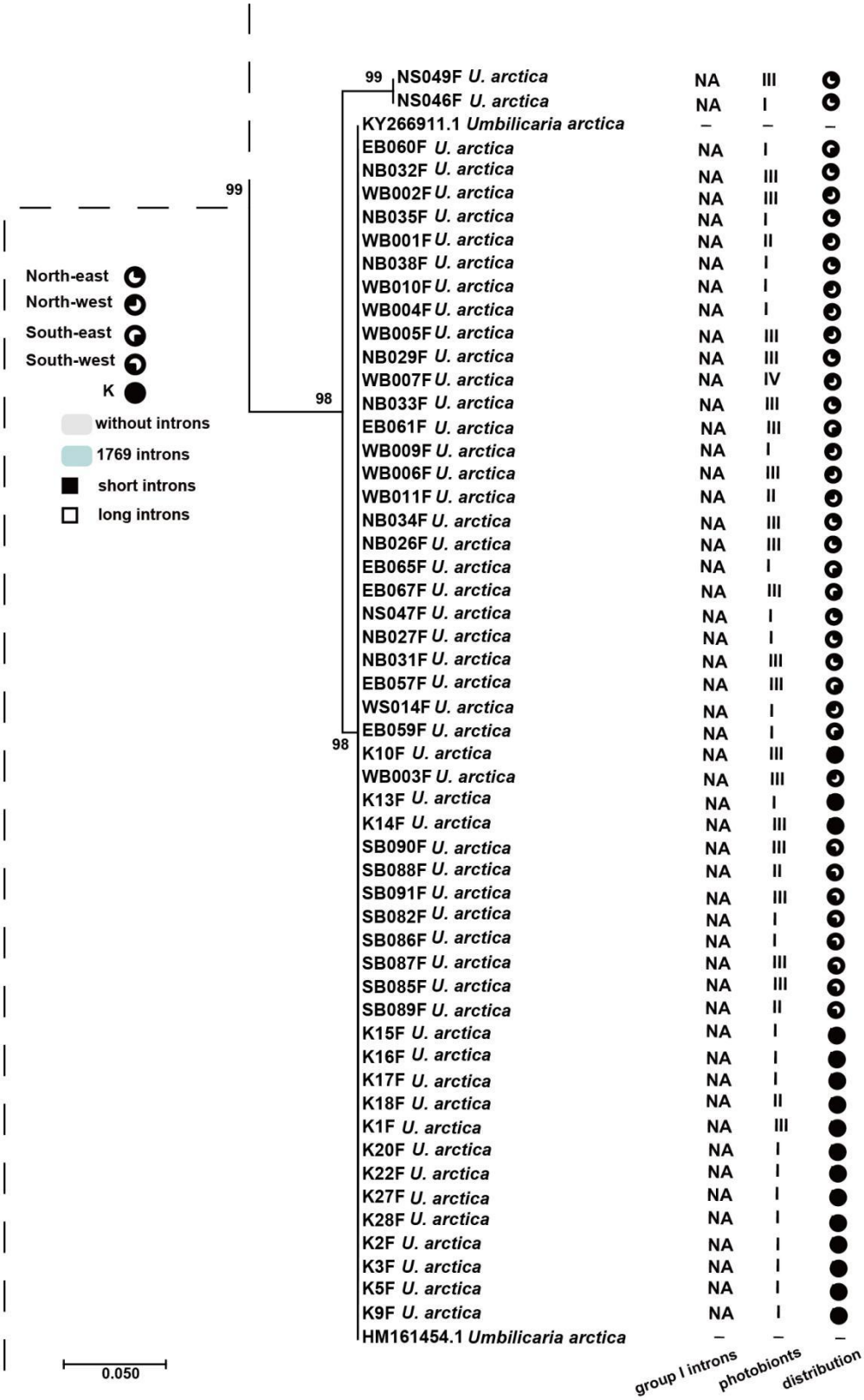
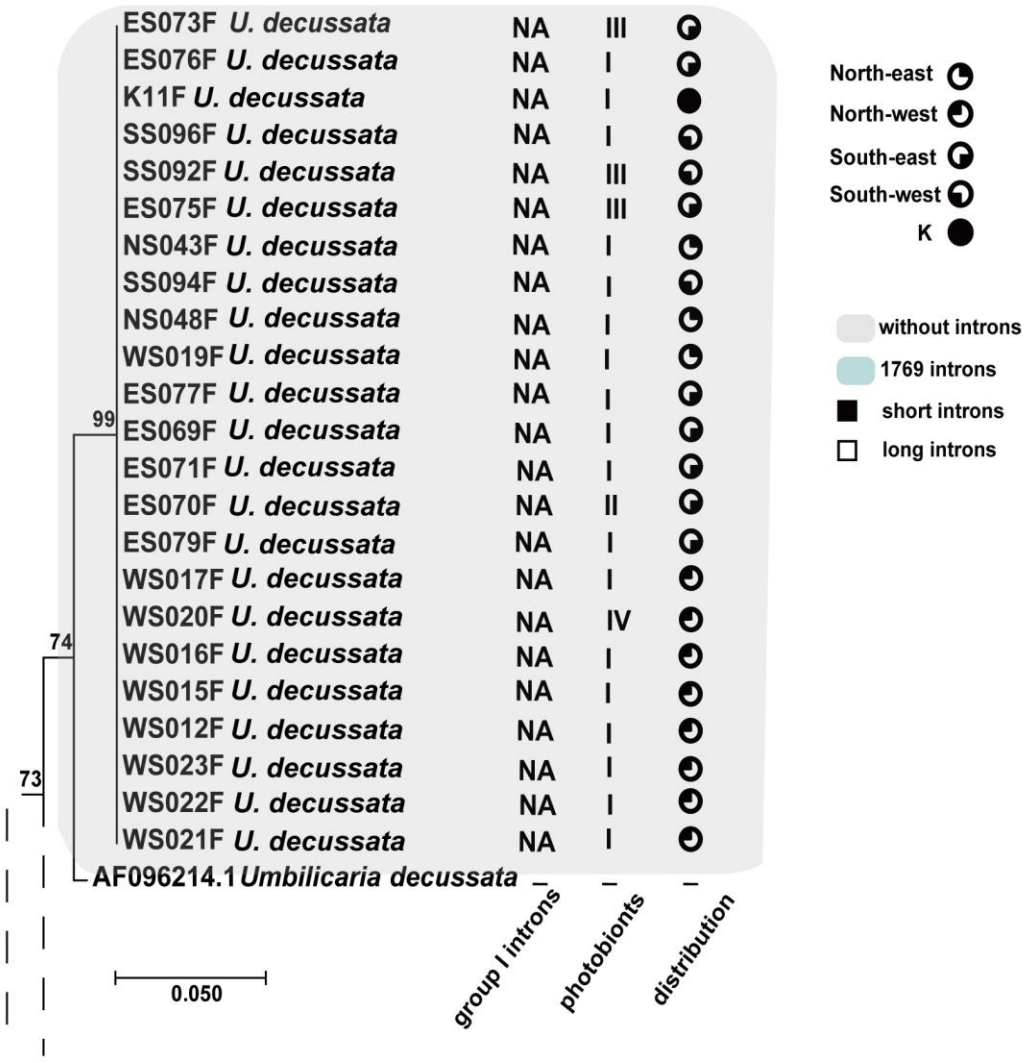
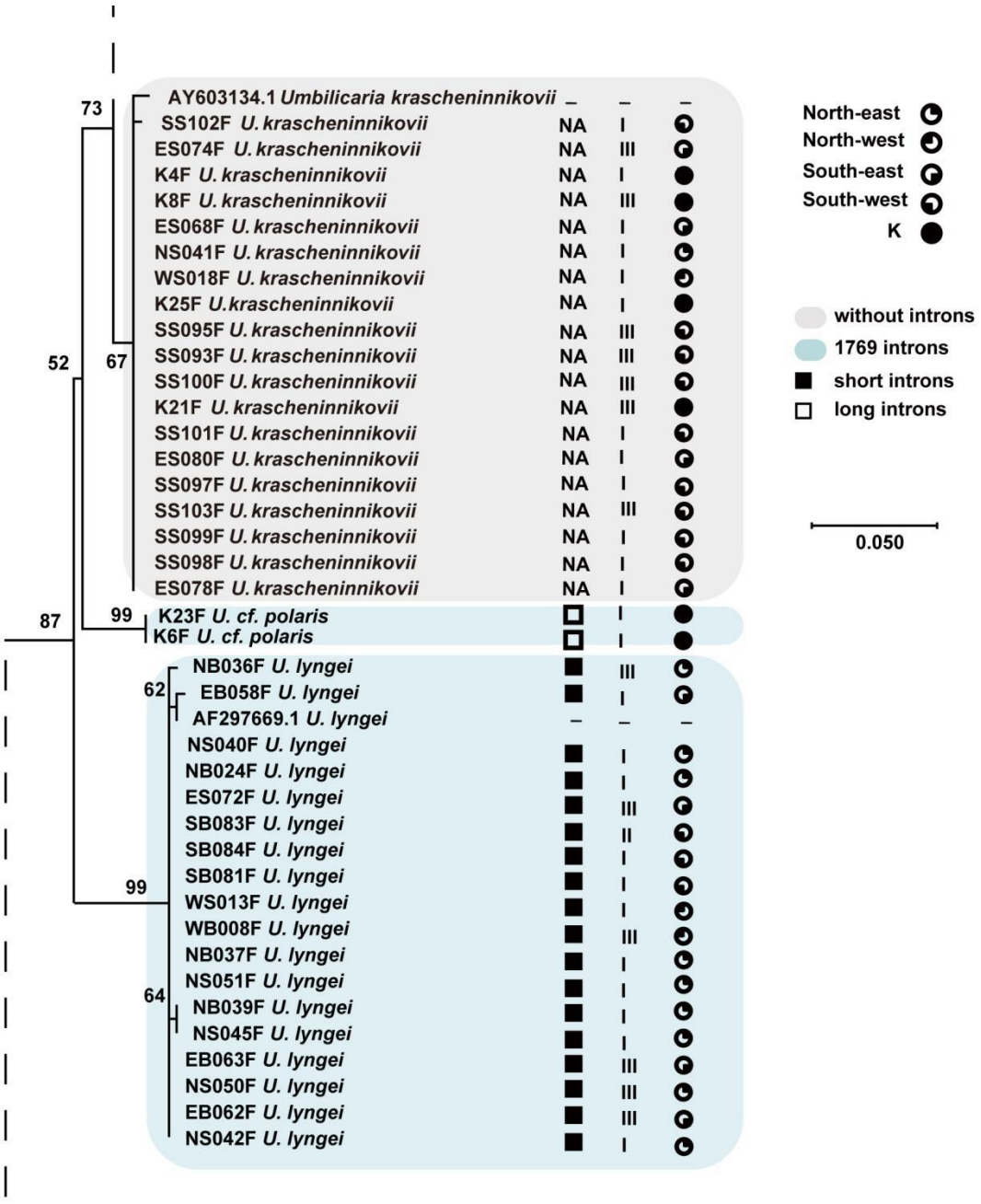
Supplementary material material for Shunan Cao, Chunyan Yang, Weiran Liu, Jiewei Sun, Chuanpeng Liu & Qiming Zhou. Microgeographic distribution and mycobiont–photobiont associations in Arctic *Umbilicaria* lichens. *Polar Research 45*. Correspondence: Shunan Cao, Key Laboratory for Polar Science, Polar Research Institute of China, Ministry of Natural Resources, Shanghai, No. 1000 Xuelong Road, Pudong, Shanghai 201209, China. E-mail: caoshunan@pric.org.cn



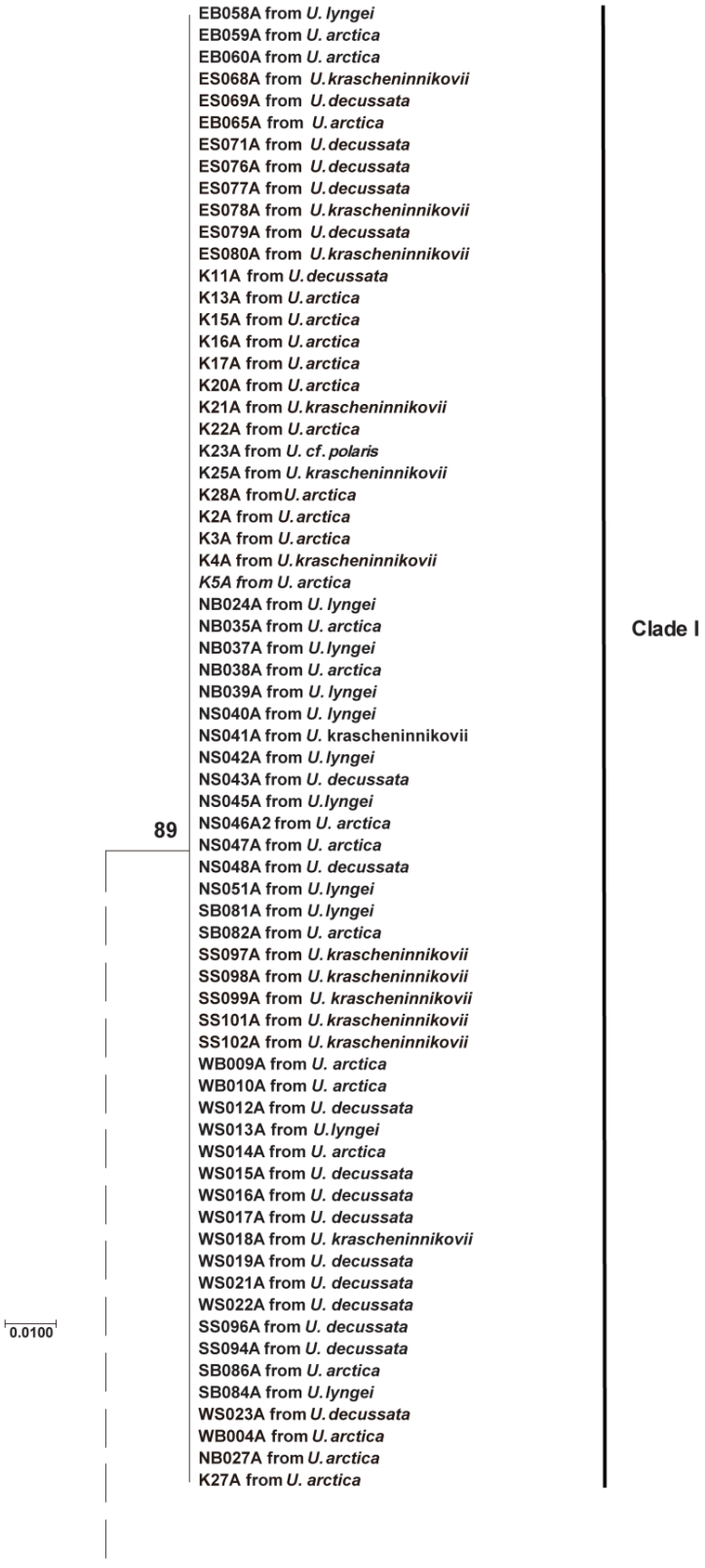
Supplementary Fig. S1. Expanded view of *U. arctica* in Fig. 2.



Supplementary Fig. S2. Expanded view of *U. decussata* in Fig. 2.



Supplementary Fig. 3. Expanded view of *U. krascheninnikovii, U.* cf. *polaris* and *U. lyngei* in Fig. 2.



Supplementary Fig. S4. Expanded view of clade I in Fig. 3.

Supplementary Table S1. Information of all individuals, including group I introns and GenBank accession numbers, for the taxa sequenced in this study. GenBank accession numbers include mycobionts and photobionts.

No.	No. of thallus	*Umbilicaria* species	Locality [a]	GenBank no.		Group I intron (site 1769) [b]	
				No. of lichen-forming fungi	No. of photobionts	Length (bps)	Type
1	WB001	*U. arctica*	NW upper A	PX780523	PX738070	–	–
2	WB002	*U. arctica*	NW upper A	PX780524	PX738069	–	–
3	WB003	*U. arctica*	NW upper A	PX780525	PX738068	–	–
4	WB004	*U. arctica*	NW upper A	PX780526	PX738067	–	–
5	WB005	*U. arctica*	NW upper A	PX780527	PX738066	–	–
6	WB006	*U. arctica*	NW upper A	PX780528	PX738065	–	–
7	WB007	*U. arctica*	NW upper A	PX780529	PX738064	–	–
8	WB008	*U. lyngei*	NW upper A	PX783221	PX738063	199	short
9	WB009	*U. arctica*	NW upper A	PX780530	PX738062	–	–
10	WB010	*U. arctica*	NW upper A	PX780531	PX738061	–	–
11	WB011	*U. arctica*	NW upper A	PX780532	PX738060	–	–
12	WS012	*U. decussata*	NW lower A	PX788493	PX738059	–	–
13	WS013	*U. lyngei*	NW lower A	PX783222	PX738058	200	short
14	WS014	*U. arctica*	NW lower A	PX780533	PX738057	–	–
15	WS015	*U. decussata*	NW lower A	PX788494	PX738056	–	–
16	WS016	*U. decussata*	NW lower A	PX788495	PX738055	–	–
17	WS017	*U. decussata*	NW lower A	PX788496	PX738054	–	–
18	WS018	*U. kraschenin-nikovii*	NW lower A	PX780576	PX738053	–	–
19	WS019	*U. decussata*	NW lower A	PX788497	PX738052	–	–
20	WS020	*U. decussata*	NW lower A	PX788498	PX738051	–	–
21	WS021	*U. decussata*	NW lower A	PX788499	PX738050	–	–
22	WS022	*U. decussata*	NW lower A	PX788500	PX738049	–	–
23	WS023	*U. decussata*	NW lower A	PX788501	PX738048	–	–
24	NB024	*U. lyngei*	NE upper A	PX783223	PX738047	200	short
25	NB026	*U. arctica*	NE upper A	PX780534	PX738046	–	–
26	NB027	*U. arctica*	NE upper A	PX780535	PX738045	–	–
27	NB029	*U. arctica*	NE upper A	PX780536	PX738044	–	–
28	NB031	*U. arctica*	NE upper A	PX780537	PX738043	–	–
29	NB032	*U. arctica*	NE upper A	PX780538	PX738042	–	–
30	NB033	*U. arctica*	NE upper A	PX780539	PX738041	–	–
31	NB034	*U. arctica*	NE upper A	PX780540	PX738040	–	–
32	NB035	*U. arctica*	NE upper A	PX780541	PX738039	–	–

No.	No. of thallus	*Umbilicaria* species	Locality [a]	GenBank no.		Group I intron (site 1769) [b]	
				No. of lichen-forming fungi	No. of photobionts	Length (bps)	Type
33	NB036	*U. lyngei*	NE upper A	PX783224	PX738038	200	short
34	NB037	*U. lyngei*	NE upper A	PX783225	PX738037	200	short
35	NB038	*U. arctica*	NE upper A	PX780542	PX738036	–	–
36	NB039	*U. lyngei*	NE upper A	PX783226	PX738035	200	short
37	NS040	*U. lyngei*	NE lower A	PX783227	PX738034	200	short
38	NS041	*U. kraschenin-nikovii*	NE lower A	PX780577	PX738033	–	–
39	NS042	*U. lyngei*	NE lower A	PX783228	PX738032	200	short
40	NS043	*U. decussata*	NE lower A	PX788502	PX738031	–	–
41	NS045	*U. lyngei*	NE lower A	PX783229	PX738030	199	short
42	NS046	*U. arctica*	NE lower A	PX780543	PX738029	–	–
43	NS047	*U. arctica*	NE lower A	PX780544	PX738028	–	–
44	NS048	*U. decussata*	NE lower A	PX788503	PX738027	–	–
45	NS049	*U. arctica*	NE lower A	PX780545	PX738026	–	–
46	NS050	*U. lyngei*	NE lower A	PX783230	PX738025	199	short
47	NS051	*U. lyngei*	NE lower A	PX783231	PX738024	200	short
48	EB057	*U. arctica*	SE upper A	PX780546	PX738023	–	–
49	EB058	*U. lyngei*	SE upper A	PX783232	PX738022	200	short
50	EB059	*U. arctica*	SE upper A	PX780547	PX738021	–	–
51	EB060	*U. arctica*	SE upper A	PX780548	PX738020	–	–
52	EB061	*U. arctica*	SE upper A	PX780549	PX738019	–	–
53	EB062	*U. lyngei*	SE upper A	PX783233	PX738018	200	short
54	EB063	*U. lyngei*	SE upper A	PX783234	PX738017	200	short
55	EB065	*U. arctica*	SE upper A	PX780550	PX738016	–	–
56	EB067	*U. arctica*	SE upper A	PX780551	PX738015	–	–
57	ES068	*U. kraschenin-nikovii*	SE lower A	PX780578	PX738014	–	–
58	ES069	*U. decussata*	SE lower A	PX788504	PX738013	–	–
59	ES070	*U. decussata*	SE lower A	PX788505	PX738012	–	–
60	ES071	*U. decussata*	SE lower A	PX788506	PX738011	–	–
61	ES072	*U. lyngei*	SE lower A	PX783235	PX738010	199	short
62	ES073	*U. decussata*	SE lower A	PX788507	PX738009	–	–
63	ES074	*U. kraschenin-nikovii*	SE lower A	PX780579	PX738008	–	–
64	ES075	*U. decussata*	SE lower A	PX788508	PX738007	–	–
65	ES076	*U. decussata*	SE lower A	PX788509	PX738006	–	–
66	ES077	*U. decussata*	SE lower A	PX788510	PX738005	–	–

No.	No. of thallus	*Umbilicaria* species	Locality [a]	GenBank no.		Group I intron (site 1769) [b]	
				No. of lichen-forming fungi	No. of photobionts	Length (bps)	Type
67	ES078	*U. kraschenin-nikovii*	SE lower A	PX780580	PX738004	–	–
68	ES079	*U. decussata*	SE lower A	PX788511	PX738003	–	–
69	ES080	*U. kraschenin-nikovii*	SE lower A	PX780581	PX738002	–	–
70	SB081	*U. lyngei*	SW upper A	PX783236	PX738001	200	short
71	SB082	*U. arctica*	SW upper A	PX780552	PX738000	–	–
72	SB083	*U. lyngei*	SW upper A	PX783237	PX737999	200	short
73	SB084	*U. lyngei*	SW upper A	PX783238	PX737998	200	short
74	SB085	*U. arctica*	SW upper A	PX780553	PX737997	–	–
75	SB086	*U. arctica*	SW upper A	PX780554	PX737996	–	–
76	SB087	*U. arctica*	SW upper A	PX780555	PX737995	–	–
77	SB088	*U. arctica*	SW upper A	PX780556	PX737994	–	–
78	SB089	*U. arctica*	SW upper A	PX780557	PX737993	–	–
79	SB090	*U. arctica*	SW upper A	PX780558	PX737992	–	–
80	SB091	*U. arctica*	SW upper A	PX780559	PX737991	–	–
81	SS092	*U. decussata*	SW lower A	PX788512	PX737990	–	–
82	SS093	*U. kraschenin-nikovii*	SW lower A	PX780582	PX737989	–	–
83	SS094	*U. decussata*	SW lower A	PX788513	PX737988	–	–
84	SS095	*U. kraschenin-nikovii*	SW lower A	PX780583	PX737987	–	–
85	SS096	*U. decussata*	SW lower A	PX788514	PX737986	–	–
86	SS097	*U. kraschenin-nikovii*	SW lower A	PX780584	PX737985	–	–
87	SS098	*U. kraschenin-nikovii*	SW lower A	PX780585	PX737984	–	–
88	SS099	*U. kraschenin-nikovii*	SW lower A	PX780586	PX737983	–	–
89	SS100	*U. kraschenin-nikovii*	SW lower A	PX780587	PX737982	–	–
90	SS101	*U. kraschenin-nikovii*	SW lower A	PX780588	PX737981	–	–
91	SS102	*U. kraschenin-nikovii*	SW lower A	PX780589	PX737980	–	–
92	SS103	*U. kraschenin-nikovii*	SW lower A	PX780590	PX737979	–	–
93	K1	*U. arctica*	Stone K	PX780560	PX737978	–	–

No.	No. of thallus	*Umbilicaria* species	Locality [a]	GenBank no.		Group I intron (site 1769) [b]	
				No. of lichen-forming fungi	No. of photobionts	Length (bps)	Type
94	K2	*U. arctica*	Stone K	PX780561	PX737977	–	–
95	K3	*U. arctica*	Stone K	PX780562	PX737976	–	–
96	K4	*U. kraschenin-nikovii*	Stone K	PX780591	PX737975	–	–
97	K5	*U. arctica*	Stone K	PX780563	PX737974	–	–
98	K6	*U.* cf. *polaris*	Stone K	PX783239	PX737973	420	long
99	K8	*U. kraschenin-nikovii*	Stone K	PX780592	PX737972	–	–
100	K9	*U. arctica*	Stone K	PX780564	PX737971	–	–
101	K10	*U. arctica*	Stone K	PX780565	PX737970	–	–
102	K11	*U. decussata*	Stone K	PX788515	PX737969	–	–
103	K13	*U. arctica*	Stone K	PX780566	PX737968	–	–
104	K14	*U. arctica*	Stone K	PX780567	PX737967	–	–
105	K15	*U. arctica*	Stone K	PX780568	PX737966	–	–
106	K16	*U. arctica*	Stone K	PX780569	PX737965	–	–
107	K17	*U. arctica*	Stone K	PX780570	PX737964	–	–
108	K18	*U. arctica*	Stone K	PX780571	PX737963	–	–
109	K20	*U. arctica*	Stone K	PX780572	PX737962	–	–
110	K21	*U. kraschenin-nikovii*	Stone K	PX780593	PX737961	–	–
111	K22	*U. arctica*	Stone K	PX780573	PX737960	–	–
112	K23	*U.* cf. *polaris*	Stone K	PX783240	PX737959	422	long
113	K25	*U. kraschenin-nikovii*	Stone K	PX780594	PX737958	–	–
114	K27	*U. arctica*	Stone K	PX780574	PX737957	–	–
115	K28	*U. arctica*	Stone K	PX780575	PX737956	–	–

[a] "A" is Stone A. [b] A dash indicates that no group I introns were found at position 1769 in the mycobionts, which does not mean that mycobionts do not contain other group I introns.