

Contents

Preface — v

Contributing authors — xiii

1 Functionality

Asunción de los Ríos and Virginia Souza-Egipsy

1.1 The interface of rocks and microorganisms — 3

1.1.1 The lithobiontic niche — 3

1.1.2 Research strategies for the study of the rock-microorganism interface — 6

1.1.3 Composition and spatial organization of lithobiontic communities — 13

1.1.4 Microbial-mineral interactions — 18

1.1.5 Concluding remarks — 24

Acknowledgments — 25

References — 25

Pedro H. Lebre, Don A. Cowan, and Thulani P. Makhalanyane

1.2 The hypolithic habitat: microbial communities under translucent rocks — 39

1.2.1 Climate change, desertification, and refuge niches — 39

1.2.2 Hypoliths and their quartz substrate — 40

1.2.3 Phylogenetic diversity under rocks — 42

1.2.4 Drivers of hypolith development — 43

1.2.5 Functional activity in environmentally challenging habitats — 44

1.2.6 Viruses as drivers of diversity in hypoliths — 46

1.2.7 Concluding remarks — 47

Acknowledgments — 48

References — 48

2 Organisms

Claudia Coleine and Laura Selbmann

2.1 Black fungi inhabiting rock surfaces — 57

2.1.1 Introduction — 57

2.1.2 Rocks as substratum for fungi — 58

2.1.3 Black meristematic RIF — 59

2.1.4 Natural rocks as main substrate for black fungi — 63

- 2.1.5 Monuments and role of black fungi in deterioration — 69
- 2.1.6 Potentialities — 72
- 2.1.7 Conclusions and future research directions — 77
- Acknowledgments — 77
- References — 77

Jan Kaštovský, Tomáš Hauer and Jiří Komárek

- 2.2 Cyanobacteria on rock surfaces — 87**
- 2.2.1 Short introduction — 87
- 2.2.2 Key to genera — 90
- 2.2.3 Coccal taxa — 99
- 2.2.4 Simple trichal taxa — 110
- 2.2.5 Heterocytous taxa — 120
- References — 135

Patrick Jung and Burkhard Büdel

- 2.3 Lichens as pioneers on rock surfaces — 141**
- 2.3.1 Lichens: a self-sustaining ecosystem — 141
- 2.3.2 Ecology and diversity of rock lichens — 142
- 2.3.3 Colonizing the rock surface — 149
- 2.3.4 Colonizing the lithomatrix — 152
- 2.3.5 Bioweathering — 154
- References — 156

Christoph Scheidegger

- 2.4 High alpine lichens — 161**
- 2.4.1 Introduction — 161
- 2.4.2 Upper altitudinal limits of lichens — 163
- 2.4.3 High alpine lichen ecology and physiology — 165
- 2.4.4 High alpine refugia during last glacial maximum — 169
- Acknowledgments — 171
- References — 172

Martin Grube and Lucia Muggia

- 2.5 Complex lichen communities inhabiting rock surfaces — 175**
- 2.5.1 Introduction — 175
- 2.5.2 Factors influencing the composition of lichens on rock surfaces — 177
- 2.5.3 Interactions of lichens on rocks — 178
- 2.5.4 Other fungi — 182
- 2.5.5 Rock lichens as algal metacommunities — 183
- 2.5.6 Bacterial communities of lichens — 184
- 2.5.7 Conclusions — 185
- References — 185

Tatyana Darienko and Thomas Friedl

- 2.6 Eukaryotic algal communities of rock surfaces — 189**
 - 2.6.1 Introduction — 189
 - 2.6.2 The lithophytic habitats and ecological factors — 190
 - 2.6.3 Taxonomic composition of algal communities growing on rock habitats — 193
 - 2.6.4 Rock substrates and their algal communities — 198
 - 2.6.5 Formally described algal communities — 206
 - References — 207

Stefan Porembski

- 2.7 Desiccation-tolerant vascular plants: systematic distribution, ecology, and biogeography — 213**
 - 2.7.1 Introduction — 213
 - 2.7.2 Systematic overview — 214
 - 2.7.3 Ecological aspects — 222
 - 2.7.4 Habitats — 223
 - 2.7.5 Geographic distribution — 225
 - 2.7.6 Economic use — 227
 - 2.7.7 Conservation — 227
 - 2.7.8 Research perspectives — 228
 - Acknowledgments — 228
 - References — 228

Index — 233