Table S1. *Species with details of voucher specimens and GenBank accession numbers of nucleotide sequences, included in this study. Newly obtained sequences in* **bold***.*

 GenBank accession no.

**Species Voucher** ITSmrSSURPB1

*Austrella arachnoidea* *Jørgensen* 8200 (BG) NA **KC608054** **KC608108**

*Degelia atlantica* I *Ekman* 3263 (BG) **KC618687** **KC608055** NA

*Degelia atlantic*a II *Ekman* 5605 (UPS) **KC618688** **KC608056** NA

*Degelia atlantica* III *Lindblom & Blom* L251 (BG) NA **KC608057** **KC608109**

*Degelia cyanoloma* 1995, *Purvis, James & Smith* (BM) **KC618689** AY340491 GQ259052

*Degelia duplomarginata* *Wedin* 8023 (S) NA **KC608058** NA

*Degelia durietzii* *Elvebakk* 02-296 (TROM) NA **KC608059** NA

*Degelia gayana* I *Wedin* 6112 (UPS) **KC618690** AY652619 NA

*Degelia gayana* II AF350290 NA NA

*Degelia gayana* III NA AY652620 NA

*Degelia plumbea* I *Ekman* 3201 (BG) AF429264 **KC608060** NA

*Degelia plumbe*a II *Ekman* 3543 (BG) AF429265 **KC608061** NA

*Degelia plumbea* III *Ekman* 5606 (UPS) **KC618691** **KC608062** NA

*Degelia plumbea* IV NA DQ912300 DQ912374

*Degeliella rosulata* *Galloway* 840b (BG) **KC618692** **KC608063** NA

*Degeliella versicolor* *Galloway* 840a (BG) **KC618693** **KC608064** NA

*Erioderma pedicellatum* mrSSU: 2007, *MacPitcher* s. n. (BG-L85909) NA **KC608065** **KC608110**

 RPB1: 2007, *MacPitcher* s. n. (BG-L85911)

*Erioderma sorediatum* *Tønsberg* 30133 (BG) NA NA **KC608111**

*Erioderma verruculosum* NA DQ972990 DQ973062

*Fuscoderma amphibolum* *Wedin* 4099 (UPS) **KC618694** GQ259023 NA

*Fuscoderma applanatum* I *Tibell* 19076 (BG) **KC618695** **KC608066** **KC608112**

*Fuscoderma applanatum* II *Wedin* 8016 (UPS) **KC618696** NA GQ259053

*Fuscopannaria ahlneri* *Thor* 16992 (UPS) **KC618697** GQ259025 GQ259054

*Fuscopannaria cheiroloba* *Tønsberg* 38743 (BG) **KC618698** NA **KC608113**

*Fuscopannaria ignobilis* *Tønsberg* 31574 (BG) **KC618700** **KC608068** DQ986839

*Fuscopannaria laceratula* *Nash* 43995 (BG) NA **KC608070** **KC608115**

*Fuscopannaria leucosticta* *Harris* 33159 (S) **KC618701** DQ900630 GQ259055

*Fuscopannaria leucostictoides* *Tønsberg* 28955 (BG) **KC618702** **KC608071** **KC608116**

*Fuscopannaria maritima* *McCune* 16095 (BG) **KC618703** **KC608072** **KC608117**

*Fuscopannaria olivacea* *Coppins* 12494 (BG) **KC618704** **KC608073** NA

*Fuscopannaria pacifica* I *Tønsberg* 29359 (BG) **KC618705** **KC608074** **KC608118**

*Fuscopannaria pacifica* II *Tønsberg* 23317 (BG) AF429278 **KC608069** **KC608114**

*Fuscopannaria praetermissa* *Tønsberg* 36838 (BG) **KC618706** **KC608075** GQ259056

*Fuscopannaria protensa* *Thor* 20406 (UPS) **KC618707** NA **KC608119**

*Fuscopannaria sampaiana* I *Anonby* 1010 (BG) **KC618708** **KC608076** **KC608120**

*Fuscopannaria sampaiana* II 2009, *Giavarino* s. n. (NMW) **KC618709** **KC608077** **KC608121**

*Fuscopannaria sorediata* *Clayden* 14319 (NBM) **KC618699** **KC608067** NA

*Joergensenia cephalodina* I EU885307 EU885329 NA

*Joergensenia cephalodina* II EU885308 EU885330 NA

*Leciophysma finmarkicum* *Nordin* 5515 (UPS) **KC618710** GQ259027 GQ259057

*Leciphysma furfurascens* *Nordin* 5695 (UPS) **KC618711** GQ259028 GQ259058

*Leioderma erythrocarpum* 2009, *Schumm & Frahm* s. n.(BG, dupl of hb. NA **KC608078** NA

 *Schumm* 15583)

*Leioderma pycnophorum* NA GQ259031 GQ259059

*Moelleropsis nebulosa* I 2003, *Schumm* s. n. (hb. *Schumm* 11167) **KC618712** **KC608079** **KC608122**

*Moelleropsis nebulosa* II *Nordin* 3512 (UPS) **KC618713** **KC608080** **KC608123**

*Moelleropsis nebulosa* III 2000, *Johnsen* s. n. (BG) **KC618714** **KC608081** NA

*Pannaria* aff. *immixta* *Elvebakk* 02-352B (BG) NA **KC608084** **KC608125**

*Pannaria athroophylla* I EU885295 EU885317 NA

*Pannaria athroophylla* II EU885303 EU885325 NA

*Pannaria calophylla* EU885296 EU885318 NA

*Pannaria contorta* EU885297 EU885319 NA

*Pannaria dichroa* *Gremmen* G03-99 (BG) **KC618715** **KC608082** NA

*Pannaria farinosa* EU885299 EU885321 NA

*Pannaria hispidula* EU885304 EU885326 NA

*Pannaria hookeri* 1989, *Jørgensen* s. n. (BG L2985) AF429282 **KC608083** **KC608124**

*Pannaria implexa* NA EU885333 NA

*Pannaria insularis* *Kashiwadani* 43760 (BG) **KC618716** **KC608085** **KC608126**

*Pannaria isabellina* EU885298 EU885320 NA

*Pannaria lurida* subsp. *lurida* *Kashiwadani* 43861 & *Moon* (BG) NA **KC608086** **KC608127**

*Pannaria lurida* subsp. *russellii* *Tønsberg* 22565 (BG) NA **KC608087** **KC608128**

*Pannaria microphyllizans* EU885300 EU885322 NA

*Pannaria multifida* 2009, *Schumm & Frahm* s. n. (BG, dupl. of hb. **KC618717** **KC608088** **KC608129**

 *Schumm* 15237)

*Pannaria orphnina* *Søchting* US7833 (BG) NA NA **KC608130**

*Pannaria pallida* EU885301 EU885323 NA

*Pannaria rubiginella* I *Tønsberg* 32508 (BG) **KC618718** **KC608089** **KC608131**

*Pannaria rubiginella* II *Thor* 10050 (S) NA GQ259037 GQ259074

*Pannaria rubiginosa* AF429280 AY340513 GQ259073

*Pannaria sphinctrina* EU885302 EU885324 NA

*Pannaria subfusca* *Tønsberg* 33592 (BG) **KC618719** NA **KC608132**

*Pannaria tavaresii* 2001, *Schumm* s.n. (hb. *Schumm* 8630) **KC618720** NA **KC608133**

*Parmeliella appalachensis* *Lendemer* 578 & Smith (BG) **KC618721** **KC608090** NA

*Parmeliella incrassata* *Palice* 2236 (PRA) **KC618722** **KC608091** **KC608134**

*Parmeliella lacerata* *Nordin* 4672 (UPS) **KC618723** **KC608092** NA

*Parmeliella mariana* 1999, *Schumm & Schwarz* s. n. (BG, dupl. of NA **KC608093** **KC608135**

 hb. *Schumm* 6030)

*Parmeliella miradorensis* *Tønsberg* 23053 (BG) NA **KC608094** **KC608136**

*Parmeliella nigrocincta* *Elvebakk* 02-356 (BG) **KC618724** **KC608095** **KC608137**

*Parmeliella pannosa* 1999, *Ståhl* s. n. (BG) **KC618725** **KC608096** NA

*Parmeliella stylophora* *Kashiwadani* 43327 (BG) NA **KC608097** **KC608138**

*Parmeliella* cf. *thysanota* *Galloway* 847 (BG) **KC618726** NA **KC608139**

*Parmeliella triptophylla* I *Ekman* 3203 (BG) AF429269 **KC608098** NA

*Parmeliella triptophylla* II *Wedin* 7037 (UPS) **KC618727** AY652623 GQ259075

*Physma byrsaeum* NA GQ259039 GQ259077

*Physma radians* *Thor* 12457 (UPS) **KC618728** GQ259040 GQ259078

*Protopannaria pezizoides* I *Wiklund* 51 (UPS) **KC618729** AY340519 GQ259081

*Protopannaria pezizoides* II *Ihlen* 460 (BG) AF429270 **KC608099** NA

*Psoroma aphthosum* EU885306 EU885328 NA

*Psoroma echinaceum* *Wedin* 6042 (BG) **KC618730** NA **KC608140**

*Psoroma fruticulosum* *Elvebakk* 98-421 (BG) **KC618731** NA **KC608141**

*Psoroma hypnorum* I *Ihlen* 453 (BG) AF429272 **KC608100** **KC608142**

*Psoroma hypnorum* II EU885312 EU885334 NA

*Psoroma hypnorum* III *Holien* 7730 (TRH) AF429273 **KC608101** NA

*Psoroma hypnorum* IV EU885309 EU885331 NA

*Psoroma hypnorum* V *Wiklund* 35 (UPS) **KC618732** AY340523 GQ259085

*Psoroma paleaceum* EU885305 EU885327 NA

*Psoroma saccharatum* *Søchting* US7656 (BG) **KC618733** **KC608102** **KC608143**

*Psoroma tenue* *Tønsberg* 32008 (BG) GQ927290 NA **KC608144**

*Psorophorus fuegiensis* *Wedin* 6108 (BM) AF429274 **KC608103** NA

*Psorophorus pholidotus* EU885314 EU885336 NA

*Ramalodium succulentum* *Tibell* 12239 (UPS) NA GQ259043 GQ259086

*Santessoniella arctophila* 2002, *Kristinsson* s. n. (BG) **KC618734** **KC608104** **KC608145**

*Santessoniella sp.* a *Anderson* 942 (BG) **KC618735** **KC608105** **KC608146**

*Santessoniella grisea* *Tønsberg* 24918 (BG) **KC618736** NANA

*Santessoniella polychidioides* *Galloway* 10231 (BM) AF429275 **KC608106** NA

*Santessoniella saximontana* *Spribille & Houde* 21173 (BG) **KC618737** NANA

*Siphulastrum squamosum* *Coppins* 4570 (BG) NA **KC608107** **KC608147**

*Staurolemma oculatum* *Aptroot* 55941 (ABL) **KC618738** GQ259045 GQ259087

*Staurolemma omphalarioides* *Hafellner & Hafellner* 41399 (UPS) **KC618739** GQ259044 NA

*Vahliella leucophaea* AF429266 AY652621 GQ259090

*Xanthopsoroma contextum* EU885313 EU885335 NA

*Xanthopsoroma soccatum* EU885315 EU885337 NA

Notes: Abbreviations of public herbaria in which vouchers are deposited follow Index Herbariorum (http://sciweb.nybg.org/science2/IndexHerbariorum.asp). Roman numbers are used when more than one terminal represent a species. Sequences from the same terminal are mostly based on the same specimen and this is always the case when a species is represented by more than one terminal. NA = genes for which data were not available; hb. = private herbarium; dupl. = duplicate specimen. The private herbarium of Felix Schumm is to be incorporated in herbarium B.

a This is an undescribed species that morphologically belongs within the current understanding of *Santessoniella* and is morphologically similar to *S. crossophylla*.

Table S2. *Descriptive statistics for the data included in this study, divided into the five subsets suggested by PartitionFinder.*

No. of No. of No. of variable Sites containing Alignment cells

Data taxa sites sites missing data with missing data

ITS1+ITS2 86 254 211 (83%) 110 (43%) 3385 (15%)

5.8S 86 154 27 (18%) 1 (0%) 1 (0%)

mrSSU 96 726 343 (47%) 335 (46%) 4132 (6%)

RPB1 1st and 2nd pos. 61 370 78 (21%) 48 (13%) 167 (1%)

RPB13rd pos. 61 185 174 (94%) 25 (14%) 90 (1%)

Concatenated 107 1683 827 (49%) 1683 (100%) 52352 (29%)

Notes: A suspected *ITS* non-orthologue (in three terminals of *Degelia plumbea*) was removed before concatenation, which resulted in six gap-only columns that were removed. The increased number of cells with missing data in the concatenated data is caused by missing data from entire markers. This was always caused by technical difficulties with the PCR amplification, a problem that is particularly pronounced for the *RPB1* gene.