Thomson



Letharia vulpina (L.) Hue

PARMELIACEAE



Parmelia caperata (L.) Ach.



Parmelia conspersa (Ehrh. ex Ach.) Ach.

PARMELIACEAE



Parmelia conspersa var. *stenophylla* Ach.



Parmelia delisei (Duby) Nyl

PARMELIACEAE



Parmelia furfuracea (L.) Ach.



Parmelia mexicana Gyeln

PARMELIACEAE



Parmelia omphalodes (L.) Ach.



Parmelia perlata (Huds.) Ach.

PARMELIACEAE



Parmelia pulverulenta Sensu Auct.



Parmelina quercina (Willd.) Hale

PARMELIACEAE



Parmelia rudecta Ach.



Parmelia saxatilis (L.) Ach.

PARMELIACEAE



Parmelia scabrosa Taylor



Parmelia soredica Nyl.

PARMELIACEAE



Parmelia subrudecta Nyl.



Parmelia sulcate Taylor

PARMELIACEAE



Parmelia tinctina Maheu & A.Gillet

PELTIGERACEAE



Peltigera aphthosa (L.) Willd.

PELTIGERACEAE



Peltigera canina (L.) Willd.



Peltigera didactyla (L.) Willd.

PELTIGERACEAE



Peltigera elisabethae Gyel.



Peltigera horizontalis (Huds.) Baumg.

PELTIGERACEAE



Peltigera hydrothyria Miadl. & Lutzoni



Peltigera lepidophora (Vainio) Bitter.

PELTIGERACEAE



Peltigera leucophlebia (Nyl.) Gyeln.



Peltigera malacea (Ach.) Fun.

PELTIGERACEAE



Peltigera polydactyla (Neck.) Hoffm.



Peltigera polydactylon (Neck.) Hoffm.

PELTIGERACEAE



Peltigera rufescens (Weiss) Humb.



Peltigera venosa (L.) Hoffm.

PHYSCIACEAE



Physcia adscendens H.Olivier



Physcia aipolia (Ehrh. ex Humb.) Fürnr.

PHYSCIACEAE



Physcia stellaris (L.) Nyl.



Physcia tenella (Scop.) DC.

PTILIDIACEAE



Ptilidium ciliare (L.) Hampe



Ptilidium pulcherrimum (Weber) Vain

POLYTRICHACEAE



Polytrichum commune Hedw.



Polytrichum juniperinum Hedw.

POLYTRICHACEAE



Polytrichum piliferum Hedw.



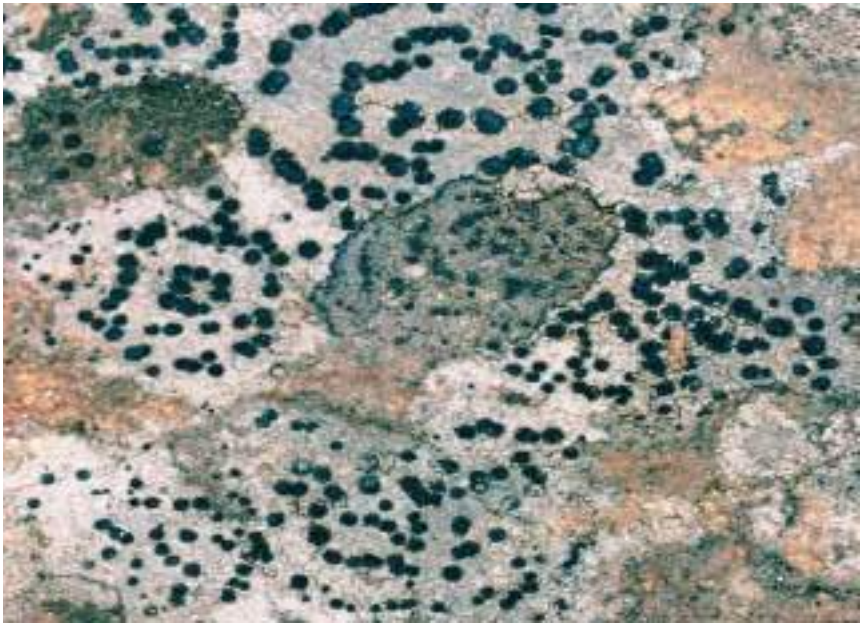
Syntrichia princeps (De Not.) Mitt.

POLYTRICHACEAE



Syntrichia ruralis (Hedw.) F. Weber & D. Mohr

PYRONEMATACEAE



Rhizocarpon concentricum (Davies) Beltram

PYRONEMATACEAE



Rhizocarpon geographicum (L.) DC.

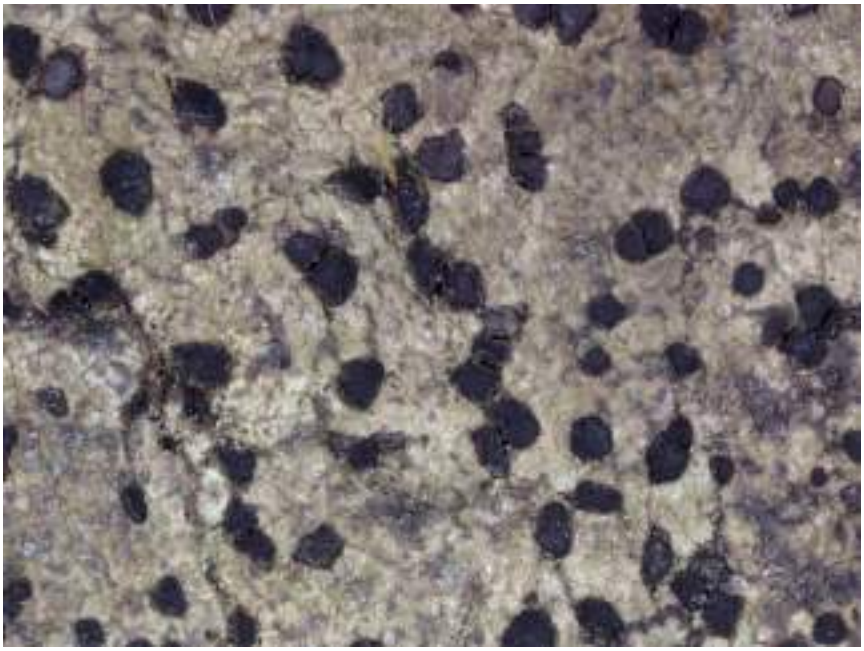


Rhizocarpon geminatum Körb. Syst.

PYRONEMATACEAE



Rhizocarpon grande (Flörke ex Flot.) Arnold.



Rhizocarpon infernulum (Nyl.) Lynge

PYRONEMATACEAE



Rhizocarpon lavatum (Ach.) Hazsl.



Rhizocarpon lecanorinum Anders.

PYRONEMATACEAE



Rhizoplaca chrysoleuca (Sm.) Zopf



Rhizoplaca melanophthalma (DC.) Leuckert

PYRONEMATACEAE



Rhizocarpon reductum Th.Fr.



Rhizoplaca subdiscrepans (Nyl.) R. Sant.

RAMALINACEAE



Ramalina calicaris (L.) Fr.



Ramalina celastri (Spreng.) Krog & Swinscow

RAMALINACEAE



Ramalina farinacea (L.) Ach.



Ramalina fastigiata (Pers.) Ach.

RAMALINACEAE



Ramalina pollinaria (Westr.) Ach.



Ramalina siliquosa (Huds.) A.L.Sm.

RAMALINACEAE



Ramalina thrausta (Ach.) Nyl.

RHIZOCARPACEAE



Rhizocarpon alpicola (Fr.) Rabenh.

SPHAEROPHORACEAE



Sphaerophorus fragilis (L.) Pers.



Sphaerophorus globosus (Huds.) Vain.

STEREOCAULACEAE



Stereocaulon paschale (L.) Hoffm.



Stereocaulon saxatile H.Magn.

STEREOCAULACEAE



Stereocaulon tomentosum Fr.



Stereocaulon vesuvianum Pers.

TELOSCHISTACEAE



Xanthoria candelaria (L.) Th. Fr.



Xanthoria elegans (Link) Th.Fr.

TELOSCHISTACEAE



Xanthoria fallax (Hepp ex Arnold) Arnold



Xanthoria parietina (L.) Th.Fr

TELOSCHISTACEAE



Xanthoria polycarpa (Hoffm.) Th. Fr. ex. Rieber.

UMBILICARIACEAE



Umbilicaria americana Poelt & T.H.Nash

UMBILICARIACEAE



Umbilicaria deusta (L.) Baumg.



Umbilicaria torrefacta (Lightf.) Schrad.

INDEX

Acrocladium auriculatum 2
Alectoria nigricans 40
ochroleuca 41
sarmentosa 41
Amblystegium confervoides 3
serpens 3
varium 4
Arctoparmelia centrifuga 42
Incurva 42
Biantheridion undulifolium 4
Calicium tigillare 5
Calycularia crispula 2
Candelaria concolor 5
Candelariella aurella 6
medians 6
reflexa 7
vitelline 7
xanthostigma 8
Cetraria ericetorum 43
islandica 43
Cladonia arbuscular 8
arbuscular subsp.
squarrosa 9
bellidiflora 10
cervicornis 10
cf. arbuscular 9
coniocraea 11
coniocraea var *ochrochlora 11*
fimbriata 12
foliacea 12
furcata subsp. *furcata 13*
furcate 13
gracilis 14
macilenta 14
phyllophora 15
rangiferina 15
squamosa 16
subulate 16
uncialis 16
Diatrype bullata 18
disciformis 19
stigma 19
virescens 20
Diatrypella favacea 20
quercina 21
Dicranum fulvum 21
fuscescens 22
majus 22
montanum 23
polysetum 23
scoparium 24
viride 24
Dolichousnea longissimi 44
Evernia divaricata 44
mesomorpha 45
prunastri 45
Frullania dilatate 25
tamarisci 25
Fuscidea cyathoides 26
intercincta 26
kochiana 27
Huperzia appressa 36
Hypnum cupressiforme 28
lacunosum 28
plumiforme 29
Hypogymnia physodes 46
tubulosa 46
Lecanora caesiosora 31
campestris 32
hybocarpa 32
muralis 33
rupicola 33
saligna 34
Lecidea atrobrunnea 34
tessellata 35
columbiana 47
vulpina 47
Lobaria oregano 30
pulmonaria 30
scrobiculata 31
Lunularia cruciata 36
Lycopodium japonicum 37
selago 37
Marchandiomyces corallinus 18
Marchantia polymorpha 38

polymorpha subsp
polymorpha 38
Ophioparma ventosa 40
Parmelia caperata 48
conspersa 48
conspersa var. *stenophylla 49*
delisei 49
furfuracea 50
mexicana 50
omphalodes 51
perlata 51
pulverulenta 52
rudecta 53
saxatilis 53
scabrosa 54
soredica 54
subrudecta 55
sulcate 55
tinctina 56
Parmelina quercina 52
Peltigera aphthosa 56
canina 57
didactyla 57
elisabethae 58
horizontalis 58
hydrothyria 59
lepidophora 59
leucophlebia 60
malacea 60
polydactyla 61
polydactylon 61
rufescens 62
venosa 62
Phlebia coccineofulva 39
gigantea 39
Physcia adscendens 63
aipolia 63
stellaris 64
tenella 64
Pilophorus acicularis 17
Pleopsidium chlorophanum 1
flavum 1
Polytrichum commune 66
juniperinum 67
piliferum 68
Porpidia cinereoatra 35
Ptilidium ciliare 65
pulcherrimum 65
Racomitrium lanuginosum 27
Ramalina calicaris 74
celastri 74
farinacea 75
fastigiata 75
pollinaria 76
siliquosa 76
thrausta 77
Rhizocarpon alpicola 77
concentricum 68
geminatum 69
geographicum 69
grande 70
infernulum 70
lavatum 71
lecanorinum 71
reductum 73
Rhizoplaca chrysoleuca 72
melanophthalma 72
subdiscrepans 73
Sphaerophorus fragilis 78
globosus 78
Stereocaulon paschale 79
saxatile 79
tomentosum 80
vesuvianum 80
Syntrichia princeps 67
ruralis 68
Thamnolia vermicularis 29
Umbilicaria americana 83
deusta 84
torrefacta 84
Xanthoria candelaria 81
Xanthoria elegans 81
fallax 82
parietina 82
polycarpa 83

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