Habitat-specific changes of plant and soil microbial community composition to fairy ring fungus *Agaricus xanthodermus* on the Qinghai-Tibetan Plateau

Table S1 Relative abundance (%) of dominant bacterial genera (>1%) in different zones of fairy ring A and B. Data are means ± SE (n = 3). Significant differences of each variable among zones are evaluated by one-way ANOVA with LSD Post-Hoc Test and indicated by dissimilar letters. Significant differences are shown in bold.

	Fairy ring A				Fairy ring B			
Bacterial genus	OUT	ON1	ON2	IN	OUT	ON1	ON2	IN
Gaiella	3.60 ± 0.09	2.30 ± 0.25	3.47 ± 0.79	2.85 ± 0.32	**3.87 ± 0.33 a**	**2.33 ± 0.12 b**	**3.67 ± 0.26 a**	**3.87 ± 0.18 a**
Bacillus	**2.02 ± 0.19 b**	**7.51 ± 0.54 a**	**3.33 ± 0.48 b**	**3.37 ± 0.42 b**	1.80 ± 0.61	1.78 ± 0.45	1.50 ± 0.18	1.61 ± 0.14
Arthrobacter	3.31 ± 0.04	1.39 ± 0.39	1.24 ± 0.26	3.86 ± 2.42	2.54 ± 0.71	2.79 ± 0.60	2.62 ± 0.26	3.03 ± 0.61
Mycobacterium	**2.62 ± 0.13 bc**	**3.30 ± 0.29 a**	**3.15 ± 0.17 ab**	**2.40 ± 0.02 c**	2.30 ± 0.26	2.00 ± 0.39	2.28 ± 0.24	2.50 ± 0.26
Solirubrobacter	**3.15 ± 0.65 a**	**1.83 ± 0.09 b**	**2.12 ± 0.09 ab**	**2.00 ± 0.26 ab**	**2.66 ± 0.44 a**	**1.77 ± 0.15 b**	**2.10 ± 0.20 ab**	**2.13 ± 0.12 ab**
Rhodoplanes	**1.98 ± 0.20 b**	**2.43 ± 0.33 ab**	**3.01 ± 0.03 a**	**2.55 ± 0.18 ab**	2.03 ± 0.24	1.45 ± 0.11	1.75 ± 0.10	2.01 ± 0.25
Bradyrhizobium	**1.45 ± 0.14 b**	**2.66 ± 0.60 a**	**2.76 ± 0.22 a**	**1.73 ± 0.21 ab**	1.28 ± 0.14	1.72 ± 0.45	1.36 ± 0.17	1.57 ± 0.23
Nocardioides	**0.95 ± 0.16 b**	**2.60 ± 0.50 a**	**1.64 ± 0.55 ab**	**1.15 ± 0.07 b**	1.45 ± 0.48	1.70 ± 0.14	1.15 ± 0.12	1.02 ± 0.19
Mesorhizobium	**1.37 ± 0.16 b**	**1.79 ± 0.18 ab**	**2.16 ± 0.31 a**	**1.77 ± 0.05 ab**	1.08 ± 0.14	1.05 ± 0.14	0.89 ± 0.06	1.04 ± 0.07
Pseudonocardia	**2.16 ± 0.14 a**	**1.15 ± 0.11 b**	**1.49 ± 0.29 ab**	**1.55 ± 0.32 ab**	**1.55 ± 0.06 a**	**0.75 ± 0.06 b**	**0.87 ± 0.18 b**	**1.11 ± 0.11 b**
Sphingomonas	1.12 ± 0.20	1.22 ± 0.04	1.31 ± 0.15	1.09 ± 0.09	1.35 ± 0.16	1.46 ± 0.22	1.30 ± 0.21	1.63 ± 0.06
Ilumatobacter	**1.32 ± 0.07 a**	**0.61 ± 0.05 c**	**1.05 ± 0.15 ab**	**0.94 ± 0.11 b**	1.73 ± 0.08	1.21 ± 0.10	1.28 ± 0.18	1.45 ± 0.25
Streptosporangium	**0.45 ± 0.11 b**	**2.08 ± 0.43 a**	**1.43 ± 0.78 ab**	**0.87 ± 0.09 ab**	**0.84 ± 0.58 b**	**2.85 ± 0.75 a**	**0.45 ± 0.07 b**	**0.40 ± 0.07 b**

Table S2 Relative abundance (%) of dominant fungal genera (>1%) in different zones of fairy ring A and B. Data are means ± SE (n = 3). Significant differences of each variable among zones are evaluated by one-way ANOVA with LSD Post-Hoc Test and indicated by dissimilar letters. Significant differences are shown in bold.

	Fairy ring A				Fairy ring B			
Fungal genus	OUT	ON1	ON2	IN	OUT	ON1	ON2	IN
Hygrocybe	0.15 ± 0.11	0.15 ± 0.15	0.22 ± 0.18	7.46 ± 7.40	28.56 ± 26.09	2.55 ± 2.45	0.26 ± 0.12	0.20 ± 0.08
Solicoccozyma	**8.32 ± 0.70 a**	**0.81 ± 0.53 c**	**1.38 ± 0.56 bc**	**4.77 ± 1.94 ab**	8.85 ± 4.03	2.90 ± 1.52	2.28 ± 0.86	4.96 ± 0.38
Coniochaeta	**6.11 ± 0.56 a**	**1.31 ± 0.33 b**	**2.70 ± 1.77 ab**	**3.65 ± 1.08 ab**	4.31 ± 1.35	4.75 ± 1.99	5.67 ± 4.08	3.72 ± 1.01
Pseudogymnoascus	**5.92 ± 1.01 a**	**0.70 ± 0.57 b**	**2.37 ± 1.86 ab**	**2.57 ± 0.70 ab**	5.02 ± 2.36	1.31 ± 0.56	2.83 ± 2.01	2.24 ± 018
Pseudeurotium	-	3.54 ± 1.04	5.34 ± 2.99	6.40 ± 4.87	-	2.87 ± 1.44	0.58 ± 0.33	0.28 ± 0.07
Fusicolla	0.21 ± 0.08	0.03 ± 0.02	0.20 ± 0.18	0.16 ± 0.15	1.13 ± 0.65	0.10 ± 0.04	0.16 ± 0.04	13.34 ± 12.91
Cladosporium	1.95 ± 0.49	1.96 ± 1.21	1.98 ± 1.05	0.74 ± 0.32	2.76 ± 1.19	1.95 ± 0.14	0.90 ± 0.51	1.01 ± 0.10
Thelebolus	7.69 ± 5.94	0.27 ± 0.12	0.12 ± 0.07	1.60 ± 1.40	0.26 ± 0.21	0.67 ± 0.37	0.04 ± 0.01	0.13 ± 0.05
Exophiala	**3.24 ± 0.25 a**	**0.44 ± 0.25 b**	**0.65 ± 0.31 b**	**2.33 ± 0.85 a**	**1.16 ± 0.30 a**	**0.54 ± 0.28 ab**	**0.35 ± 0.09 b**	**0.78 ± 0.06 ab**

Table S3 Environmental variables at different fairy rings. Data are means ± SE (n = 12). Significant differences were determined using the t-test (*$P \leqslant 0.05$; **$P \leqslant 0.01$; ***$P \leqslant 0.001$).

Variable	Fairy ring A	Fairy ring B
Moisture (%)	37.83 ± 0.40***	32.17 ± 0.96
pH	7.15 ± 0.06	7.51 ± 0.07**
Organic C (g/kg)	15.20 ± 0.37***	11.80 ± 0.17
Total N (g/kg)	1.14 ± 0.02***	0.84 ± 0.05
Available N (mg/kg)	29.81 ± 1.74 ***	15.68 ± 1.31
Available P (mg/kg)	3.22 ± 0.40	6.06 ± 1.55
Available N: P ratio	9.58 ± 0.76***	3.67 ± 0.47
β-Glucosidase (μmol/g/h)	0.11 ± 0.01	0.09 ± 0.01
Peroxidase (μmol/g/h)	8.73 ± 0.33	7.75 ± 0.18
Phenol oxidase (μmol/g/h)	0.47 ± 0.02	0.39 ± 0.05

Figure S1 *Agaricus xanthodermus* fruiting body appeared in the outer edge of the fairy rings.

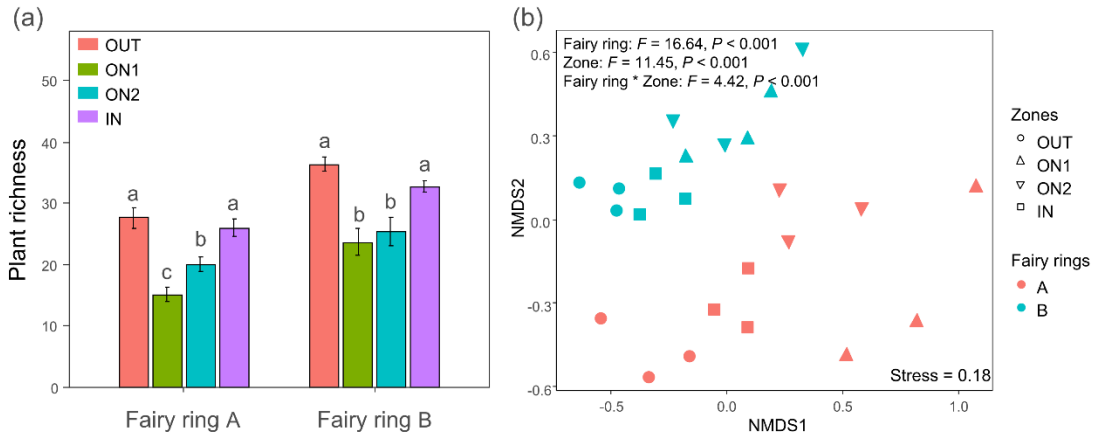

Figure S2 Plant richness (a) in the different zones (OUT, ON1, ON2, IN) of fairy ring A and B, respectively. Bars represent means ± SEs. Differences in lowercase letters between box plots indicate a significant difference based on the Tukey LSD Post-Hoc Test ($p < 0.05$). Nonmetric multidimensional scaling analysis (NMDS) (Bray–Curtis distance) of community composition of plant (b) in the different zones.

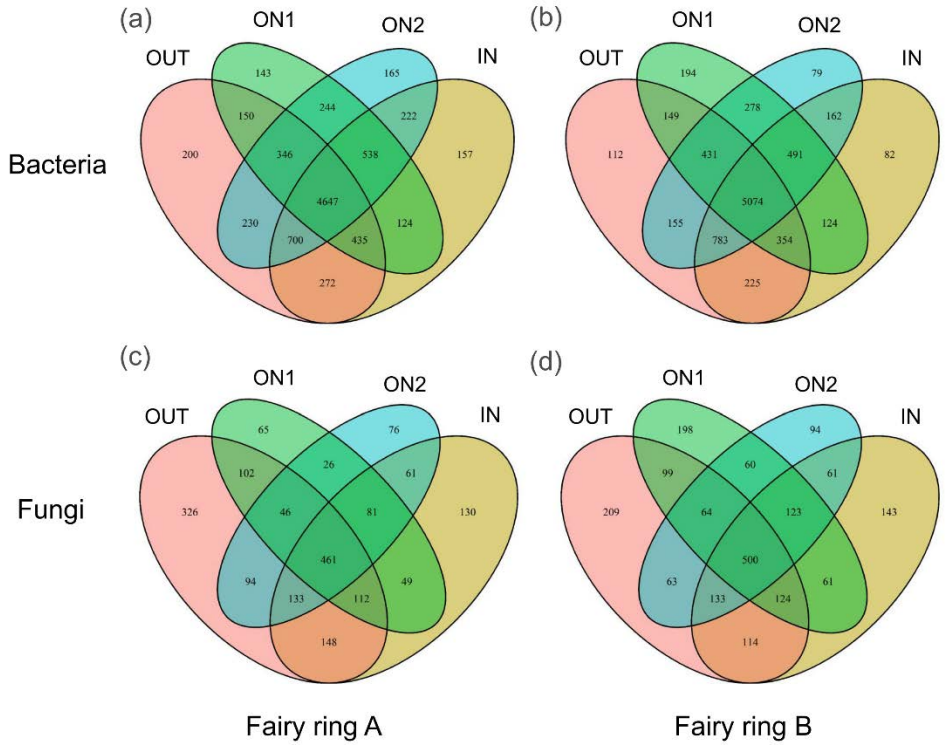

Figure S3 The Venn diagrams show the number of zOTUs that are unique and shared among different zones of fairy ring A and B for bacteria (a, b) and fungi (c, d), respectively.