Biogeosciences

Open Access

EGU

Supplement of

Characteristics of bacterial and fungal communities and their associations with sugar compounds in atmospheric aerosols at a rural site in northern China

Mutong Niu et al.

Correspondence to: Wei Hu (huwei@tju.edu.cn) and Pingqing Fu (fupingqing@tju.edu.cn)

Table S1. Reference samples used to trace the source of the airborne microbes obtained from the NCBI SRA repository (http://www.ncbi.nlm.nih.gov/sra).

Accession number	Platform	Sampling Site	Source
Bacteria			
SRR6429182	Illumina MiSeq	Bohai Sea	Ocean
SRR6429183	Illumina MiSeq	Bohai Sea	Ocean
SRR6429184	Illumina MiSeq	Bohai Sea	Ocean
SRR6429185	Illumina MiSeq	Bohai Sea	Ocean
Fungi			
SRR5149688	Illumina MiSeq	Bohai Sea	Ocean
SRR5149690	Illumina MiSeq	Bohai Sea	Ocean
SRR5149691	Illumina MiSeq	Bohai Sea	Ocean
SRR5149695	Illumina MiSeq	Bohai Sea	Ocean
SRR5149697	Illumina MiSeq	Bohai Sea	Ocean

Table S2. α-Diversity indices of airborne bacteria and fungi.

Samples	Tags	OTU	Chao1	Shannon	Simpson
Bacteria					
0807D	27674	164	201.0	5.4	0.96
0807N	23442	381	458.0	6.7	0.96
0808D	42354	223	720.0	5.4	0.95
0808N	30991	1018	490.3	8.5	0.99
0809D	40535	377	602.1	5.9	0.96
0809N	47006	348	721.5	6.6	0.98
0810D	31402	235	781.6	5.7	0.94
0810N	27560	340	540.1	5.7	0.97
0811D	43710	308	1078.3	4.6	0.83
0811N	63049	669	495.2	8.1	0.99
0812D	41915	412	677.3	3.4	0.85
0812N	42050	335	756.0	6.5	0.98
0813D	49260	516	672.1	7.4	0.99
0813N	28961	336	425.5	6.0	0.95
Daytime	**39550**	**319**	**675.1**	**5.4**	**0.93**
Nighttime	**37580**	**489**	**555.2**	**6.8**	**0.97**
Fungi					
0807D	27498	103	133.0	2.7	0.70
0807N	60901	445	332.5	4.0	0.83
0808D	30219	247	425.8	3.5	0.69
0808N	63457	465	469.1	3.9	0.8
0809D	114521	376	412.3	2.9	0.56
0809N	52159	464	396.2	4.2	0.81
0810D	69933	375	492.1	5.2	0.93
0810N	70349	473	568.5	4.9	0.90
0811D	62021	365	609.6	3.4	0.64
0811N	31324	558	628.8	4.1	0.74
0812D	50487	285	565.9	4.4	0.85
0812N	57687	450	702.0	4.4	0.86
0813D	54338	403	555.6	3.7	0.79
0813N	51989	472	619.9	4.8	0.90
Daytime	**58431**	**308***	**456.3**	**3.7**	**0.74**
Nighttime	**55409**	**475***	**531.0**	**4.3**	**0.83**

Table S3. The taxa at the phylum and genus levels with LDA scores > 2 and their relative abundances in the daytime and nighttime.

Taxonomic level	Name	Day	Night	LDA (log$_{10}$)	Dominant group
phylum	Ascomycota	65.3	28.6	5.3	Day
genus	*Curvularia*	0.64	0.11	3.4	Day
genus	*Plenodomus*	0.01	0.00	3.7	Day
genus	*Periconia*	1.86	0.26	3.9	Day
genus	*Cladosporium*	1.39	0.35	3.7	Day
genus	*Sphaerulina*	0.53	0.11	3.3	Day
genus	*Aspergillus*	2.88	0.26	4.1	Day
genus	*Gelasinospora*	0.19	0.02	3.0	Day
genus	*Holtermanniella*	0.46	0.16	3.2	Day
phylum	Basidiomycota	13.6	34.0	5.0	Night
genus	*Phaeosphaeria*	0.07	0.16	2.8	Night
genus	*Dissoconium*	0.01	0.08	2.8	Night
genus	*Cyphellophora*	0.00	0.04	2.9	Night
genus	*Phyllopsora*	0.00	0.02	3.3	Night
genus	*Spathularia*	0.00	0.02	3.1	Night
genus	*Colletotrichum*	0.02	0.12	2.9	Night
genus	*Gibellulopsis*	0.00	0.01	3.2	Night
genus	*Plectosphaerella*	0.08	1.49	3.8	Night
genus	*Clonostachys*	0.02	0.20	3.1	Night
genus	*Lecanicillium*	0.02	0.04	2.9	Night
genus	*Cosmospora*	0.03	0.16	2.9	Night
genus	*Pseudocosmospora*	0.00	0.01	3.2	Night
genus	*Alfaria*	0.01	0.07	2.7	Night
genus	*Phomatospora*	0.01	0.07	2.7	Night
genus	*Phyllachora*	0.00	0.01	3.0	Night
genus	*Agaricus*	0.14	1.46	3.9	Night
genus	*Clitopilus*	0.01	0.11	2.8	Night
genus	*Crinipellis*	0.01	0.03	2.8	Night
genus	*Marasmius*	0.01	0.07	3.2	Night
genus	*Cryptomarasmius*	0.00	0.02	2.9	Night
genus	*Volvariella*	0.00	0.01	3.0	Night
genus	*Hohenbuehelia*	0.00	0.02	2.9	Night
genus	*Pterula*	0.00	0.00	3.2	Night
genus	*Aphanobasidium*	0.00	0.02	3.0	Night
genus	*Coprinopsis*	1.67	11.4	4.7	Night
genus	*Cristinia*	0.00	0.01	2.8	Night
genus	*Schizophyllum*	0.01	0.03	2.9	Night
genus	*Clitocybe*	0.02	0.16	2.9	Night
genus	*Melanoleuca*	0.00	0.02	3.0	Night
genus	*Coniophora*	0.00	0.01	3.5	Night
genus	*Ceratobasidium*	0.00	0.02	3.3	Night
genus	*Limonomyces*	0.07	1.35	3.8	Night
genus	*Hyphodontia*	0.00	0.03	2.7	Night
genus	*Hydnophlebia*	0.04	0.21	3.0	Night
genus	*Hyphoderma*	0.04	0.13	2.8	Night
genus	*Brunneoporus*	0.01	0.02	3.0	Night
genus	*Podoscypha*	0.00	0.02	3.0	Night
genus	*Peniophora*	0.00	0.25	3.1	Night
genus	*Trechispora*	0.07	0.08	2.6	Night
genus	*Kondoa*	0.00	0.06	2.8	Night
genus	*Golubevia*	0.00	0.01	2.9	Night
genus	*Meira*	0.00	0.02	2.9	Night
genus	*Rhodosporidiobolus*	0.02	0.05	3.1	Night
genus	*Sporobolomyces*	0.02	0.15	3.0	Night
genus	*Colacogloea*	0.00	0.02	3.3	Night
genus	*Hannaella*	0.01	0.09	2.8	Night
genus	*Bulleromyces*	0.01	0.03	3.0	Night

Table S4. Concentrations of sugar components in aerosol samples.

| Compounds (ng m^{-3})	Daytime (N = 7)				Nighttime (N = 7)			
	Min	Max	Mean	SD	Min	Max	Mean	SD
Anhydrosugars								
levoglucosan	10.3	30.3	18.4	7.43	2.97	55.8	30.0	20.1
mannosan	0.78	1.93	1.30	0.47	0.24	4.99	2.05	1.60
galactosan	0.55	0.96	0.68	0.15	0.21	3.01	1.41	0.98
subtotal	11.7	33.0	20.4	7.90	3.42	63.8	33.4	22.5
Primary sugars								
xylose	0.34	1.04	0.61	0.26	0.20	1.85	0.79	0.54
fructose	6.21	20.4	11.6	4.85	1.42	12.5	7.27	3.79
glucose	23.8	60.8	42.4	14.7	17.7	52.0	36.6	12.8
sucrose	0.59	111	67.6	35.8	1.27	65.3	28.6	23.5
trehalose	18.6	48.2	29.8	10.6	39.2	102	67.6	23.4
subtotal	100	228	152	49.0	78.4	190	141	47.2
Sugar alcohols								
arabitol	10.4	23.7	16.0	5.13	16.3	59.6	31.1	13.4
mannitol	26.7	55.9	41.5	10.7	68.7	128	101	21.9
glycerol	2.73	16.2	6.90	4.39	3.86	14.3	9.79	3.60
erythritol	3.65	6.47	4.76	1.11	5.65	18.1	11.9	4.37
inositol	1.96	10.4	4.84	2.67	1.29	5.22	3.34	1.37
subtotal	53.1	97.3	74.1	19.1	110	193	157	33.6
$\sum$saccharides	186	358	247	67.0	196	420	331	84.4

Table S5. Spearman correlation of sugar components and environmental or fungal α-diversity indices.

Factors	Anhyrosugars			Sugar alcohols					Primary saccharides				
	Galactosan	Mannosan	Levoglucosan	Arabitol	Mannitol	Erythritol	Inositol	Glycerol	Glucose	Sucrose	Fructose	Xylose	Trehalose
Galactosan	1												
Mannosan	0.833**	1											
Levoglucosan	0.881**	0.916**	1										
Arabitol	0.547*	0.503	0.398	1									
Mannitol	0.569*	0.560*	0.477	0.864**	1								
Erythritol	0.459	0.411	0.477	0.719**	0.851**	1							
Inositol	0.2	0.516	0.433	-0.086	-0.064	-0.051	1						
Glycerol	0.626*	0.473	0.38	0.688**	0.499	0.284	-0.02	1					
Glucose	0.27	0.516	0.323	0.16	0.073	-0.305	0.503	0.187	1				
Sucrose	-0.169	0.051	0.182	-0.371	-0.473	-0.16	0.429	-0.42	-0.007	1			
Fructose	0.407	0.662**	0.618*	-0.134	-0.13	-0.108	0.754**	-0.024	0.508	0.495	1		
Xylose	0.727**	0.881**	0.921**	0.279	0.367	0.327	0.604*	0.244	0.525	0.292	0.771**	1	
Trehalose	0.31	0.446	0.336	0.745**	0.877**	0.749**	0.09	0.275	0.156	-0.275	-0.103	0.332	1
OC	0.653*	0.855**	0.881**	0.429	0.385	0.433	0.411	0.288	0.341	0.411	0.622*	0.829**	0.345
Ca^{2+}	0.543*	0.534*	0.653*	0.556*	0.415	0.547*	0.218	0.367	0.055	0.358	0.138	0.486	0.415
Cl^-	0.829**	0.811**	0.749**	0.798**	0.719**	0.547*	0.116	0.789**	0.292	-0.244	0.191	0.582*	0.49
SO_4^{2-}	0.446	0.705**	0.560*	0.187	0.125	0.055	0.587*	0.178	0.508	0.42	0.829**	0.670**	0.156
Temperature	-0.196	0.033	0.046	-0.644*	-0.670**	-0.604*	0.411	-0.464	0.31	0.679**	0.631*	0.235	-0.604*
RH	0.407	0.244	0.181	0.608*	0.806**	0.670**	-0.297	0.445	-0.207	-0.705**	-0.313	0.053	0.698**
Wind speed	-0.613*	-0.49	-0.675**	-0.407	-0.495	-0.662**	-0.029	-0.244	0.213	-0.046	-0.015	-0.415	-0.376
$PM_{2.5}$	0.152	0.187	-0.007	0.117	0.361	0.442	0.337	0.18	0.09	-0.233	0.037	-0.004	0.429
PM_{10}	0.521	0.732**	0.609*	0.635*	0.53	0.336	0.288	0.389	0.640*	0.174	0.398	0.662**	0.534*
SO_2	0.031	0.277	0.077	0.29	0.242	0.141	0.031	-0.024	0.099	-0.042	0.064	-0.02	-0.053
NO_2	-0.126	0.042	-0.051	-0.267	-0.294	-0.373	-0.289	0.139	0.104	0.241	0.435	-0.038	-0.448
O_3	0.468	0.53	0.464	0.459	0.899**	0.899**	0.815**	-0.011	0.099	-0.16	-0.138	0.354	0.859**
OTU	0.552*	0.503	0.534*	0.679**	0.837**	0.785**	0.051	0.336	-0.011	-0.292	-0.086	0.433	0.851**
Shannon index	0.415	0.424	0.257	0.402	0.516	0.095	0.125	0.292	0.604*	-0.635*	0.015	0.279	0.525

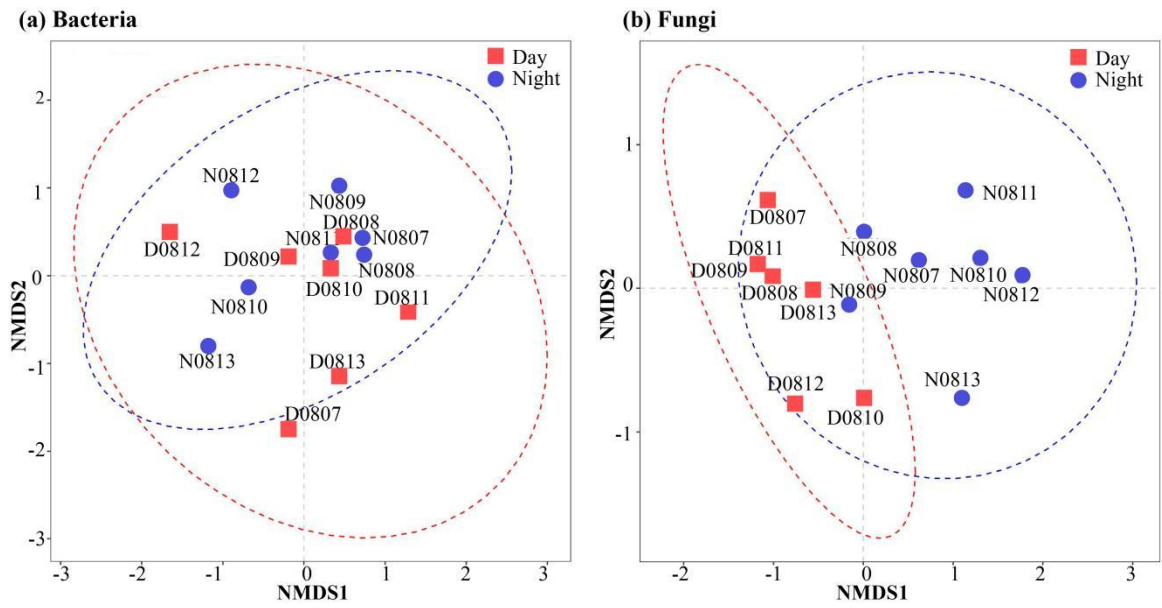Note: *$p < 0.01$; **$p < 0.05$.
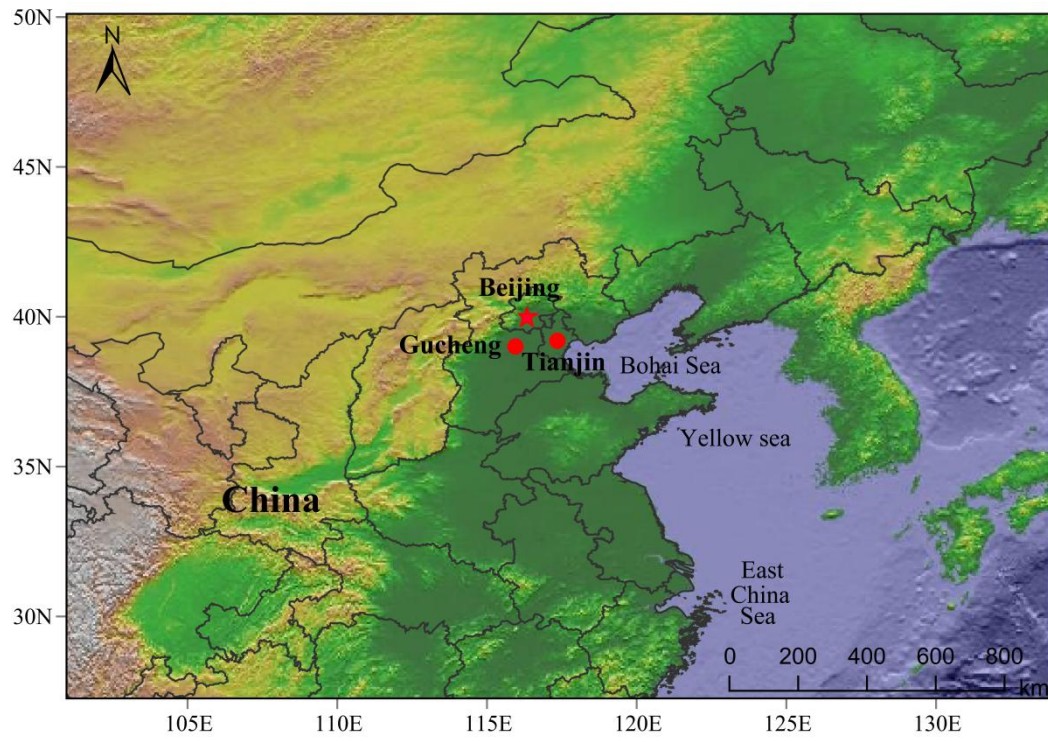
Figure S1. The geographical location of the observation site Gucheng (map from MeteoInfo software).
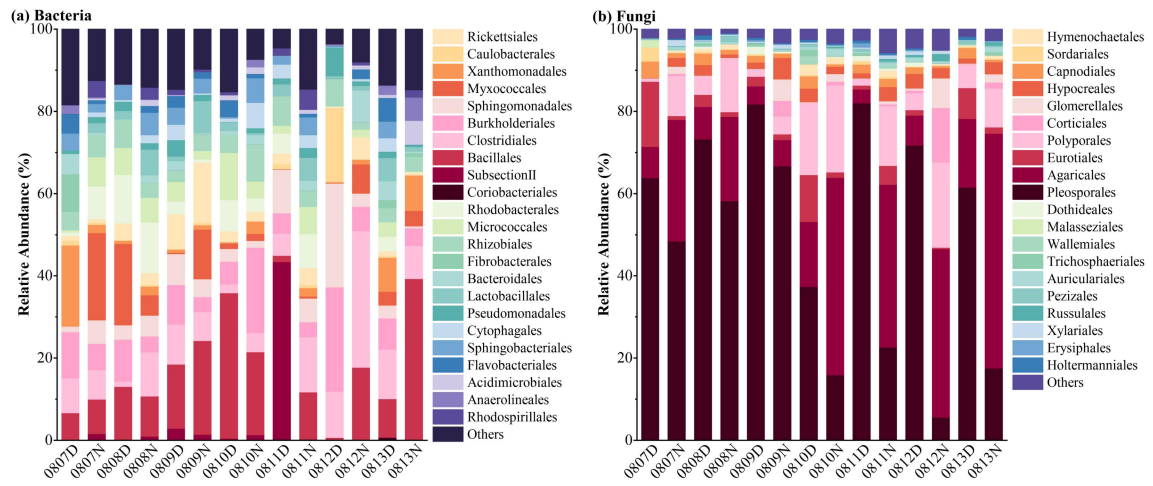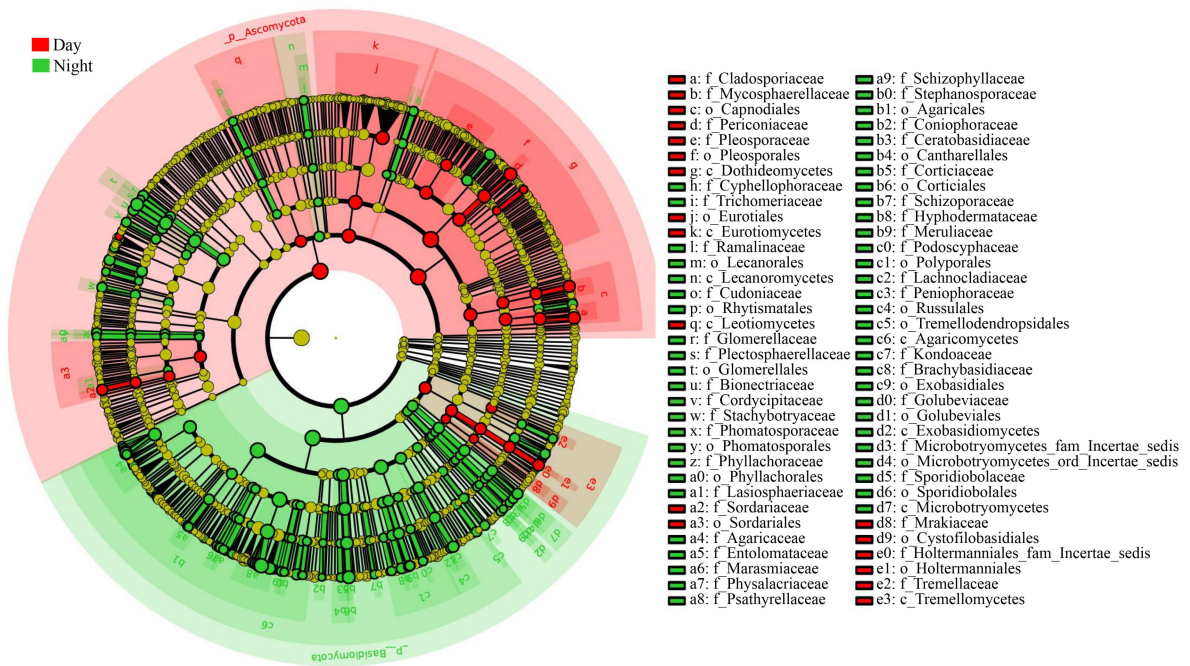
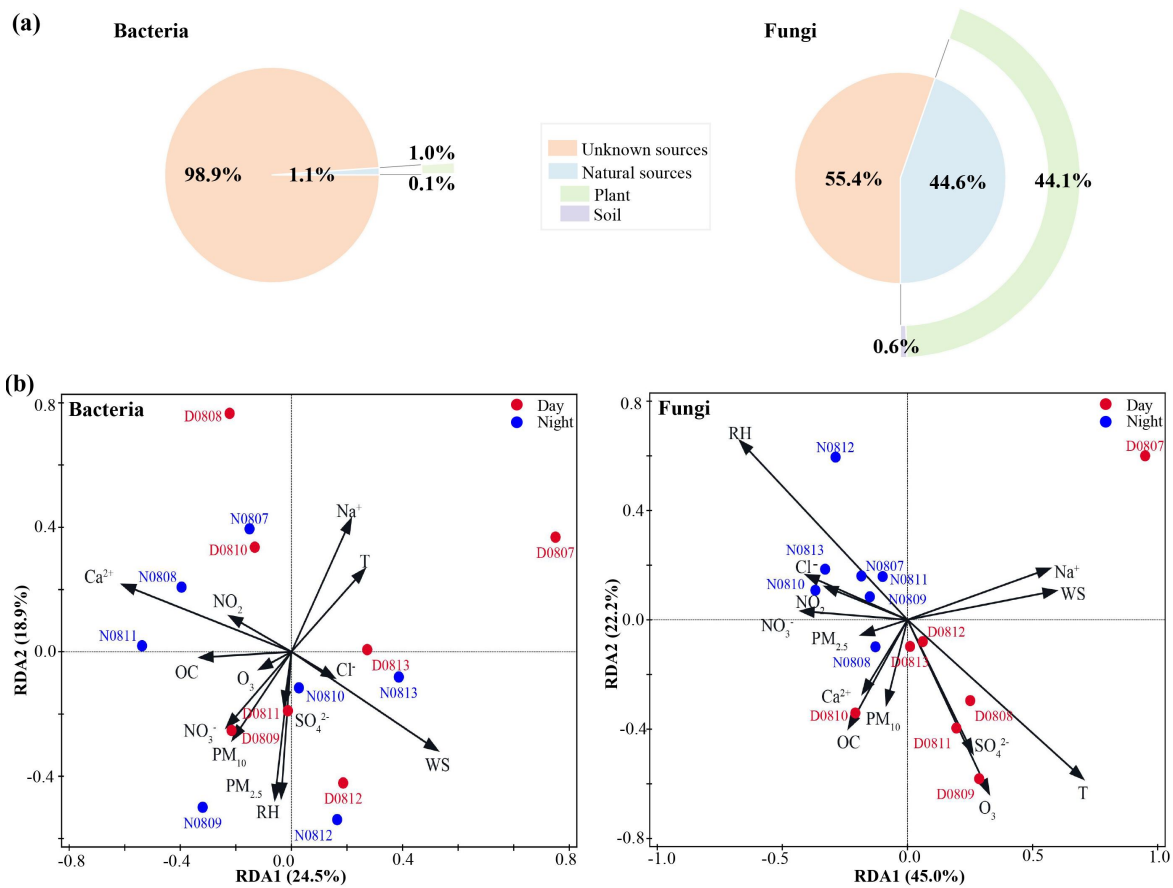**Figure S2.** Relative abundances of airborne (a) bacteria and (b) fungi at the order level.

Figure S3. Comparison of the (a) bacterial and (b) fungal communities between in the daytime and nighttime samples, respectively.

Figure S4. The cladogram of fungal taxa based on LEfSe analysis of fungal abundance between daytime and nighttime samples.

Figure S5. (a) Contribution of potential sources to airborne bacteria and fungi estimated by SourceTracker analysis. (b) The relationship between bacterial or fungal communities and environmental factors based on redundancy analysis (RDA). T, air temperature; RH, relative humidity; WS, wind speed.
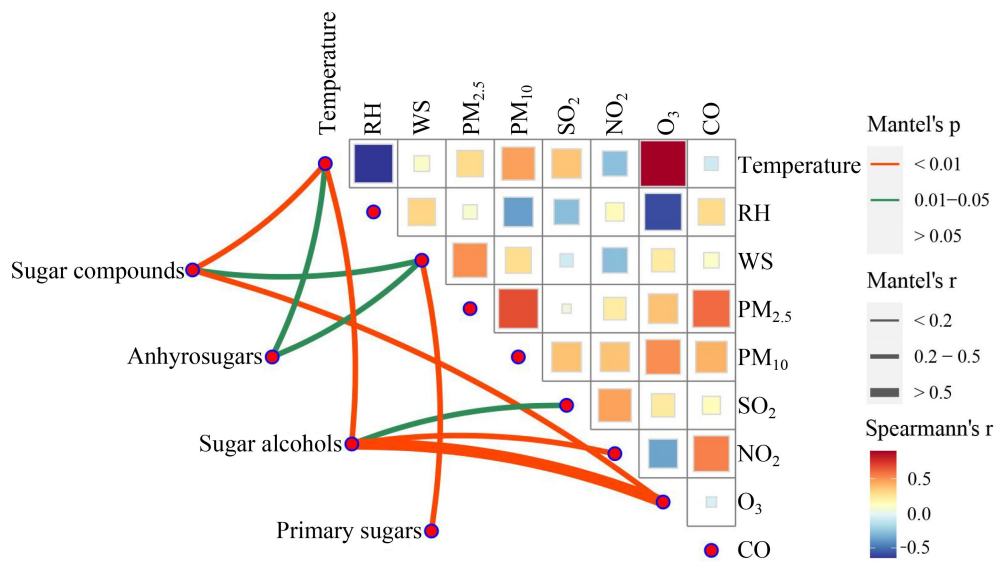
Figure S6. Correlations of sugar compounds with environmental factors based on Bray–Curtis distance. Edge width corresponds to Mantel's r value, and the edge color denotes statistical significance. Pairwise correlations of environmental factors with a heatmap are calculated by Spearman's correlation analysis.
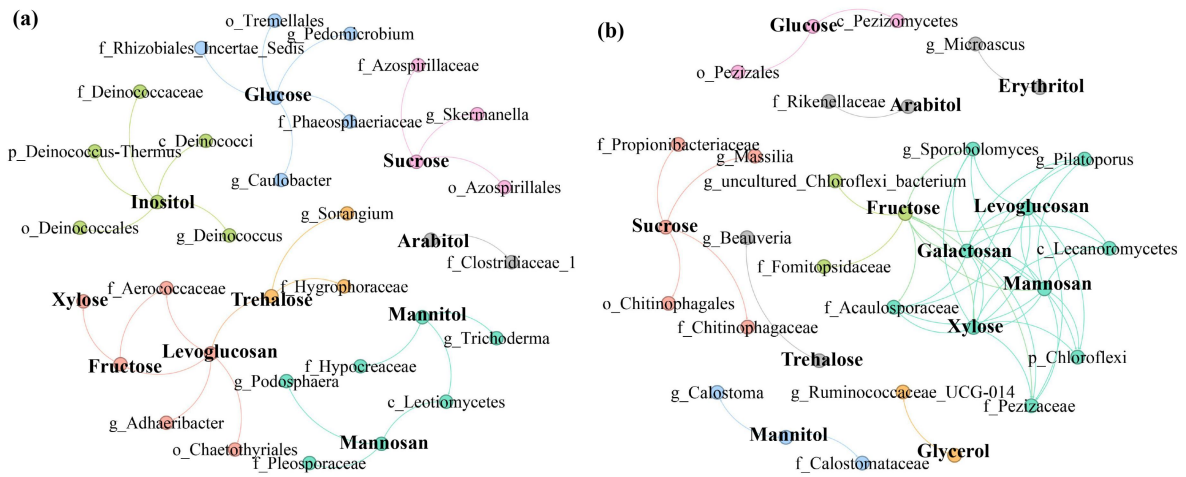
Figure S7. Co-occurrence networks between microbial taxa and sugar components (bold font) were constructed based on Spearman's correlation analysis in the (a) daytime and (b) nighttime samples. The nodes are colored according to different types of modularity classes.