	ITS1		ITS2	
	Seqs	OTUs	Seqs	OTUs
Fungi (0.95)	992852	1911	1173834	1691
Raw in OTU table (n≥10)	989946	1302	1170751	1057
After decontam	915747	1206	1016235	1044
Final(97% coverage)	889290	1193	992890	1032

Table S1. Total sequence count + OTUs for ITS1 + ITS2 datasets at each OTU table trimming step.[1]Non-target samples discarded.

	ITS1		ITS2	
	Seqs	zOTUs	Seqs	zOTUs
All zotus[1]	1061048	3135	2689730	1880
Fungi (0.95)	1024007	3094	1210397	1705
After decontam	997077	3012	1107636	1685
Final(97% coverage)	967316	2772	1083789	1559

Table S2. Total sequence count + zotus (n=8) for ITS1 + ITS2 datasets at each zotu table trimming step. [1]Non-target samples and "zotus"/ASVs with <8 copies discarded.

	Bistorta vivipara (n=519)[1]	Dryas octopetala (n=22)	Salix polaris (n=20)[2]
Fungi (0.95)	917667	41314	33871
Raw in OTU table (n≥10)	914888	41272	33786
After decontam	843137	39880	32730
Final (97% coverage)	803649	39880	30069
Sequences per sample	min=251, avg=1523.6, max=7680	min=382, avg=1812.7, max=3735	min=449, avg=1551.2, max=3516

Table S3. ITS1 data quality filtering steps (OTUs). For *Bistorta vivipara*, 80 samples of the original 599 that had too few sequences to meet the coverage threshold of 97% in both the OTU and zotu datasets were discarded. [2]1 *Salix polaris* sample was discarded for the same reason.

	Bistorta vivipara (n=519)[1]	Dryas octopetala (n=22)	Salix polaris (n=20) [2]
Fungi (0.95)	984812	44702	36145
After decontam	919672	43286	34119
Final (97% coverage)	908621	43286	33141
Sequences per	min=251, avg=1519.4,	min=382, avg=1812.7,	min=449, avg=1546.7,

sample	max=7680	max=3730	max=3516

Table S4. ITS1 data quality filtering steps (zotus). [1]For *Bistorta vivipara*, 80 samples of the original 599 that had too few sequences to meet the coverage threshold of 97% in both the OTU and zotu datasets were discarded. [2]1 *Salix polaris* sample was discarded for the same reason.

Plant host	Arctostaphylos alpine (n=10)	A.uva-ursi (n=76) [1]	B.nana (n=8)	Betula pendula (n=81)[2]	Pinus sylvestris (n=41)	Salix herbacea (n=7)	Cassiope tetragona (n=15)
Fungi (0.95)	60168	249638	50124	107463	212727	25604	468110
Raw in OTU table (n≥10)	59878	248708	49945	106620	212589	25322	467689
After decontam	59829	248428	49927	106549	212577	25298	313627
Final (97% coverage)	59829	241418	49927	90214	212577	25298	313627
Sequences per sample	min=2173 avg=5998.2 max=9437	min=665, avg=3047.8 max=10187	min=3157 avg=6243.1max=10646	min=536 avg=1019.2 max=2240	min=669 avg=5185.7 max=19286	min=1996 avg=3627.6 max=7025	min= 420 avg=20911.8 max=56456

Table S5. ITS2 data quality filtering steps (OTUs). For *Arctostaphylos uva-ursi* and *Betula pendula*, respectively 6 and 23 of the original 82 and 104 samples had too few sequences to meet the coverage threshold of 97% in both the OTU and zotu datasets and were discarded.

Plant host	Arctostaphylos alpine (n=10)	A.uva-ursi (n=76) [1]	B.nana (n=8)	Betula pendula (n=81)[2]	Pinus sylvestris (n=41)	Salix herbacea (n=7)	Cassiope tetragona (n=15)
Fungi (0.95)	61718	254512	51229	112588	219210	25535	485605
After decontam	61703	254557	51182	109810	219124	25497	385763
Final (97% coverag	61703	247091	51182	93429	219124	25497	385763

e)							
Sequences per sample	min=2157 avg=6170.3 max=9842	min=846, avg=3272 max=10298	min=3151 avg=6397.8 max=10793	min=550 avg=1153.4 max=2388	min=670 avg=5344.5 max=20526	min=2022 avg=3642.4 max=7083	min= 563 avg=25717.5 max=61829

Table S6. ITS2 data quality filtering steps (zotus). For *Arctostaphylos uva-ursi*, and *Betula pendula*, respectively 6 and 23 of the original 82 and 104 samples had too few sequences to meet the coverage threshold of 97% in both the OTU and zotu datasets and were discarded.

Host plant	R^2	P-value
Arctostaphylos alpine (n=10)	0.2433	0.08393
A.uva-ursi (n=76) [1]	0.02791	0.07193
B.nana (n=8)	0.2525	0.1163
Betula pendula (n=81)[2]	-0.00519	0.4861
Pinus sylvestris (n=41)	0.1176	0.0161
Salix herbacea (n=7)	0.05233	0.3007
Cassiope tetragona (n=15)	-0.06255	0.6818
Bistorta vivipara (n=519)[1]	0.001058	0.2139
Dryas octopetala (n=22)	-0.04172	0.6944
Salix polaris (n=20) [2]	-0.01962	0.4361

Table S7. *Mycena* infection load (% reads of total) correlations with sampling depth.

ITS1 OTUs	***Mycena* species identification**	**Host plant**	**ITS1 ASVs**	***Mycena* species identification**	**Host pla**
OTU_614	*M.sp_monticola((0.915)*	Bv	ASV_1232	*M.sp_monticola((0.915)*	Bv
OTU_201	*M.sp.pasvikensis(0.95)*	Bv	ASV_298	*M.sp_pasvikensis(0.95a)*	Bv
-	-		ASV_1358	*M.sp_pasvikensis(0.95b)*	Bv
-	-		ASV_3028	*M.sp_plumbea(0.916)*	None (>1%)
OTU_505	*M.sp.rebaudengoi(0.93)*	Bv	ASV_962	*M.sp_rebaudengoi(0.93)*	Bv
OTU_448	*M.sp.rebaudengoi(0.95)*	Bv	ASV_844	*M.sp_rebaudengoi(0.95a)*	Bv
-	-		ASV_1298	*M.sp_rebaudengoi(0.95b)*	Bv
-	-		ASV_2179	*M.sp_tenax(0.92)*	None

					(>1%)
OTU_124	*M.alb/oli/citr*	Bv,Do	ASV_147	*M.alb/oli/citr*	Bv,Do
OTU_1828	*M.cinerella*	Bv	ASV_1179	*M.cinerella1*	Bv
-	-		ASV_2044	*M.cinerella2*	Bv
-	-		ASV_246	*M.cinerella3*	Bv
OTU_274	*M.concolor*	Bv	ASV_804	*M.concolor1*	Bv
-	-		ASV_1638	*M.concolor2*	Bv
-	-		ASV_1705	*M.concolor3*	Bv
-	-		ASV_1559	*M.concolor4*	Bv
-	-		ASV_1777	*M.concolor5*	Bv
-	-		ASV_2131	*M.concolor6*	Bv
-	-		ASV_1710	*M.concolor7*	Bv
OTU_90	*M.epipterygia1*	Bv	ASV_346	*M.epipterygia1*	Bv
OTU_618	*M.epipterygia2*	Do	ASV_1237	*M.epipterygia2*	Bv
OTU_762	*M.gal/meg*	Bv	ASV_1631	*M.gal/meg*	Bv
OTU_631	*M.galopus*	Bv	ASV_1274	*M.galopus*	Bv
OTU_314	*M.metata*	Bv	ASV_540	*M.metata*	Bv
OTU_118	*M.pasvikensis*	Bv	ASV_175	*M.pasvikensis1*	Bv
-	-		ASV_638	*M.pasvikensis2*	Bv
OTU_426	*M.pura*	Bv	ASV_799	*M.pura*	Bv
OTU_1169	*M.rebaudengoi*	None (>1%)	ASV_2835	*M.rebaudengoi*	None (>1%)
OTU_1204	*M.sanguinolenta*	Bv	ASV_2963	*M.sanguinolenta*	Bv
OTU_543	*M.leptocephala*	Bv	ASV_1053	*M.leptocephala*	Bv
OTU_21	*M.strob/aur*	Bv,Do,Sp	ASV_19	*M.strob/aur1*	Bv,Do,S
-	-		ASV_440	*M.strob/aur2*	Bv
-	-		ASV_543	*M.strob/aur3*	Bv
-	-		ASV_724	*M.strob/aur4*	Bv
-	-		ASV_2904	*M.strob/aur5*	None (>1%)
OTU_51	*M.stylobates1*	Bv,Do	ASV_50	*M.stylobates*	Bv,Do,S
OTU_598	*M.stylobates2*	None (>1%)	ASV_1188	*M.stylobates*	Bv
NA	(No corresponding Mycena-OTU)		ASV_1838	*M.sp_cinerella(0.93)*	None (>1%)
NA	(No corresponding Mycena-OTU)		ASV_1755	*M.sp_cinerella(0.95)*	None (>1%)
NA	(No corresponding Mycena-OTU)		ASV_1600	*M.sp_cinerella(0.96)*	None (>1%)
NA	(No corresponding Mycena-OTU)		ASV_2791	*M.sp_citrinomarginata(0.95)*	None (>1%)
NA	(No corresponding Mycena-OTU)		ASV_2659	*M.sp_epipterygia(0.93)*	None (>1%)
NA	(No corresponding Mycena-OTU)		ASV_2167	*M.sp_metata(0.91)*	None

				(>1%)
NA	(No corresponding Mycena-OTU)	ASV_1895	*M.sp_metata(0.93)*	None (>1%)
NA	(No corresponding Mycena-OTU)	ASV_950	*M.sp_metata(0.97)*	Bv

Table S8. Total list of OTUs and ASVs in the ITS1 data identified as *Mycena* by clustering into new OTUs at 3% similarity with the *Mycena* database. Thick dark lines separate delimitations of ASV groups that clustered together with a particular OTU from the ITS1 dataset. The bottom 8 ASVs did not cluster together with any OTUs. For sequences that did not cluster together with any named species in the *Mycena* database ("M.sp_[epithet](number)") and thus could not be identified to the species level, species epithet followed by number in parentheses denote sequence similarity to its most similar species in the database. For all OTUs/ASV, only plant hosts where at least 1% of the reads in at least one sample represents the particular OTU/ASV are listed under "Host plant" columns. "None (>1%)" then means that no hosts met this criterion.
Host plant abbreviations: Bv=*Bistorta vivipara*, Do=*Dryas octopetala*, Sp=*Salix polaris*.Mycena abbreviations: M.strob/aur= *M.strobiluroides/aurantiomarginata*, M.gal/meg=*M.galericulata/megaspora,* M.alb/oli/citr= *M.albidolilacea/olivaceomarginata/citrinomarginata*.

ITS2 OTUs	***Mycena* species identification**	**Host plant**	**ITS2 ASVs**	***Mycena* species identification**	**Host plant**
OTU_232	*M.aciculata*	Bp	ASV_348	*M.aciculata*	Aa
OTU_73	*M.alb/oli/citr*	Bp,Ct	ASV_115	*M.alb/oli/citr1*	Ct
-	-	-	ASV_548	*M.alb/oli/citr2*	None (>1%)
-	-	-	ASV_561	*M.alb/oli/citr3*	Bp
-	-	-	ASV_1562	*M.alb/oli/citr4*	None (>1%)
OTU_358	*M.alexandri*	None (>1%)	ASV_698	*M.alexandri1*	None (>1%)
-	-	-	ASV_770	*M.alexandri2*	None (>1%)
OTU_194	*M.amicta*	Bp	ASV_300	*M.amicta1*	Bp
-	-	-	ASV_697	*M.amicta2*	None (>1%)
OTU_20	*M.cinerella*	Aa,Au,Bn,Bp,Sh	ASV_130	*M.cinerella1*	Aa,Au,Sh
-	-	-	ASV_31	*M.cinerella2*	Bp
OTU_4	*M.epipterygia(OTU1)*	Aa,Au,Bn,Bp,Ct	ASV_7	*M.epipterygia1*	Ct
-	-	-	ASV_9	*M.epipterygia2*	Ct
-	-	-	ASV_63	*M.epipterygia3*	Aa,Au,Bn,Bp
-	-	-	ASV_16	*M.epipterygia4*	Aa,Au,Bn

			9		
-	-		ASV_179	*M.epipterygia5*	Aa,Au
OTU_883	*M.epipterygia(OTU2)*	None (>1%)	ASV_1577	*M.epipterygia6*	None (>1%)
OTU_400	*M.gal/meg*	None (>1%)	ASV_788	*M.gal/meg*	Ct
OTU_10	*M.galopus*	Aa,Au,Bn,Bp,Sh	ASV_114	*M.galopus1*	Aa,Au,Bn
-	-	-	ASV_16	*M.galopus2*	None (>1%)
-	-	-	ASV_25	*M.galopus3*	Ct
OTU_185	*M.latifolia*	Bp	ASV_1154	*M.latifolia1*	None (>1%)
-	-	-	ASV_267	*M.latifolia2*	Bp
OTU_6	*M.leptocephala*	Aa,Au,Bn,Bp,Ct,Sh	ASV_15	*M.leptocephala1*	Bp,Ct
-	-	-	ASV_113	*M.leptocephala2*	None (>1%)
-	-	-	ASV_149	*M.leptocephala3*	Bp
OTU_17	*M.metata*	Aa,Au,Bn,Bp,Ct,Sh	ASV_58	*M.metata1*	Ct
-	-	-	ASV_87	*M.metata2*	Ct
-	-	-	ASV_95	*M.metata3*	Aa,Au,Bn,Sh
-	-	-	ASV_177	*M.metata4*	Aa,Au,Bn,Sh
-	-	-	ASV_195	*M.metata5*	Bn,Ct
-	-	-	ASV_203	*M.metata6*	Bp
OTU_33	*M.pasvikensis*	Bp,Ct	ASV_85	*M.pasvikensis1*	Ct
-	-	-	ASV_109	*M.pasvikensis2*	Ct
-	-	-	ASV_783	*M.pasvikensis3*	Bp
-	-	-	ASV_577	*M.rebaudengoi*	Bp
OTU_948	*M.rubromarginata*	None (>1%)	ASV_1492	*M.rubromarginata*	None (>1%)
OTU_13	*M.sanguinolenta*	Au,Bn,Bp,Ps,Sh	ASV_26	*M.sanguinolenta1*	None (>1%)
-	-	-	ASV_49	*M.sanguinolenta2*	Au
OTU_743	*M.septentrionalis*	None (>1%)	ASV_1325	*M.septentrionalis*	None (>1%)

OTU_536	*M.capillaripes*	None (>1%)	ASV_511	*M.capillaripes*	Au
OTU_127	*M.strob/aur*	Bp,Ct	ASV_222	*M.strob/aur1*	Ct
-	-	-	ASV_688	*M.strob/aur2*	Bp
OTU_139	*M.stylobates*	Bp,Ct	ASV_354	*M.stylobates1*	None (>1%)
-	-	-	ASV_626	*M.stylobates2*	None (>1%)
-	-	-	ASV_801	*M.stylobates3*	Bp
-	-	-	ASV_927	*M.stylobates4*	Ct
OTU_723	*M.sp. flos-nivum(0.98)*	Bp	ASV_1246	*M.sp. flos-nivum(0.98)*	Bp
OTU_1061	*M.sp_subcana(0.97)*	None (>1%)		(No corresponding Mycena-ASVs)	
NA	(No corresponding Mycena-OTU)	NA	ASV_186	*M.sp1*	Au
NA	(No corresponding Mycena-OTU)	NA	ASV_223	*M.sp2*	Bp
NA	(No corresponding Mycena-OTU)	NA	ASV_483	*M.sp3*	Au
NA	(No corresponding Mycena-OTU)	NA	ASV_238	*M.abramsii1*	Ct
NA	(No corresponding Mycena-OTU)	NA	ASV_502	*M.abramsii2*	None (>1%)
NA	(No corresponding Mycena-OTU)	NA	ASV_1402	*M.clavicularis1*	None (>1%)
NA	(No corresponding Mycena-OTU)	NA	ASV_187	*M.clavicularis2*	Au
NA	(No corresponding Mycena-OTU)	NA	ASV_327	*M.concolor*	None (>1%)

Table S9. Total list of OTUs and ASVs in the ITS2 data identified as *Mycena* by clustering into new OTUs at 3% similarity with the *Mycena* database. Thick dark lines separate delimitations of ASV groups that clustered together with the particular OTU from the ITS2 dataset. The bottom 8 ASVs did not cluster together with any OTUs. For sequences that did not cluster together with any named species in the *Mycena*

database ("M.sp_[epithet](number)") and thus could not be identified to the species level, species epithet followed by number in parentheses denote sequence similarity to its most similar species in the database. For all OTUs/ASV, only plant hosts where at least 1% of the reads in at least one sample represents the particular OTU/ASV are listed under "Host plant" columns. "None (>1%)" then means that no hosts met this criterion. Host plant abbreviations: Aa=*Arctostaphylos alpine*, Au=*A. uva-ursi*, Bn=*Betula nana*, Bp=*B.pendula*, Ct=*Cassiope tetragona*.Ps=*Pinus sylvestris*, Sh=*Salix herbacea*. Mycena abbreviations: M.gal/meg=*M.galericulata/megaspora,* M.alb/oli/citr= *M.albidolilacea/olivaceomarginata/citrinomarginata*.

Pairwise Comparison - *Mycena* infection level	**difference**	**p-value**	**signif.**	**LCL**	**UCL**
B.vivipara - D.octopetala	-0.12511525	0.0000	***	-0.16518000	-0.08505050
B.vivipara - S.polaris	-0.14247594	0.0000	***	-0.18441846	-0.10053342
D.octopetala - S.polaris	-0.01736069	0.7533		-0.07422727	0.03950589
Pairwise Comparison -species richness at 97% cov	**difference**	**p-value**	**signif.**	**LCL**	**UCL**
B.vivipara - D.octopetala	0.1947128	0.9924		-3.697995	4.087421
B.vivipara - S.polaris	-0.1377645	0.9965		-4.212917	3.937388
D.octopetala - S.polaris	-0.3324773	0.9890		-5.857658	5.192703

Table S10. ITS1 data comparisons of *Mycena* infection load (top) and 97% coverage-based species richness (bottom) using Scheffes test for correction for multiple comparisons. Each component is a matrix with differences in observed means, LCL and UCL the lower/upper end point of the interval. Significant P-values (corrected for multiple comparisons) in bold, with asterisks *,** and *** denoting 0.05,0.01 and 0.001 levels.

Pairwise Comparison - *Mycena* infection level	**difference**	**p-value**	**signif.**	**LCL**	**UCL**
A.alpine - A.uva-ursi	-0.0087233685	1.0000		-0.14649037	0.12904364
A.alpine - B.nana	-0.1280569193	0.4426		-0.32232169	0.06620785
A.alpine - B.pendula	-0.1760051850	**0.0033**	**	-0.31327687	-0.03873350
A.alpine - C.tetragona	-0.2300524341	**0.0011**	**	-0.39724893	-0.06285594
A.alpine - P.sylvestris	0.0916919285	0.4902		-0.05275089	0.23613474
A.alpine - S.herbacea	-0.0006946679	1.0000		-0.20252119	0.20113185
A.uva-ursi - B.nana	-0.1193335508	0.2334		-0.27156018	0.03289308
A.uva-ursi - B.pendula	-0.1672818165	**0.0000**	***	-0.23268567	-0.10187797
A.uva-ursi - C.tetragona	-0.2213290656	**0.0000**	***	-0.33703911	-0.10561902
A.uva-ursi - P.sylvestris	0.1004152970	**0.0039**	**	0.02105615	0.17977444

A.uva-ursi - S.herbacea	0.0080287006	1.0000		-0.15373684	0.16979424
B.nana - B.pendula	-0.0479482656	0.9657		-0.19972678	0.10383024
B.nana - C.tetragona	-0.1019955148	0.6220		-0.28129378	0.07730275
B.nana - P.sylvestris	0.2197488478	**0.0010**	***	0.06145505	0.37804265
B.nana - S.herbacea	0.1273622515	0.5580		-0.08459799	0.33932249
B.pendula - C.tetragona	-0.0540472491	0.8033		-0.16916711	0.06107261
B.pendula - P.sylvestris	0.2676971135	**0.0000**	***	0.18920098	0.34619325
B.pendula - S.herbacea	0.1753105171	**0.0235**	*	0.01396660	0.33665443
C.tetragona - P.sylvestris	0.3217443626	**0.0000**	***	0.19816122	0.44532751
C.tetragona - S.herbacea	0.2293577662	**0.0061**	**	0.04189308	0.41682246
P.sylvestris - S.herbacea	-0.0923865964	0.6560		-0.25987412	0.07510093
Pairwise Comparison -species richness at 97% cov	**difference**	**p-value**	**signif.**	**LCL**	**UCL**
A.alpine - A.uva-ursi	21.5162684	0.108		3.094243 3	9.938294
A.alpine - B.nana	9.2362750	0.9396		-16.740558 3	5.213108
A.alpine - B.pendula	5.7823198	0.9662		-12.573473 2	4.138112
A.alpine - C.tetragona	46.7560333	0.0	***	24.398735 6	9.113332
A.alpine - P.sylvestris	58.5593634	0.0	***	39.244657 7	7.874070
A.alpine - S.herbacea	6.7373286	0.9897		-20.250652 3	3.725309
A.uva-ursi - B.nana	-12.2799934	0.5532		-32.635542	8.075555
A.uva-ursi - B.pendula	-15.7339487	0.0	***	-24.479667 -	6.988231
A.uva-ursi - C.tetragona	25.2397649	0.0	***	9.767168 4	0.712362
A.uva-ursi - P.sylvestris	37.0430950	0.0	***	26.431293 4	7.654897
A.uva-ursi - S.herbacea	-14.7789398	0.3972		-36.410019	6.852139
B.nana - B.pendula	-3.4539552	0.9988		-23.749581 1	6.841671
B.nana - C.tetragona	37.5197583	0.001	***	13.544227 6	1.495290
B.nana - P.sylvestris	49.3230884	0.0	***	28.156246 7	0.489930
B.nana - S.herbacea	-2.4989464 1.	1.0		-30.841995 2	5.844102
B.pendula - C.tetragona	40.9737136	0.0	***	25.580035 5	6.367393
B.pendula - P.sylvestris	52.7770437	0.0	***	42.280642 6	3.273445
B.pendula - S.herbacea	0.9550088	1.0		-20.619691 2	2.529708
C.tetragona - P.sylvestris	11.8033301	0.3418		-4.722048 2	8.328708
C.tetragona - S.herbacea	-40.0187048	0.0	***	-65.086240 - 1	4.951169
P.sylvestris - S.herbacea	-51.8220348	0.0	***	-74.218249 - 2	9.425820

Table S11. ITS2 data comparisons of *Mycena* infection load (top) and 97% coverage-based species richness (bottom) using Scheffes test for correction for multiple comparisons. Each component is a matrix with differences in observed means, LCL and UCL the lower/upper end point of the interval. Significant P-values (corrected for multiple comparisons) in bold, with asterisks *,** and *** denoting 0.05,0.01 and 0.001 levels.

Environmental parameter	**R^2**	**P-value**
Precipitation Seasonality	-0.003311	0.953
Mean Diurnal Range	-0.003268	0.8988
Min_Temperature_of_Coldest_Month	-0.002958	0.7411
Max_Temperature_of_Warmest_Month	-0.002869	0.7124
Precipitation_of_Driest_Quarter	-0.002614	0.645
Precipitation_of_Wettest_Quarter	-0.001026	0.4067
Temperature_Annual_Range	-0.002818	0.6974
Precipitation_of_Wettest_Month	-0.00216	0.555
Mean_Temperature_of_Coldest_Quarter	-0.003223	0.8633
Mean_Temperature_of_Warmest_Quarter	-0.003283	0.9137
Annual mean preciitation	-0.001208	0.426
Annual mean temperatue	-0.002059	0.5383
Latitude	-0.002843	0.7911
Longitude	0.0007986	0.2621

Table S12. Environmental correlation tests for B. vivipara with *Mycena* infection levels (% reads of total).

Response d15N, BIC min., genus-place-%N					
RSquare	0,571				
RSquare Adj	0,561				
Root Mean Square Error	2,978				
Mean of Response	0,698				
Observations (or Sum Wgts)	253				
Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Ratio	
Model	6	2903,09	483,85	54,56	
Error	246	2181,44	8,87		Prob > F
C. Total	252	5084,53		<.0001	
Parameter Estimates					
Term	%Variance	Estimate	Std Error	Prob >|t|	VIF
Intercept	--	1,53	0,26	<.0001	--
Place{Gribskov&Solhomfjell-Finse&Vettakollen&Svalbard}	8,4	-1,26	0,19	<.0001	1,03

Type_genus{Trametes&Microcephale&Pluteus&Naucoria&Hygrophoropsis&Cystoderma&Lycoperdon&Rhodocollybia&Calvatia&Mycena&Galerina&Amanita&Helvella&Hypholoma-Lepista&Lactarius&Laccaria&Collybia&Ramaria&Russula&Inocybe&Cortinarius&Suillus&Rhizopogon&Hydnellum&Agaricus&Tricholoma&Hydnum}	41,1	-3,94	0,27	<.0001	1,90
Type_genus{Trametes&Microcephale&Pluteus&Naucoria&Hygrophoropsis&Cystoderma-Lycoperdon&Rhodocollybia&Calvatia&Mycena&Galerina&Amanita&Helvella&Hypholoma}	3,8	-1,71	0,38	<.0001	1,65
Type_genus{Lycoperdon&Rhodocollybia&Calvatia&Mycena-Galerina&Amanita&Helvella&Hypholoma}	1,7	-0,82	0,27	0,0031	1,10
Effect Tests					
Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Place{Gribskov&Solhomfjell-Finse&Vettakollen&Svalbard}	1	1	384,43	43,35	<.0001
Place{Gribskov-Solhomfjell}	1	1	48,95	5,52	0,0196
Type_genus{Trametes&Microcephale&Pluteus&Naucoria&Hygrophoropsis&Cystoderma&Lycoperdon&Rhodocollybia&Calvatia&Mycena&Galerina&Amanita&Helvella&Hypholoma-Lepista&Lactarius&Laccaria&Collybia&Ramaria&Russula&Inocybe&Cortinarius&Suillus&Rhizopogon&Hydnellum&Agaricus&Tricholoma&Hydnum}	1	1	1884,77	212,54	<.0001
Type_genus{Trametes&Microcephale&Pluteus&Naucoria&Hygrophoropsis&Cystoderma-Lycoperdon&Rhodocollybia&Calvatia&Mycena&Galerina&Amanita&Helvella&Hypholoma}	1	1	176,10	19,86	<.0001

Table S13. Results from the stepwise regression models on the ^{15}N isotope data.

Response d13C					
RSquare	0,672				
RSquare Adj	0,659				
Root Mean Square Error	1,05				

Mean of Response	-24,73				
Observations (or Sum Wgts)	252				
Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Ratio	
Model	9	548,2	60,9	55,0	
Error	242	268,1	1,1		Prob > F
C. Total	251	816,4		<.0001	
Parameter Estimates					
Term	%Variance	Estimate	Std Error	Prob>|t|	VIF
Intercept	--	-25,66	0,26	<.0001	--
Place{Svalbard&Finse&Gribskov-Solhomfjell&Vettakollen}	10,3	-0,53	0,07	<.0001	1,1
Place{Svalbard-Finse&Gribskov}	1,4	-0,25	0,09	0,0075	1,1
%N	2,8	0,175	0,045	0,0001	1,3
Type_genus**{Lactarius&Russula&Helvella&Naucoria&Amanita&Tricholoma&Laccaria&Cortinarius**&*Inocybe&Galerina&Microcephale-Hydnum&Pluteus&Lycoperdon&Hydnellum&Cystoderma*&Rhizopogon&Mycena&Calvatia&Lepista&Rhodocollybia&Ramaria&**Hypholoma&Suillus&Trametes&Agaricus&Collybia&Hygrophoropsis**}	30,6	-1,15	0,09	<.0001	1,7
Type_genus{Lactarius&Russula&Helvella&Naucoria&Amanita&Tricholoma&Laccaria&Cortinarius-Inocybe&Galerina&Microcephale}	3,8	-0,58	0,13	<.0001	1,3
Type_genus{Amanita&Tricholoma-Laccaria&Cortinarius}	1,2	-0,49	0,19	0,0119	1,1
Type_genus{Hydnum&Pluteus&Lycoperdon&Hydnellum&Cystoderma&Rhizopogon&Mycena&Calvatia&Lepista&Rhodocollybia&Ramaria-Hypholoma&Suillus&Trametes&Agaricus&Collybia&Hygrophoropsis}	11,6	-0,97	0,12	<.0001	1,7
Type_genus{Hydnum&Pluteus&Lycoperdon&Hydnellum&Cystoderma-Rhizopogon&Mycena&Calvatia&Lepista&Rhodocollybia&Ramaria}	2,6	-0,55	0,15	0,0003	1,8
Type_genus{Hypholoma&Suillus-Trametes&Agaricus&Collybia&Hygrophoropsis}	1,5	-0,56	0,20	0,0048	1,1
Type_genus**{Lactarius&Russula&Helvella&Naucoria&Amanita&Tricholoma&Laccaria&Cortinarius**&*Inocybe&Galerina&Microcephale-Hydnum&Pluteus&Lycoperdon&Hydnell*	30,6	-1,15	0,09	<.0001	1,7

um&Cystoderma&Rhizopogon&Mycena&Calvatia&Lepista&Rhodocollybia&Ramaria&**Hypholoma&Suillus&Trametes&Agaricus&Collybia&Hygrophoropsis**}					
Effect Tests					
Source	Nparm	%Variance	Sum of Squares	F Ratio	Prob > F
Place{Svalbard&Finse&Gribskov-Solhomfjell&Vettakollen}	1	10,3	60,4	54,5	<.0001
Place{Svalbard-Finse&Gribskov}	1	1,4	8,1	7,3	0,0075
%N	1	2,8	16,6	15,0	0,0001
Type_genus{Lactarius&Russula&Helvella&Naucoria&Amanita&Tricholoma&Laccaria&Cortinarius&Inocybe&Galerina&Microcephale-Hydnum&Pluteus&Lycoperdon&Hydnellum&Cystoderma&Rhizopogon&Mycena&Calvatia&Lepista&Rhodocollybia&Ramaria&Hypholoma&Suillus&Trametes&Agaricus&Collybia&Hygrophoropsis}	1	30,6	178,8	161,4	<.0001
Type_genus{Lactarius&Russula&Helvella&Naucoria&Amanita&Tricholoma&Laccaria&Cortinarius-Inocybe&Galerina&Microcephale}	1	3,8	22,4	20,2	<.0001
Type_genus{Amanita&Tricholoma-Laccaria&Cortinarius}	1	1,2	7,1	6,4	0,0119
Type_genus{Hydnum&Pluteus&Lycoperdon&Hydnellum&Cystoderma&Rhizopogon&Mycena&Calvatia&Lepista&Rhodocollybia&Ramaria-Hypholoma&Suillus&Trametes&Agaricus&Collybia&Hygrophoropsis}	1	11,6	67,6	61,1	<.0001
Type_genus{Hydnum&Pluteus&Lycoperdon&Hydnellum&Cystoderma-Rhizopogon&Mycena&Calvatia&Lepista&Rhodocollybia&Ramaria}	1	2,6	15,2	13,7	0,0003
Type_genus{Hypholoma&Suillus-Trametes&Agaricus&Collybia&Hygrophoropsis}	1	1,5	9,0	8,1	0,0048

Table S14. Results from the stepwise regression models on the ^{13}C isotope data.

GenBank Accession number	**Genbank species name**	**Probable identification**
GU234118.1	*Mycena filopes*	*Mycena metata*
JN021065.2	*M.cf.purpureofusca*	*not M.purpureofusca*
JQ676208.1	*M.cf.purpureofusca*	*not M. purpureofusca*
JF908390.1	*M. vitilis*	*M. sanguinolenta*
DQ384588.1	*M. vitilis*	*not M. vitilis.*
MH856158	*M.galopus*	*M. epipterygia*

GU234146	*M. cinerella*	*M. strobilinoidea.*
UDB015275	*M. leptocephala*	*not M. leptocephala*
JF908471	*M. rosella*	*not M.rosella.*
JF908473	*M. rosella*	*M.rosea*
KX449424	*M. rosella*	*M.rosea*
JF908487	*M. rosella*	*M.rosea*
JF908488	*M. rosella*	*M.rosea*
KR673440.1	*M. arcangeliana*	*not M.arcangeliana*

Table S15. 14 full-length ITS sequences from GenBank that were deemed as misidentified, as they were either single sequences or multiple sequences from one source that showed less than 95% similarity with several other sequences from supposedly conspecific collections and/or fell systematically with a cluster of multiple sequences from another species.

Previously published datasets	**Source for downloading**
Davey et al. (2015)	**NCBI (SRP006874).**
Mundra et al. (2015)	**Dryad (doi:10.5061/dryad.2343k).**
Yao et al. (2013)	**Dryad (doi:10.5061/dryad.216tp).**
Lorberau et al. (2017)	**Dryad (doi:10.5061/dryad.49dn0).**
Botnen et al. (2014)	**Dryad (doi.org/10.5061/dryad.45pv2)**
Botnen et al. (2019)	**Dryad (doi.org/10.5061/ dryad.n42dd20.)**
Blaalid et al. (2012)	**European Nucleotide Archive; accession no. SRP006836.1**
Blaalid et al. (2014):	**NCBI short read archive, accession no. SRP006836**
Jarvis et al. (2015):	**NCBI short read archive, accession no. (PRJNA253816).**
New data	**Source for downloading**
B. pubescens	**NCBI (archive PRJNA706760)**
***A. alpinus, A.uva-ursi, B.nana, S. herbacea*.**	**Zenodo Digital identifier: 10.5281/zenodo.4545738**

Table S16. Data sources for the 454/Illumina data.

Sequence	**Organism**	**Specimen-Voucher**	**FINBOL-no.**
MW540654	Mycena aff. polygramma	H6029504	FIMY001-12
MW540655	Phloeomana sp.	H6029500	FIMY005-12
MW540656	Mycena niveipes	H6030712	FIMY016-12
MW540657	Mycena aurantiomarginata	H6032424	FIMY020-12
MW540658	Mycena pearsoniana	H6032595	FIMY022-12
MW540659	Mycena abramsii	H6032598	FIMY025-12
MW540660	Mycena aff. pearsoniana	H6032605	FIMY032-12
MW540662	Mycena galericulata	H6032610	FIMY035-12
MW540663	Mycena galopus	H6032614	FIMY037-12
MW540664	Mycena tintinnabulum	H6008524	FIMY041-12

MW540665	Mycena silvae-nigrae	H6004009	FIMY046-12
MW540666	Mycena aff. niveipes	H6033550	FIMY047-12
MW540667	Mycena plumipes	H6033551	FIMY052-12
MW540668	Mycena latifolia	H6033552	FIMY053-12
MW540669	Mycena sanguinolenta	H6033553	FIMY054-12
MW540670	Mycena cinerella	H6018219	FIMY055-12
MW540671	Mycena leptocephala	H6029112	FIMY064-13
MW540672	Mycena lammiensis	H6008503	FIMY068-13
MW540674	Mycena clavicularis	H6036816	FIMY070-13
MW540675	Mycena adscendens	H6036818	FIMY073-13
MW540678	Mycena mucor	H6036830	FIMY075-13
MW540679	Mycena galopus	H6036831	FIMY077-13
MW540680	Mycena megaspora	H6036833	FIMY081-13
MW540681	Mycena leptocephala	H6036834	FIMY082-13
MW540682	Mycena alexandri	H6036838	FIMY089-13
MW540683	Mycena vulgaris	H6036839	FIMY090-13
MW540686	Mycena haematopus	H6036847	FIMY092-13
MW540687	Mycena amicta	H6036851	FIMY093-13
MW540688	Mycena aetites	H6036854	FIMY097-13
MW540689	Mycena erubescens	H6036859	FIMY098-13
MW540692	Mycena filopes	H6036864	FIMY100-13
MW540693	Mycena septentrionalis	H6036865	FIMY103-13
MW540694	Mycena olivaceomarginata	H6036868	FIMY106-13
MW540695	Mycena laevigata	H6036869	FIMY110-13
MW540696	Mycena cyanorrhiza	J24082010	FIMY113-13
MW540697	Mycena rosea	H6008519	FIMY118-13
MW540698	Mycena zephirus	H6038555	FIMY119-13
MW540699	Mycena tintinnabulum	H6012651	FIMY122-13
MW540700	Mycena aff. rubromarginata	H6018205	FIMY123-13
MW540701	Mycena pterigena	H6038561	FIMY124-13
MW540702	Mycena rosella	H6039057	FIMY127-13
MW540703	Mycena polygramma	H6039058	FIMY128-13
MW540704	Mycena tubaroides	H6039061	FIMY129-13
MW540705	Mycena viridimarginata	H6039063	FIMY137-13
MW540706	Mycena vitilis	H6039064	FIMY143-13
MW540708	Mycena rubromarginata	H6039068	FIMY151-13
MW540709	Mycena polyadelpha	H6039077	FIMY157-13
MW540710	Mycena pura	H6039078	FIMY162-13
MW540711	Mycena polygramma	H6039079	FIMY164-13
MW540712	Mycena pura	H6039083	FIMY165-13
MW540713	Mycena mirata	TUR168621	FIMY168-13
MW540714	Mycena longiseta	TUR173933	FIMY170-13
MW540715	Mycena simia	TUR157134	FIMY171-13

MW540716	Mycena cf. rapiolens	TUR171435	FIMY173-13
MW540717	Mycena picta	TUR194167	FIMY175-13
MW540718	Mycena aff. algeriensis	TUR182370	FIMY184-13
MW540720	Mycena rorida	TUR136996	FIMY185-13
MW540722	Mycena maculata	TUR157124	FIMY186-13
MW540723	Mycena tristis	TUR168636	FIMY190-13
MW540725	Mycena rebaudengoi	F073581	FIMY196-14
MW540726	Mycena aff. pasvikensis	H6045675	FIMY197-14
MW540727	Mycena aff. epipterygia	H6045676	FIMY199-14
MW540728	Mycena stylobates	F073091	FIMY200-14
MW540729	Mycena capillaripes	F074461	FIMY201-14
MW540730	Mycena cf. concolor	F018012	FIMY203-14
MW540731	Mycena olivaceomarginata	F076595	FIMY204-14
MW540732	Mycena cf. mucolor	F033378	FIMY209-14
MW540734	Mycena cf. cineroides	F043625	FIMY214-14
MW540736	Mycena epipterygia	H6050643	FIMY215-14
MW540737	Mycena cf. epipterygia	H6045797	FIMY218-14
MW540738	Mycena metata	H6057234	FIMY224-14
MW540739	Mycena arcangeliana	TUR148293	FIMY227-14
MW540740	Mycena pelianthina	TUR177351	FIMY243-14
MW540741	Mycena aff. meliigena	H6057961	FIMY244-14
MW540742	Mycena aff. alexandri	TUR181346	
MW576881	Mycena rosella	CBHHK_SolIII	
MW576882	Mycena rosella	CBHHK_SolII	
MW576883	Mycena galopus	CBHHK_SolI	
MW576884	Mycena rosella	CBHHK_SolV	
MW576885	Mycena metata	CBHHK_Sol_IV	
MW576886	Mycena galopus	CBHHK_Telemark2	
MW576887	Mycena vitilis	CBHHK_100	
MW576888	Mycena galopus	CBHHK_102	
MW576890	Mycena metata	CBHHK_103	
MW576891	Mycena galopus	CBHHK_105	
MW576892	Mycena metata	CBHHK_107	
MW576893	Mycena metata	CBHHK_110	
MW576894	Mycena galopus	CBHHK_112	
MW576895	Mycena galopus	CBHHK_117	
MW576896	Mycena metata	CBHHK_118	
MW576897	Mycena metata	CBHHK_123	
MW576898	Mycena epipterygia	CBHHK_124	
MW576899	Mycena metata	CBHHK_125	
MW576900	Mycena metata	CBHHK_126	
MW576901	Mycena galopus	CBHHK_130	
MW576902	Mycena galopus	CBHHK_133	
MW576903	Mycena epipterygia	CBHHK_136	

MW576904	Mycena epipterygia	CBHHK_139
MW576905	Mycena maculata	CBHHK_140m
MW576906	Mycena metata	CBHHK_143
MW576907	Mycena vulgaris	CBHHK_146
MW576908	Mycena epipterygia	CBHHK_147
MW576909	Mycena vitilis	CBHHK_149
MW576910	Mycena metata	CBHHK_151m
MW576911	Mycena galericulata	CBHHK_152
MW576912	Mycena metata	CBHHK_154m
MW576913	Mycena rosella	CBHHK_155m
MW576914	Mycena galericulata	CBHHK_161
MW576915	Mycena crocata	CBHHK_163
MW576916	Mycena crocata	CBHHK_164m
MW576917	Mycena vitilis	CBHHK_166m
MW576918	Mycena vitilis	CBHHK_167
MW576919	Mycena vitilis	CBHHK_168m
MW576920	Mycena metata	CBHHK_170
MW576921	Mycena vitilis	CBHHK_171
MW576922	Mycena metata	CBHHK_172m
MW576923	Mycena belliae	CBHHK_174m
MW576924	Mycena sanguinolenta	CBHHK_176m
MW576925	Mycena metata	CBHHK_178
MW576926	Mycena vitilis	CBHHK_179m
MW576927	Mycena metata	CBHHK_182m
MW576928	Mycena crocata	CBHHK_184m
MW576929	Mycena metata	CBHHK_198
MW576930	Mycena metata	CBHHK_28
MW576931	Mycena vulgaris	CBHHK_31
MW576932	Mycena metata	CBHHK_32
MW576933	Mycena vitilis	CBHHK_34
MW576934	Mycena rosella	CBHHK_45
MW576935	Mycena galericulata	CBHHK_50
MW576936	Mycena galericulata	CBHHK_51
MW576937	Mycena rosella	CBHHK_53
MW576938	Mycena metata	CBHHK_61
MW576939	Mycena galopus	CBHHK_64m
MW576940	Mycena rosella	CBHHK_65
MW576941	Mycena galopus	CBHHK_69
MW576942	Mycena metata	CBHHK_70
MW576943	Mycena metata	CBHHK_73
MW576944	Mycena sanguinolenta	CBHHK_80
MW576945	Mycena metata	CBHHK_81
MW576946	Mycena vitilis	CBHHK_85
MW576947	Mycena metata	CBHHK_88
MW576948	Mycena amicta	JBFRANK_9232

MT153145	Mycena rorida	JBFRANK_9284
MW576950	Mycena capillaripes	JBFRANK_9286
MW576951	Mycena metata	CBHHK_93
MW576952	Mycena vitilis	CBHHK_94
MW576953	Mycena rosella	CBHHK_95
MW576954	Mycena epipterygia	CBHHK_96
MW576955	Mycena galopus	JBFRANK_9904
MW576956	Mycena vitilis	CBHHK_99
MW576957	Mycena cf.alexandri	CBHHK_A171
AB512311	Mycena sanguinolenta	
AB512312	Mycena chlorophos	
AF335444	Mycena aff.murina	
AY805614	Mycena galopus	
MT153137	Mycena latifolia	
MT153132	Mycena filopes	
MT153125	Mycena albidolilacea	
MT153149	Mycena vulgaris	
MT153146	Mycena rosella	
MT153144	Mycena rebaudengoi	
MT153147	Mycena sanguinolenta	
MT153142	Mycena polygramma	
MT153131	Mycena epipterygia	
MT153140	Mycena metata	
MT153133	Mycena galericulata	
MT153148	Mycena vitilis	
MT153128	Mycena belliae	
MT153130	Mycena crocata	
MT153139	Mycena maculata	
MT153136	Mycena haematopus	
MT153143	Mycena pura	
MT153126	Mycena alexandri	
DQ384586	Mycena cf.epipterygia	
DQ404392	Mycena galericulata	
DQ490643	Mycena aff.pura	
DQ490645	Mycena amicta	
DQ494677	Mycena plumbea	
EF530930	Mycena maculata	
EF530939	Mycena rubromarginata	
EF530946	Mycena epipterygia.var.epipterygia	
EU486451	Mycena epipterygia	
EU517504	Mycena pura	
EU517505	Mycena pura	
EU517506	Mycena pura	

EU669223	Mycena tenax
EU669224	Mycena tenax
EU697245	Mycena monticola
EU834204	Mycena cf.quiniaultensis
EU846251	Mycena tenax
EU846300	Mycena hudsoniana
FJ596760	Mycena rorida
FJ596761	Mycena rorida
FJ596764	Mycena sanguinolenta
FJ596884	Mycena epipterygia
FJ596888	Mycena semivestipes
FN394560	Mycena dura
FN394562	Mycena pura
FN394610	Mycena pura
FN394614	Mycena pearsoniana
FN394618	Mycena diosma
GU054133	Mycena chlorophos
GU062319	Mycena galericulata
GU234095	Mycena atroalboides
GU234111	Mycena citrinomarginata
GU234112	Mycena olivaceomarginata
GU234119	Mycena olivaceomarginata
GU234138	Mycena simia
GU234150	Mycena citrinomarginata
GU234165	Mycena pura
MT153141	Mycena olivaceomarginata
MT153138	Mycena leptocephala
HM240533	Mycena epipterygia
HM240534	Mycena galopus
HM240535	Mycena pura
HM240536	Mycena rubromarginata
HM240537	Mycena rubromarginata
HQ604765	Mycena purpureofusca
HQ604766	Mycena purpureofusca
HQ604767	Mycena purpureofusca
HQ604768	Mycena haematopus
HQ604771	Mycena epipterygia
HQ604772	Mycena epipterygia
HQ604774	Mycena tenerrima
JF340273	Mycena galericulata
JF519108	Mycena amicta
JF908366	Mycena corynephora

JF908367	Mycena corynephora
JF908368	Mycena corynephora
JF908369	Mycena corynephora
JF908370	Mycena sanguinolenta
JF908371	Mycena angusta
JF908372	Mycena rhamnicola
JF908374	Mycena belliae
JF908375	Mycena terena
JF908376	Mycena leaiana
JF908377	Mycena albidolilacea
JF908378	Mycena viridimarginata
JF908379	Mycena pelianthina
JF908380	Mycena pelianthina
JF908385	Mycena cyanorhiza
JF908386	Mycena pseudocorticola
JF908387	Mycena pseudocorticola
JF908388	Mycena supina
JF908389	Mycena supina
JF908391	Mycena renati
JF908392	Mycena strobilinoidea
JF908393	Mycena strobilinoidea
JF908394	Mycena amicta
JF908400	Mycena abramsii
JF908401	Mycena arcangeliana
JF908402	Mycena arcangeliana
JF908403	Mycena pura
JF908407	Mycena megaspora
JF908410	Mycena filopes
JF908415	Mycena citrinomarginata
JF908416	Mycena citrinomarginata
JF908417	Mycena diosma
JF908420	Mycena adscendens
JF908421	Mycena romagnesiana
JF908422	Mycena romagnesiana
JF908423	Mycena meliigena
JF908424	Mycena algeriensis
JF908425	Mycena algeriensis
JF908426	Mycena alnetorum
JF908427	Mycena calceata
JF908428	Mycena meliigena
JF908429	Mycena meliigena
JF908430	Mycena rubromarginata
JF908433	Mycena polygramma
JF908434	Mycena polygramma
JF908435	Mycena vulgaris

JF908439	Mycena stylobates
JF908440	Mycena strobilicola
JF908441	Mycena galericulata
JF908442	Mycena galericulata
JF908443	Mycena capillaris
JF908449	Mycena pura
JF908450	Mycena pura
JF908451	Mycena pura
JF908452	Mycena silvaenigrae
JF908453	Mycena silvaenigrae
JF908455	Mycena niveipes
JF908456	Mycena polyadelpha
JF908457	Mycena subcana
JF908458	Mycena epipterygia
JF908460	Mycena epipterygia
JF908461	Mycena zephirus
JF908462	Mycena zephirus
JF908463	Mycena pilosella
JF908465	Mycena valida
JF908466	Mycena clavicularis
JF908467	Mycena clavicularis
JF908469	Mycena seynesii
JF908470	Mycena seynesii
JF908472	Mycena pura
JF908473	Mycena rosea
JF908475	Mycena cupressina
JF908477	Mycena rebaudengoi
JF908478	Mycena juniperina
JF908479	Mycena aurantiomarginata
JF908480	Mycena albidorosea
JF908481	Mycena graminicola
JF908483	Mycena thymicola
JF908484	Mycena galopus
JF908485	Mycena latifolia
JF908486	Mycena rhamnicola
JF908487	Mycena rosea
JF908488	Mycena rosea
JF908490	Mycena albidoaquosa
JF908491	Mycena pachyderma
JF908492	Mycena crocata
JN182198	Mycena pearsoniana
JN182199	Mycena pearsoniana
JN182200	Mycena pearsoniana
JN182201	Mycena pearsoniana

JN182202	Mycena pura
JN198391	Mycena plumbea
JQ358808	Mycena laevigata
JQ358809	Mycena purpureofusca
JQ358810	Mycena rubromarginata
JQ364945	Mycena purpureofusca
JQ926166	Mycena galopus
JX297424	Mycena plumipes
JX297425	Mycena plumipes
JX297426	Mycena plumipes
JX297427	Mycena plumipes
JX310425	Mycena monticola
JX434650	Mycena cf.sanguinolenta
JX481737	Mycena deeptha
KC581347	Mycena pura
KC876328	Mycena silvaenigrae
KC965695	Mycena urania
KF007948	Mycena pura
KF010856	Mycena chlorophos
KF359604	Mycena silvaenigrae
KF537247	Mycena sinar
KF537248	Mycena cahaya
KF537249	Mycena sinar.var.tangkaisinar
KF537250	Mycena seminau
KF537251	Mycena sinar.var.tangkaisinar
KF537252	Mycena seminau
KF668293	Mycena galopus
KF668294	Mycena sanguinolenta
KF668310	Mycena haematopoda
KF692075	Mycena haematopus
KF913022	Mycena pura
KF913023	Mycena pura
KJ093496	Mycena aff.murina
KJ144653	Mycena aff.pura
KJ206965	Mycena chlorophos
KJ206966	Mycena noctilucens
KJ206967	Mycena chlorophos
KJ206968	Mycena chlorophos
KJ206969	Mycena chlorophos
KJ206970	Mycena chlorophos
KJ206971	Mycena chlorophos
KJ206972	Mycena chlorophos
KJ206973	Mycena chlorophos

KJ206974	Mycena chlorophos
KJ206975	Mycena illuminans
KJ206976	Mycena illuminans
KJ206980	Mycena illuminans
KJ206983	Mycena chlorophos
KJ206985	Mycena chlorophos
KJ206986	Mycena chlorophos
KJ609168	Mycena chlorophos
KJ705175	Mycena filopes
KJ705176	Mycena leaiana.var.leaiana
KJ705177	Mycena vulgaris
KJ705178	Mycena galericulata
KJ705179	Mycena robusta
KJ705180	Mycena citrinomarginata
KJ705181	Mycena haematopus
KJ705182	Mycena maculata
KJ705183	Mycena maculata
KJ705184	Mycena pura
KJ705186	Mycena pura
KJ705187	Mycena pura
KJ705188	Mycena amicta
KJ713981	Mycena pura
KJ831841	Mycena chlorophos
KM085362	Mycena galericulata
KM085398	Mycena alnetorum
KM282283	Mycena galericulata
KP406534	Mycena epipterygia
KP454009	Mycena rubromarginata
KP454034	Mycena epipterygia.var.lignicola
KR673438	Mycena arcangeliana
KR673481	Mycena abramsii
KR673599	Mycena galericulata
KR673702	Mycena haematopus
KT222190	Mycena dura
KT695316	Mycena haematopus
KT900140	Mycena adscendens
KT900141	Mycena adscendens
KT900142	Mycena adscendens
KT900143	Mycena adscendens
KT900144	Mycena alexandri
KT900145	Mycena alexandri
KT900146	Mycena cinerella_Aronsen051014

KU295552	Mycena alnetorum
KU516418	Mycena galopus
KU516419	Mycena galopus
KU516420	Mycena galopus
KU516421	Mycena galopus
KU518323	Mycena haematopus
KU861555	Mycena pasvikensis_AAronsen11111
KU861556	Mycena pasvikensis_AAronsen8612
KU861557	Mycena pasvikensis
KU861558	Mycena pasvikensis
KU861559	Mycena pasvikensis_AAronsen2814
KU861565	Mycena mucor_AAronsen5140914
KU861566	Mycena mucor_AAronsen7051113
KU861567	Mycena polyadelpha(AAronsen8261013)
KX010907	Mycena deformis
KX010908	Mycena globulispora
KX010909	Mycena oculisnymphae
KX010910	Mycena oculisnymphae
KX058336	Mycena plumbea
KX236103	Mycena maculata
KX449424	Mycena rosea
KX449443	Mycena inclinata
KX513844	Mycena bulliformis
KY352524	Mycena abramsii
KY681454	Mycena zephirus
KY744173	Mycena albiceps
KY950446	Mycena galericulata
LC314114	Mycena abramsii
LC373247	Mycena diosma
MF161203	Mycena haematopus
MF417759	Mycena citricolor
MF417760	Mycena citricolor
MF417761	Mycena citricolor
MF417762	Mycena citricolor

MF417763	Mycena citricolor
MF686517	Mycena haematopus
MF686520	Mycena leaiana
MF773619	Mycena haematopus
MF908474	Mycena maculata
MF926553	Mycena cf.cinerella
MF926554	Mycena cf.cinerella
MF943121	Mycena purpureofusca
MF955190	Mycena cf.pura
MF955191	Mycena cf.pura
MF955192	Mycena cf.pura
MF993026	Mycena indigotica
MG654739	Mycena citrinomarginata
MG654740	Mycena purpureofusca
MG654741	Mycena purpureofusca
MG654742	Mycena purpureofusca
MG654743	Mycena strobilinoidea
MG654744	Mycena strobilinoidea
MG719609	Mycena haematopus
MG719614	Mycena filopes
MG719769	Mycena plumbea
MG738261	Mycena haematopus
MG748570	Mycena niveipes
MG926696	Mycena globulispora
MG926697	Mycena globulispora
MG969987	Mycena citrinomarginata
MG969988	Mycena citrinomarginata
MH063433	Mycena indigotica
MH136830	Mycena alphitophora
MH136831	Mycena alphitophora
MH136832	Mycena corynephora
MH136833	Mycena corynephora
MH136834	Mycena corynephora
MH142010	Mycena haematopus
MH142012	Mycena haematopus
MH145355	Mycena amicta
MH380201	Mycena filopes
MH396626	Mycena abramsii
MH396627	Mycena abramsii
MH396628	Mycena abramsii
MH396629	Mycena abramsii
MH396630	Mycena epipterygia
MH396631	Mycena epipterygia
MH396632	Mycena epipterygia
MH396633	Mycena epipterygia

MH396634	Mycena filopes
MH396635	Mycena filopes
MH396636	Mycena metata
MH396637	Mycena metata
MH414547	Mycena aff.holoporphyra
MH414551	Mycena breviseta
MH414554	Mycena aff.discobasis
MH414555	Mycena aff.discobasis
MH414556	Mycena discogena
MH414557	Mycena lasiopus
MH414558	Mycena lasiopus
MH414562	Filoboletus_pallescens
MH414563	Filoboletus_pallescens
MH718251	Mycena polygramma
MH856225	Mycena aetites
MH856226	Mycena aetites
MH856227	Mycena olivaceomarginata
MH856228	Mycena olivaceomarginata
MH856229	Mycena olivaceomarginata
MH856231	Mycena maculata
MH856232	Mycena maculata
MH856233	Mycena maculata
MH856234	Mycena maculata
MH856235	Mycena polygramma
MH856236	Mycena polygramma
MH856237	Mycena polygramma
MH856238	Mycena polygramma
MH856239	Mycena polygramma
MH856240	Mycena vulgaris
MH856332	Mycena capillaripes
MH856333	Mycena cinerella
MH856334	Mycena olivascens
MH856335	Mycena rubromarginata
MH856336	Mycena rubromarginata
MH856337	Mycena rubromarginata
MH856338	Mycena rubromarginata
MH856339	Mycena zephirus
MH856340	Mycena zephirus
MH856341	Mycena zephirus
MH856655	Mycena amicta
MH856656	Mycena citrinomarginata
MH856657	Mycena

	aurantiomarginata
MH856658	Mycena renati
MH856661	Mycena flosnivium
MH856662	Mycena sanguinolenta
MH856663	Mycena xantholeuca
MH856664	Mycena xantholeuca
MH857183	Mycena amicta
MH857184	Mycena amicta
MH857186	Mycena flosnivium
MH857195	Mycena citrinomarginata
MH857196	Mycena citrinomarginata
MH857197	Mycena citrinomarginata
MH857198	Mycena citrinomarginata
MH857462	Mycena alcalina
MH857694	Mycena citricolor
MH861224	Mycena pura.var.pura
MH979290	Mycena leaiana
MK169369	Mycena epipterygia.var.lignicola
MK169370	Mycena overholtsii
MK290379	Mycena pura
MK307839	Mycena clavicularis
MK348517	Mycena cf.filopes
MK351700	Mycena galericulata
MK371751	Mycena strobilinoidea
MK474930	Mycena xantholeuca
MK474933	Mycena xantholeuca
MK478466	Mycena tenuispinosa
MK532829	Mycena inclinata
MK532830	Mycena niveipes
MK532831	Mycena pura
MK532832	Mycena pura
UDB001611	Mycena septentrionalis
UDB011532	Mycena rosea
UDB011648	Mycena renati
UDB011668	Mycena inclinata
UDB011702	Mycena sanguinolenta
UDB011703	Mycena vulgaris
UDB011771	Mycena plumipes
UDB011809	Mycena strobilinoidea
UDB011884	Mycena epipterygia
UDB015405	Mycena megaspora
UDB015412	Mycena metata
UDB015432	Mycena polygramma
UDB015495	Mycena galericulata

UDB015861	Mycena rosella
UDB016249	Mycena polyadelpha
UDB016258	Mycena mirata
UDB018159	Mycena stipata
UDB018200	Mycena zephirus
UDB019511	Mycena laevigata
UDB019514	Mycena capillaripes
UDB019554	Mycena meliigena
UDB023691	Mycena laevigata
UDB034828	Mycena leptocephala
UDB037953	Mycena maculata

Table S17. GenBank Accession numbers for the 576 sequences in the Mycena database. Voucher information for newly sequenced specimens in the 3rd column. FinBOL-numbers (4th column) are listed for those specimens sequenced for this project as part of the FinBOL (Finnish Barcode of Life)-project under the BOLD programme (Ratnasingham and Hebert, 2007).

Host species

Bistorta vivipara, *Salix polaris* and *Dryas octopetala* are all commonly found pioneer species in the Arctic and Alpine tundras, and known to host other root-associated fungi (Hesselman, 1900; Elven et al., 2005; Bjørbækmo et al., 2010; Botnen et al., 2014). *Dryas octopetala* and *S. polaris* are woody dwarf shrubs which may produce extensive root systems, including subterraneaous runners; *B. vivipara* is a herbaceous perennial with a less extensive root system which mainly reproduces asexually by bulbils.
As an ericoid plant of the High Arctic, *Cassiope tetragona* has traditionally been believed to form ericaceous mycorrhiza (ErM) ((Strelkova, 1956; Michelsen et al., 1996)). However, (Lorberau et al., 2017) retrieved very few ErM sequences and instead found the traditionally saprotrophic genera *Clavaria* and *Mycena* and the possibly endophytic/mycorrhizal*, Sebacina* to be dominant.
Arctostaphylos alpina and *A. uva-ursi* are Subarctic-Alpine ericaceous plants that form arbutoid mycorrhiza where the invading hyphae form a mantle and Hartig net, but also penetrate into the outer epidermal cells of the roots (Smith and Read, 2008; Kühdorf et al., 2014).
Salix herbacea and *Betula nana* are ectomycorrhizal woody dwarf shrubs found on alpine and Arctic/Subarctic tundra (Mühlmann, 2008; Deslippe et al., 2011). *Pinus sylvestris* and *Betula pubescens* are both ectomycorrhizal tree hosts with a wide geographic range from boreal, temperate to subtropical areas. and which may grow up to >20 meters in height at maturity (Jonsson et al., 1999; Priha et al., 1999; Seppänen et al., 2007).

Extended collection sites info

The *A. uva-ursi* roots for the "altitude" study (and 9 additional *P.sylvestris* samples in addition to those from (Jarvis et al., 2015) in this study) were collected in the Invereshie-Inshriach National Nature Reserve in the north-west of the Cairngorm National Park in Scotland (Fig. 1S). At the ancient suppressed tree-line (450–500

masl), a semi-closed canopy of >5 m tall Scots pine (*Pinus sylvestris)* gives way to *Calluna-Arctostaphylos* subalpine heath. There are scattered Scots pine trees in the heath decreasing in size from the tree-line to ca. 650 masl. Bearberry extends up to 800-850masl.

Nine transects were positioned on south-west facing slopes of three adjacent mountains (Fig. 2S). Bearberry sampling locations were situated every 50 m in altitude, with transects separated by >100 m laterally. There were seven sampling points on each transect. Sample sites were located using an altimeter (Suunto vector, Vantaa, Finland) and GPS (Garmin eTrex, Southampton, UK). The lowest sampling location was within the upper limit of woodland with trees ≥5 m tall, where Scots pine roots were sampled separately.
At each sampling location, five Bearberry plants or Scots pine trees were selected within ±5 m of the target altitude (±15 m for five locations where insufficient plants were found), and 10 m distance of the determined sampling location in any direction. No other ECM hosts occurred along the transects. Fine roots were traced from main stems and three samples were collected from each plant, each containing >100 root tips. Samples were pooled at each sampling location and stored at –20 °C within 12 hours. Sampling was conducted June-July 2011.

Betula pubescens roots were collected at the NatureReserve at Corrimony in north-west Scotland (57°19′N 4° 43′ W). The trees are regenerating saplings at a maximum 1 m in height, growing on moorland within heather-dominated vegetation on a site heavily browsed by sheep and deer. Roots samples (supporting 100-200 ECM tips) were taken from the birches by direct tracing of fine roots from the main laterals. Roots from 5 trees from within a block were pooled to give one single sample.
A biogeography study incorporated roots sampled from ten *Arctous alpinus* sites, sixteen *Arctostaphylos uva-ursi* sites, seven *Betula nana* and seven *Salix herbacea* sites over 23 geographically distinct areas in Scotland (Hesling and Taylor 2013). These incorporated North, South, East and West extremes of the Scottish mainland Highlands, and sites on the islands of Skye and Hoy (Fig S1). Habitats included sub alpine and low alpine dwarf shrub heath, blanket bog and montane scrub. Sampling in 2010 involved collecting root samples from three positions around 10 plants within a defined sampling area which were pooled to give a single sample (Hesling & Taylor 2013). In 2011 & 2012, this was increased to 15 plants, with exceptions due to lack of suitable plants at sites: *B. nana* at Dundreggan = 8 plants, *A. alpina* Isle of Skye = 5 plants and *A. uva-ursi* Foinaven = 5 plants.
The remaining 68 *A. uva-ursi* roots for the "altitude" study (and 9 additional *P.sylvestris* samples in addition to those from (Jarvis et al., 2015) in this study) were collected June-July 2011 in the Invereshie-Inshriach National Nature Reserve in the north-west of the Cairngorm National Park in Scotland (Figs. S1, S2) at 9 transects in elevations from 450-850 masl on a *Calluna-Arctostaphylos* subalpine heath with scattered Scots pine trees up until the tree limit at ~650 masl. This was in close proximity to the mountaineous *P.sylvestris* forest studied in (Jarvis et al., 2015)

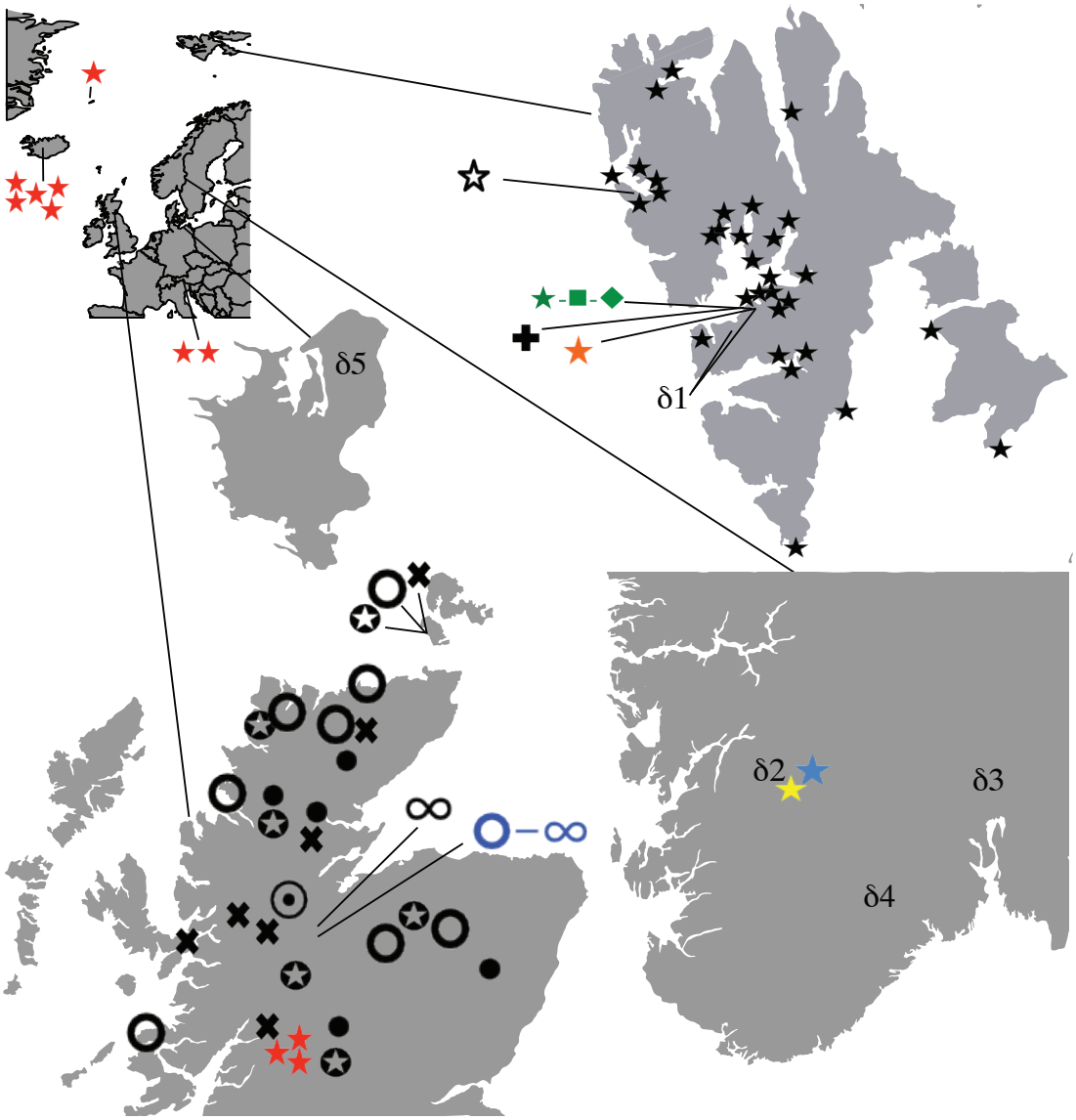

Fig.S1. Map of areas for sample origin. ★ = *Bistorta vivipara* (Blaalid et al., 2012), ★ = *Bistorta vivipara* (Yao et al., 2013). ★ = *Bistorta vivipara* (Blaalid et al 2014), ☆ = *Bistorta vivipara* Davey et al. (2015). ★-■-◆ = *Bistorta vivipara, Dryas octopetala, Salix polaris* (Botnen et al., 2014). ★ = *Bistorta vivipara* (Mundra et al., 2015), ★ = *Bistorta vivipara* (Botnen et al., 2019). □ = *Cassiope tetragona* (Lorberau et al., 2017), O-∞ = *Arctostaphylos uva-ursi+ Pinus silvestris* (altitude study site), O = *Arctostaphylos uva-ursi*. □ = *Arctostaphylos alpine.* • =*Betula nana,* ⊙ = *Betula pendula,* □ = *Salix herbacea,* ∞= *Pinus silvestris* (Jarvis et al 2015).
d represents places for samples for stable isotopic analyses: **d**1= Svalbard (South Isfjorden shores): Arctic tundra: Colesdalen 78°06'27.1 N 15°09'14.4E, Blomsterdalen 78°17'50.5N 17°05'15.1E, Bjørndalen 78°12'58.0N 15°19'09.6E, and Bolterdalen 78°08'23.7N 15°56'50.9E) **d**2= Finse (Mainland Norway, subarctic tundra, 60°34'53.1N, 7°29'04.1E), **d**3= Vettakollåsen (southeast Norway, mixed spruce/pine forest, 59°58'41.3N E10°42'31.9E), **d**4= Solhomfjell (southwest Norway, mixed spruce/pine forest, 58°59'10.2N 8°49'24.8E), **d**5= Gribskov (Sjælland, Denmark, beech-dominated broadleaf forest, 55°59'18.6N, 12°18'11.3E). Note that each symbol represents one sampling site from which multiple individual samples may have been collected.

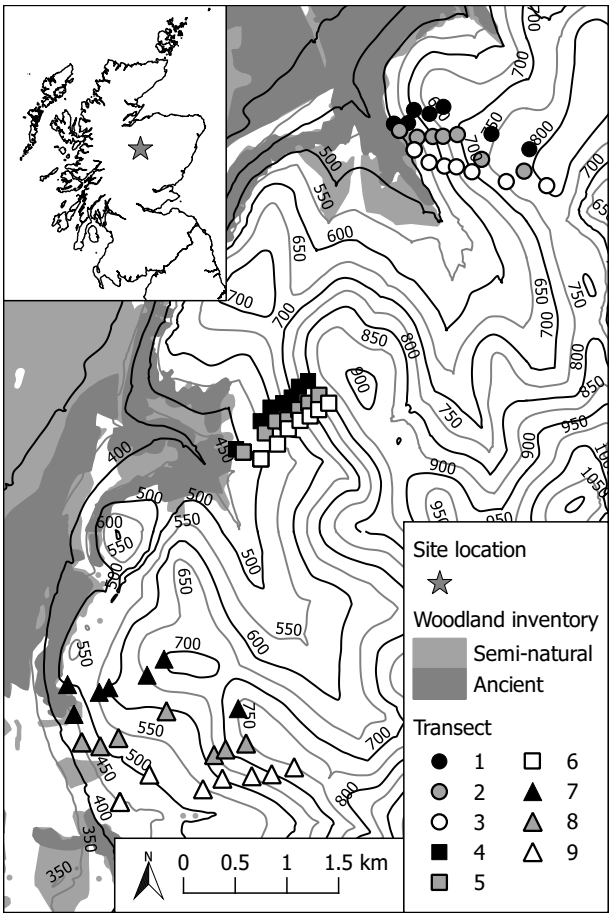

Fig.S2. Detailed map of the O-∞ = *Arctostaphylos uva-ursi/ Pinus silvestris* altitude study site in the Invereshie-Inshriach National Nature Reserve in the north-west of the Cairngorm National Park in Scotland (altitude in metres).

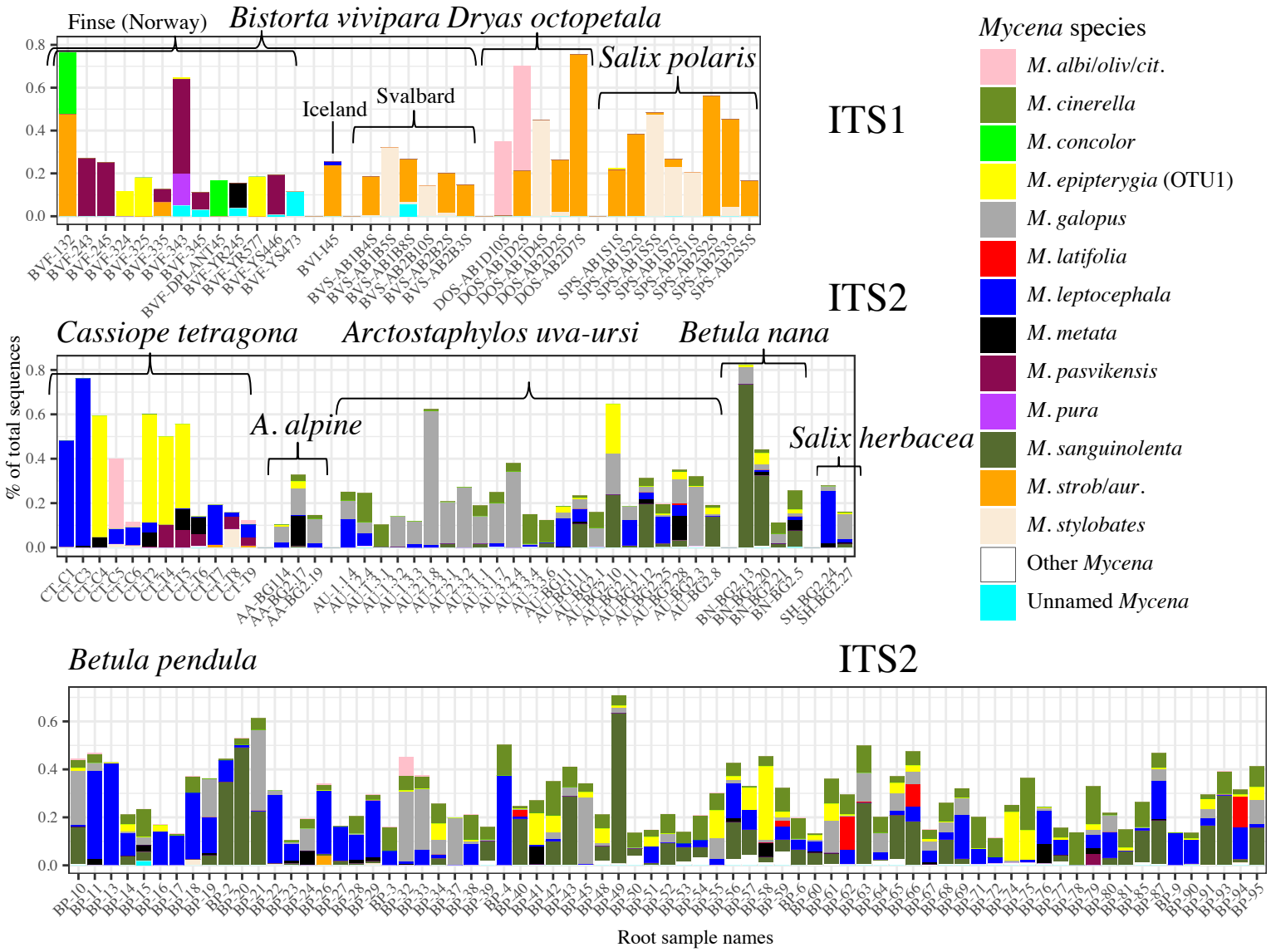

Fig.S3. Individual samples with a *Mycena* infection load (sequence content) of >10%. For *B.vivipara* from Finse (BVF_), the samples beginning with YR/YS are from Yao et al. (2013), the DPLANT45 from Blaalid et al. (2012), and the rest (BVF_[number]) from Davey et al. (2015). All *B. vivipara* from Svalbard with high *Mycena* infection rates originated from the study of Botnen et al. (2014) that also provided all *D. octopetala* + *S. polaris* samples. Note the much greater interspecific similarities in the three sets of Svalbard ITS1 samples than conspecific ditto between the *B. vivipara* from Svalbard and those from Finse. Also note the much greater similarity between *C. tetragona* from Svalbard and all the othe ITS2-based samples from Scotland than between *C. tetragona* and the other Svalbard ITS1-based samples, likely reflecting the known ITS1 reverse primer (ITS2R) bias against *Mycena*.

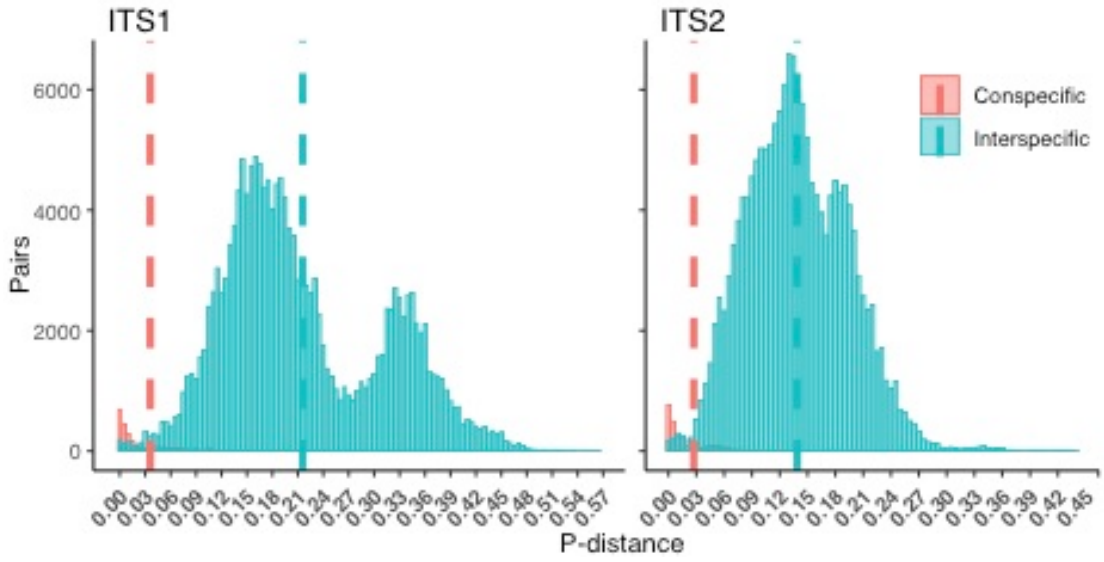

Fig.S4. Intra- and interspecific ITS1- and ITS2 distances in the 589 *Mycena* sequences that was used as a database for better species identification of *Mycena* OTUs/ASVs from HTP data sets. Note the slightly higher intraspecific variation in ITS1 (0.036) than in ITS2 (0.027), and the want of a barcoding window caused by the overlapping intra- and interspecific variation.

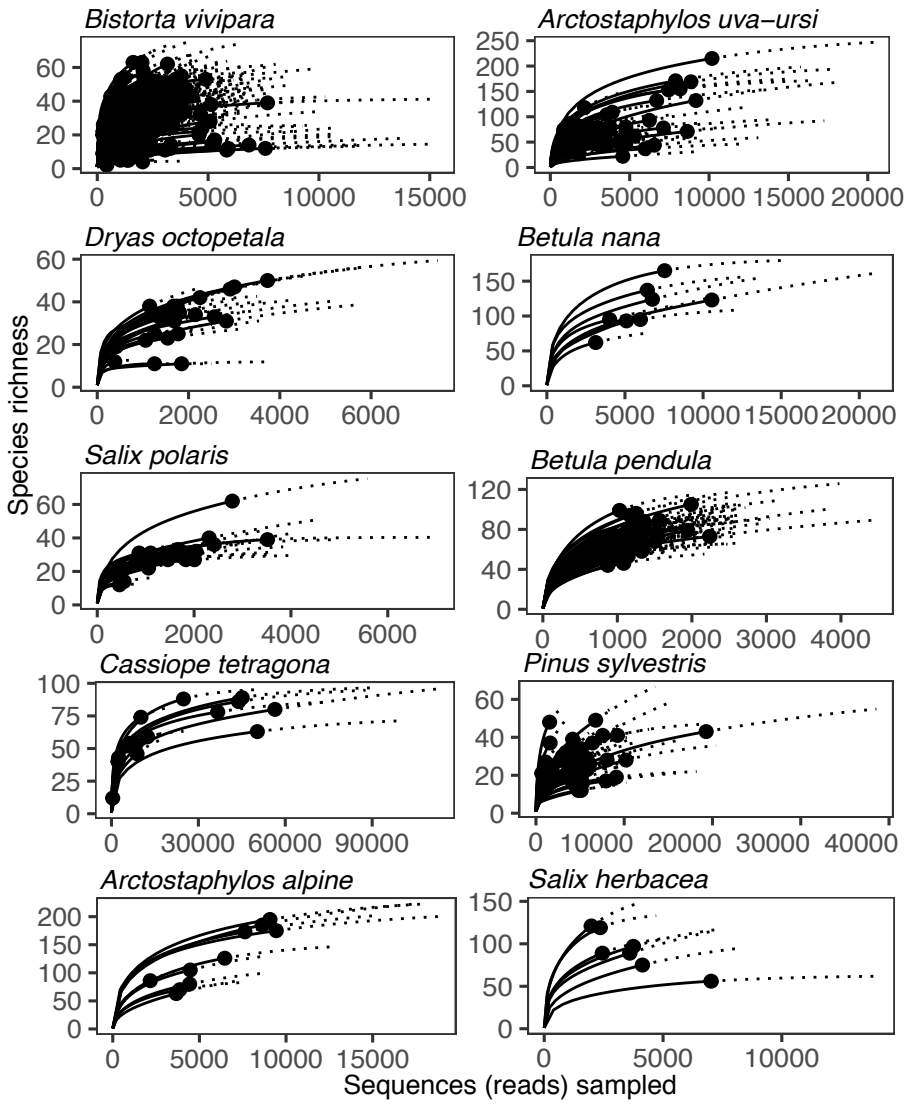

Fig.S5. iNEXT sample-based rarefaction curves with extrapolation (Hill numbers) on observed species richness. Black curves denote actual sampling (sequencing), black dots the depth limits, and dashed lines extrapolation from that up to theoretical complete coverage based on each sample.

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