

### 附录3 典型生态系统苔藓-蓝藻共生体多样性

#### Appendix 3 Diversity of bryophyte-cyanobacteria associations in typical ecosystems

| 国家/地区 Country/District                  | 纬度 Latitude                                | 苔藓种类 Bryophyte species                  | 参考文献 Reference                           |                     |
|---|--|---|--|---------------------|
| <b>北方森林生态系统 Boreal forest ecosystem</b> |  |   |  |                     |
| 美国 America                              | 61°–67° N                                  | 皱蒴藓 <i>Aulacomnium palustre</i> [2]     | Holland-Moritz et al, 2021               |                     |
|   |  | 大皱蒴藓 <i>Aulacomnium turgidum</i> [2]    |  |                     |
|   |  | 波叶曲尾藓 <i>Dicranum polysetum</i> [2]     |  |                     |
|   |  | <i>Dicranum acutifolium</i> [2]         |  |                     |
|   |  | 长叶曲尾藓 <i>Dicranum elongatum</i> [2]     |  |                     |
|   |  | 折叶直毛藓 <i>Dicranum fragilifolium</i> [2] |  |                     |
|   |  | 棕色曲尾藓 <i>Dicranum fuscescens</i> [2]    |  |                     |
|   |  | 曲尾藓 <i>Dicranum scoparium</i> [2]       |  |                     |
|   |  | 皱叶曲尾藓 <i>Dicranum undulatum</i> [2]     |  |                     |
|   |  | 塔藓 <i>Hylocomium splendens</i> [2]      |  |                     |
|   |  | <i>Hypnum lindbergii</i> [2]            |  |                     |
|   |  | 长齿藓 <i>Niphotrichum canescens</i> [2]   |  |                     |
|   |  | 白毛砂藓 <i>Racomitrium lanuginosum</i> [2] |  |                     |
|   |  | 垂枝藓 <i>Rhytidium rugosum</i> [2]        |  |                     |
|   |  | <i>Sphagnum angustifolium</i> [2]       |  |                     |
|   | <i>Sphagnum fimbriatum</i> [2]             |   |  |                     |
|   | 锈色泥炭藓 <i>Sphagnum fuscum</i> [2]           |   |  |                     |
|   | 白齿泥炭藓 <i>Sphagnum girgensohnii</i> [2]     |   |  |                     |
|   | 中位泥炭藓 <i>Sphagnum magellanicum</i> [2]     |   |  |                     |
|   | 广舌泥炭藓 <i>Sphagnum russowii</i> [2]         |   |  |                     |
|   | 粗叶泥炭藓 <i>Sphagnum squarrosum</i> [2]       |   |  |                     |
|   | 赤茎藓 <i>Pleurozium schreberi</i> [2]        |   |  |                     |
|   | 金发藓 <i>Polytrichum commune</i> [2]         |   |  |                     |
|   | 直叶金发藓 <i>Polytrichum strictum</i> [2]      |   |  |                     |
|   | 毛梳藓 <i>Ptilium crista - castrensis</i> [2] |   |  |                     |
|   | 毛青藓 <i>Tomentypnum nitens</i> [2]          |   |  |                     |
|   | 毛叶苔 <i>Ptilidium ciliare</i> [2]           |   |  |                     |
| 67° N                                   | 皱蒴藓 <i>Aulacomnium palustre</i> [2]        | Holland-Moritz et al, 2018              |  |                     |
|   | 大皱蒴藓 <i>Aulacomnium turgidum</i> [2]       |   |  |                     |
|   | 长叶曲尾藓 <i>Dicranum elongatum</i> [2]        |   |  |                     |
|   | 赤茎藓 <i>Pleurozium schreberi</i> [2]        |   |  |                     |
|   | 三洋藓 <i>Sanionia uncinata</i> [2]           |   |  |                     |
| 60°–64° N                               | 尖叶泥炭藓 <i>Sphagnum capillifolium</i> [2]    | Stuart et al, 2021                      |  |                     |
|   | 毛青藓 <i>Tomentypnum nitens</i> [2]          |   |  |                     |
|   | 曲尾藓属一种 <i>Dicranum</i> sp. [2]             |   |  |                     |
| 47° N                                   | 金发藓属一种 <i>Polytrichum</i> sp. [2]          | Carrell et al, 2019                     |  |                     |
|   | 毛青藓属一种 <i>Tomentypnum</i> sp. [2]          |   |  |                     |
| 瑞典 Sweden                               | 假泥炭藓 <i>Sphagnum fallax</i> [2,3,6,22,24]  | Zackrisson et al, 2009                  |  |                     |
|   | 塔藓 <i>Hylocomium splendens</i> [2]         |   |  |                     |
|   | 赤茎藓 <i>Pleurozium schreberi</i> [2,6]      |   |  |                     |
|   | 65°–66° N                                  |   | 赤茎藓 <i>Pleurozium schreberi</i> [2,6,19] | Bay, 2013           |
|   | 65° N                                      |   | 塔藓 <i>Hylocomium splendens</i> [2,6,19]  | Bay et al, 2013     |
|   |  |   | 波叶曲尾藓 <i>Dicranum polysetum</i> [2]      |                     |
|   | 65° N                                      |   | 塔藓 <i>Hylocomium splendens</i> [2]       | Gentili et al, 2005 |
|   |  |   | 赤茎藓 <i>Pleurozium schreberi</i> [2]      |                     |
|   |  |   | 金发藓 <i>Polytrichum commune</i> [2]       |                     |
|   | 60°–64° N                                  |   | 赤茎藓 <i>Pleurozium schreberi</i> [2,3,6]  | Liu & Rousk, 2022   |
| 曲尾藓属一种 <i>Dicranum</i> sp. [2]          |  |   |  |                     |
| 毛青藓属一种 <i>Tomentypnum</i> sp. [2]       |  |   |  |                     |
| 64°–68° N                               | 金发藓属一种 <i>Polytrichum</i> sp. [2]          | Liu & Rousk, 2022                       |  |                     |
|   | 大皱蒴藓 <i>Aulacomnium turgidum</i>           |   |  |                     |
|   | 塔藓 <i>Hylocomium splendens</i>             |   |  |                     |
|   | 毛青藓 <i>Tomentypnum nitens</i>              |   |  |                     |
| 加拿大 Canada                              | 赤茎藓 <i>Pleurozium schreberi</i>            | Houle et al, 2006                       |  |                     |
|   | 49°–50° N                                  |   | 塔藓 <i>Hylocomium splendens</i> [2,6]     |                     |
|   | 赤茎藓 <i>Pleurozium schreberi</i> [2,6]      |   |  |                     |
| 47°–55° N                               | 毛梳藓 <i>Ptilium crista-castrensis</i> [2,6] | Renaudin et al, 2022                    |  |                     |
|   | 赤茎藓 <i>Pleurozium schreberi</i> [2]        |   |  |                     |
|   | 毛梳藓 <i>Ptilium crista-castrensis</i> [2]   |   |  |                     |
| 48° N                                   | <i>Anomodon attenuatus</i> [2,3,4]         | Jean et al, 2012                        |  |                     |

| 国家/地区 Country/District                        | 纬度 Latitude | 苔藓种类 Bryophyte species   | 参考文献 Reference             |
|---|-------------|--|----------------------------|
| 芬兰 Finland                                    | 59°–70° N   | 曲尾藓属一种 <i>Dicranum</i> sp.<br>塔藓 <i>Hylocomium splendens</i><br>赤茎藓 <i>Pleurozium schreberi</i>  | Salemaa et al, 2019        |
| 瑞典、挪威、芬兰 Sweden, Norse, Finland               | 62°–70° N   | 赤茎藓 <i>Pleurozium schreberi</i> [2]  | DeLuca et al, 2002         |
| <b>苔原生态系统 Tundra ecosystem</b>                |             |  |                            |
| 叙尔特塞 Surtset                                  | 64° N       | 真藓属一种 <i>Bryum</i> sp. [5,13,17,23]<br>角齿藓 <i>Ceratodon purpureus</i> [5,17,23]<br><i>Racomitrium canescens</i> [5,13,17,23]   | Henriksson et al, 1987     |
| 冰岛 Iceland                                    | 65° N       | 白毛砂藓 <i>Racomitrium lanuginosum</i> [2,6]  | Klarenberg et al, 2019     |
| 智利 Chile                                      | 54° S       | <i>Anastrophyllum involutifolium</i> [2]<br><i>Andreaea alpina</i> [2]<br><i>Andreaea laxifolia</i> [2]<br><i>Andreaea wilsonii</i> [2]<br><i>Blepharidophyllum densifolium</i> [2,12]<br><i>Chiloscyphus leptanthus</i> [2]<br><i>Clasmatocolea humilis</i> [2,6]<br><i>Cryptochila grandiflora</i> [5]<br><i>Dendroligotrichum squamosum</i> [2]<br><i>Dicranoloma chilense</i> [2]<br><i>Ditrichum cylindricarpum</i> [5,10]<br><i>Racomitrium didymum</i> [2,6]<br><i>Racomitrium laevigatum</i> [2]<br>白毛砂藓 <i>Racomitrium lanuginosum</i> [6]<br><i>Racomitrium subcrispilum</i> [5,6] | Arróniz-Crespo et al, 2014 |
| <b>湿地生态系统 Wetland ecosystem</b>               |             |  |                            |
| 美国 America                                    | 61°–67° N   | <i>Sphagnum angustifolium</i> [2]<br><i>Sphagnum fimbriatum</i> [2]<br>锈色泥炭藓 <i>Sphagnum fuscum</i> [2]<br>白齿泥炭藓 <i>Sphagnum girgensohnii</i> [2]<br>中位泥炭藓 <i>Sphagnum magellanicum</i> [2]<br>广舌泥炭藓 <i>Sphagnum russowii</i> [2]<br>粗叶泥炭藓 <i>Sphagnum squarrosum</i> [2]  | Holland-Moritz et al, 2021 |
|   | 67° N       | 尖叶泥炭藓 <i>Sphagnum capillifolium</i> [2]  | Holland-Moritz et al, 2018 |
|   | 47° N       | 假泥炭藓 <i>Sphagnum fallax</i> [2,3,6,22,24]  | Carrell et al, 2019        |
| 瑞典 Sweden                                     | 61° N       | 皱蒴藓 <i>Aulacomnium palustre</i><br>大叶镰刀藓 <i>Drepanocladus cossonii</i><br>塔藓 <i>Hylocomium splendens</i><br><i>Lophozia lycopodioides</i><br>沼寒藓 <i>Paludella squarrosa</i><br>赤茎藓 <i>Pleurozium schreberi</i><br>金发藓 <i>Polytrichum commune</i><br>直叶金发藓 <i>Polytrichum strictum</i><br><i>Sphagnum lindbergii</i><br>岸生泥炭藓 <i>Sphagnum riparium</i><br>毛青藓 <i>Tomentypnum nitens</i><br>毛叶苔 <i>Prilidium ciliare</i>   | Gavazov et al, 2010        |
|   | 68° N       | 岸生泥炭藓 <i>Sphagnum riparium</i> [2]   | Berg et al, 2013           |
| 马里恩岛 Marion Island                            | 46° S       | <i>Brachythecium subplicatuin</i> [2]  | Smith, 1984                |
| 欧洲东北部 Northeastern Europe                     | 61° N       | 泥炭藓属一种 <i>Sphagnum</i> sp. [12,15,17,25]   | Patova et al, 2020         |
|   | 68° N       | 毛叶镰刀藓 <i>Drepanocladus trichophyllus</i> [1,2,6,9,22,23]<br><i>Sphagnum balticum</i> [2]<br>锈色泥炭藓 <i>Sphagnum fuscum</i> [2]<br>垂枝泥炭藓 <i>Sphagnum jensenii</i> [1,8,22]<br><i>Sphagnum lindbergii</i> [2,22]<br>泥炭藓 <i>Sphagnum palustre</i> [2]<br>岸生泥炭藓 <i>Sphagnum riparium</i> [2,3,6,8,9,22,23]   | Granhall & Selander, 1973  |
| 南极洲 Antarctica                                | 68° S       | <i>Bryum antarcticum</i> [2]<br><i>Bryum algens</i> [2]<br><i>Grimmia antarctici</i> [2]<br><i>Sarconeurum glaciate</i> [2]  | Davey & Marchant, 1983     |
| 英格兰 England                                   | 53° N       | 壶苞苔 <i>Blasia pusilla</i> [2,3,4]<br>黄角苔 <i>Phaeoceros laevis</i> [2,3,4]  | West & Adams, 1997         |
| <b>温带草原生态系统 Temperate grassland ecosystem</b> |             |  |                            |
| 美国 America                                    | 46° N       | <i>Racomitrium elongatum</i> [2,6]   | Calabria et al, 2020       |

| 国家/地区 Country/District                                       | 纬度 Latitude         | 苔藓种类 Bryophyte species                        | 参考文献 Reference           |
|--|---------------------|---|--------------------------|
| 加拿大 Canada   | 31° N               | 大拟垂枝藓 <i>Rhytidiadelphus triquetrus</i> [2,6] | Reddy & Giddens, 1981    |
|  |                     | 赤茎藓 <i>Pleurozium schreberi</i> [2,6]         |                          |
|  | 49° N               | 真藓属一种 <i>Bryum</i> sp. [1,2,20,21]            |                          |
|  |                     | 小石藓 <i>Weisia controrwsa</i> [1,2,20,21]      |                          |
| 角齿藓 <i>Ceratodon purpurens</i> [2]                           | Vlassak et al, 1973 |   |                          |
| <b>温带森林生态系统 Temperate forest ecosystem</b>                   |                     |   |                          |
| 新西兰 New Zealand  | 42° N               | 鳞叶凤尾藓 <i>Fissidens taxifolius</i> [2]         | Deane-Coe & Sparks, 2016 |
|  | 43° N               | 地钱 <i>Marchantia polymorpha</i> [2]           | Menge & Hedin, 2009      |
|  |                     | 细枝羽藓 <i>Thuidium delicatulum</i> [2]          |                          |
| 加拿大 Canada   | 36° N               | 树灰藓属一种 <i>Hypnodendron</i> sp.                | Jean et al, 2012         |
|  |                     | <i>Ptychomnium aciculare</i>                  |                          |
| 加拿大 Canada   | 36° N               | 歧舌苔属一种 <i>Schistochila</i> sp.                | Lindo & Whiteley, 2011   |
|  |                     | <i>Anomodon attenuatus</i> [2,3]              |                          |
|  | 49° N               | 逆毛藓 <i>Antitrichia curtipendula</i> [22]      |                          |
|  |                     | 棕色曲尾藓 <i>Dicranum fuscescens</i> [22]         |                          |
|  |                     | <i>Hylocomium splendens</i> [22]              |                          |
|  |                     | 圆枝猫尾藓 <i>Isoetecium myosuroides</i> [22]      |                          |
|  |                     | 异叶藓 <i>Kindbergia praelonga</i> [22]          |                          |
|  |                     | 波叶棉藓 <i>Plagiothecium undulatum</i> [22]      |                          |
| <i>Rhytidiadelphus loreus</i> [22]                           |                     |   |                          |
| <i>Rhytidiadelphus triquetrus</i> [22]                       |                     |   |                          |
| <b>亚热带山地雨林生态系统 Subtropical mountain rainforest ecosystem</b> |                     |   |                          |
| 中国 China   | 22°–34° N           | 高山角苔 <i>Anthoceros alpinus</i> [2]            | Peng & Zhu, 2013         |
|  |                     | 芽胞角苔 <i>Anthoceros angustus</i> [2]           |                          |
|  |                     | <i>Anthoceros bharadwajii</i> [2]             |                          |
|  |                     | 纺锤角苔 <i>Anthoceros fusiformis</i> [2]         |                          |
|  |                     | 角苔 <i>Anthoceros punctatus</i> [2]            |                          |
|  | 23°32' N            | <i>Anthoceros subtilis</i> [2]                | Peng & Zhu, 2014         |
|  |                     | <i>Notothylas guizhouensis</i> [2]            |                          |
|  |                     | 爪哇短角苔 <i>Notothylas javanica</i> [2]          |                          |
|  |                     | 南亚短角苔 <i>Notothylas levieri</i> [2]           |                          |
|  |                     | 短角苔 <i>Notothylas orbicularis</i> [2]         |                          |
| 云南短角苔 <i>Notothylas yunnanensis</i> [2]                      | Fan et al, 2022     |   |                          |
| 阿萨羽苔 <i>Plagiochila assamica</i>                             |                     |   |                          |
| 西南树平藓 <i>Homaliodendron montagneanu</i>                      |                     |   |                          |
| 大羽藓 <i>Thuidium cymbifolium</i>                              |                     |   |                          |
| 刀叶树平藓 <i>Homaliodendron scalpellifolium</i>                  |                     |   |                          |
| <b>热带雨林生态系统 Tropical rainforest ecosystem</b>                |                     |   |                          |
| 印度 India   | 7°–10° N            | <i>Leiosporoceros dussii</i> [1,2]            | Bouchard et al, 2020     |

[ ]中数字表示蓝藻物种, 详见附录2中编号。无[ ]表示引用的文献未鉴别蓝藻物种。

The numbers in [ ] indicates cyanobacterial species, as detailed in the numbering in Appendix 2. None [ ] indicates that the cited literature did not identify cyanobacterial species.