

# The leaf microbiome of tobacco plants across 8 Chinese Provinces

Haiyang Hu<sup>1+\*</sup>, Yunli Liu<sup>1†</sup>, Yiqun Huang<sup>1</sup>, Zhan Zhang<sup>2</sup>, Hongzhi Tang<sup>1</sup>

1 State Key Laboratory of Microbial Metabolism, School of Life Sciences, Biotechnology, Shanghai Jiao Tong University, Shanghai 200240, China; liuyunli@sjtu.edu.cn (Y.L.); natsumoon@outlook.com (Y.H.); tanghongzhi@sjtu.edu.cn (H.T.)

2 China Tobacco Henan Industrial Co., Ltd., Zhengzhou 450000, China; zhangzhan2059729@126.com

\* Correspondence: huhaiyang@sjtu.edu.cn; Tel.: +86-21-34204066; Fax: +86-21-34206723

† These authors contributed equally

‡ Zhang Zhan is a visiting researcher in Shanghai Jiaotong University. He worked here from 8-October to 29 December in 2020 and from 1 Apr to 30 Jun 2021.

**Table S1.** The genera with top 13 relative abundances among all samples.

No.	Genus	Relative abundance
1	<i>Mastigocoleus</i>	9.40%
2	<i>Pseudomonas</i>	9.20%
3	<i>Methylobacterium</i>	7.90%
4	<i>Sphingomonas</i>	5.90%
5	<i>Acinetobacter</i>	5.90%
6	<i>Salmonella</i>	4.30%
7	<i>Iphinoe</i>	1.40%
8	<i>Siccibacter</i>	1.10%
9	<i>Enterobacter</i>	6.10%
10	<i>Pantoea</i>	5.70%
11	<i>Leclercia</i>	4.60%
12	<i>Atlantibacter</i>	3.40%
13	<i>Bacillus</i>	1.10%

**Table S2.** Values for diversity indices including Chao1, ACE, Shannon, and Simpson.

No.	Sample names	Abbreviation	Chao1	ACE	Shannon	Simpson
1		YNMD-1	496.38	540.66	5.43	0.91404
2	Mangdui	YNMD-2	334.97	348.1	4.66	0.879039
3		YNMD-3	462.02	482.6	6.89	0.977228
4		YNMLG-1	436.24	454.06	6.24	0.965717
5	Mengligong	YNMLG-2	434.51	464.38	6	0.948951
6		YNMLG-3	420.71	436.13	6.54	0.977544
7		YNJD-1	502.11	531.2	6.51	0.96351
8	Menglijiaojid	YNJD-2	262.39	266	5.57	0.940027

9		YNJD-3	397.14	424.89	5.63	0.931951
10		YNJD-4	657.01	719.48	7.17	0.980499
11	Qujing	YNQJ	444.97	480.36	5.79	0.947153
12		YNWS-1	723.4	722.88	7.41	0.987752
13	Wenshan	YNWS-2	591.31	631.2	7.22	0.985375
14		YNWS-3	436.24	462.35	6.44	0.973301
15		YNCX-1	296.41	314.21	4.53	0.899527
16	Chuxiong	YNCX-2	391.03	426.02	6.16	0.969601
17		YNCX-3	448.15	472.89	6.16	0.956488
18	Xindian	YNXD-1	436	468.93	6.34	0.975027

19		YNXD-2	410.86	421.92	6.89	0.984097
20		YNXD-3	335.16	356.52	4.64	0.896422
21		YNLJ-1	400.12	423.49	6.65	0.980293
22	Lijiang	YNLJ-2	479	479	7.1	0.978974
23		YNHP-1	719.08	768.87	7.42	0.984453
24	Huaping	YNHP-2	504.19	543.05	6.63	0.977342
25		YNHP-3	343	343	6.26	0.968324
26		HeNZW-1	380.24	413.29	4.72	0.863809
27	Zhangwu	HeNZW-2	333.65	347.01	4.79	0.88234
28		HeNZW-3	284.12	317.46	4.61	0.892561

29		HeNPDS-1	359.09	372.8	6.57	0.980296
30	Pingdingshan	HeNPDS-2	377.14	405.89	6.3	0.970262
31		HeNPDS-3	570.03	598.2	7.3	0.98653
32		HeNLY-1	505.88	516.13	6.2	0.955718
	Luoyang					
33		HeNLY-2	475.64	499.52	5.68	0.93912
34	Zhuyang	HeN-ZY	178.4	190.34	2.84	0.742921
35	Sanmenxia	HeNSMX	368.04	383.34	4.35	0.844246
36		HeNXC-1	438.5	463.54	6.15	0.957591
	Xuchang					
37		HeNXC-2	414.02	415.17	7.11	0.985082
38	Shigang	HeNSG-1	366.02	397.39	5.37	0.939487

39		HeNSG-2	459.79	491.76	5.65	0.933176
40	Xiangcheng	HeNXC	391.75	419.94	5.82	0.958948
41		CQ-1	339.01	363.29	5.56	0.951285
42	Chongqing	CQ-2	526.28	555.93	6.44	0.963472
43		HuNYS-1	614.25	641.34	6.78	0.975255
44		HuNYS-2	399.76	423.5	5.58	0.920859
45		HuNYS-3	287.38	304.44	5.86	0.963191
46	Yangshi	HuNYS-4	226.51	234.31	4.12	0.861432
47		HuNYS-5	530.29	573.24	6.82	0.974697
48		HuNYS-6	575.05	616.85	6.77	0.970914

49		GZBJ-1	508.77	541.8	6.04	0.962006
50		GZBJ-2	482.45	510.35	6.51	0.975451
51		GZBJ-3	284.12	304.11	3.92	0.800097
52	Bijie	GZBJ-4	531.93	561.92	6.82	0.98226
53		GZBJ-5	393.85	396.19	5.1	0.908417
54		GZBJ-6	360.07	353.33	4.84	0.90591
55	Weining	GZWN-1	372	372	6.77	0.974709
56		GZWN-2	481.06	506.21	6.73	0.979132
57		GZQXN-1	381.91	395.07	6.54	0.970156
58	Qianxinan	GZQXN-2	262.78	285.57	4.13	0.842303

59		GZQXN-3	259.2	271.08	4.96	0.930895
60		GZQXN-4	409.46	443.3	6.13	0.967219
61		SCPZH-1	498.74	507.64	5.76	0.931751
62	Panzhihua	SCPZH-2	418.07	446.04	5.33	0.909534
63		SCPZH-3	367.5	395.64	5.31	0.926667
64		HLJMDJ-1	384.74	407.39	6.11	0.966191
65		HLJMDJ-2	407.54	419.33	6.88	0.983132
66	Mudanjiang	HLJMDJ-3	548.8	578.12	6.43	0.961567
67		HLJMDJ-4	533.14	559.49	7.11	0.984816
68		HLJMDJ-5	421.91	422.08	6.1	0.968276

69		FJSM-1	667.31	714.31	7	0.975688
70	Sanming	FJSM-2	553.02	543.94	6.78	0.975188
71		FJSM-3	429.74	440.72	6.75	0.976319
72		FJSW-2	421	421	7.16	0.983821
73		FJSW-1	479.71	491.17	7.1	0.984062
74		FJSW-3	528.62	511.23	6.62	0.972505
75	Shaowu	FJSW-5	352.37	359.01	5.87	0.952252
76		FJSW-6	332.01	332.75	6.28	0.970516
77		FJSW-7	331.88	343.71	5.43	0.943821
78		FJSW-4	514.94	526.67	6.77	0.971637

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**Table S3.** Lists of the core microbial communities determined for each province.

Province	Core microbial community
Yunnan	<i>Mastigocoleus testarum</i>
	<i>Atlantibacter hermannii</i>
	<i>Salmonella enterica</i>
	<i>Xanthomonas campestris</i>
	<i>Leclercia adecarboxylata</i>
	<i>Enterobacter soli</i>
	<i>Pseudomonas oryzihabitans</i> 、 <i>Pseudomonas straminea</i>
	<i>Methylobacterium goesingense</i>
	<i>Pantoea agglomerans</i>
	<i>Sphingomonas roseiflava</i> ; <i>Sphingomonas aurantiaca</i> ; <i>Sphingomonas aerolata</i>
Guizhou	<i>Ochrobactrum anthropi</i>
	<i>Agrobacterium larrymoorei</i>
	<i>Mastigocoleus testarum</i>
	<i>Atlantibacter hermannii</i>
	<i>Salmonella enterica</i>
	<i>Leclercia adecarboxylata</i>
	<i>Enterobacter soli</i>
	<i>Pantoea agglomerans</i>
	<i>Pseudomonas oryzihabitans</i>
	<i>Acinetobacter johnsonii</i>
Fujian	<i>Methylobacterium goesingense</i>
	<i>Sphingomonas aurantiaca</i>
	<i>Salmonella enterica</i>
Fujian	<i>Bordetella petrii</i> ; <i>Bordetella hinzii</i>
	<i>Atlantibacter hermannii</i>

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*Franconibacter helveticus*  
*Leclercia adecarboxylata*  
*Enterobacter soli; Enterobacter xiangfangensis; Enterobacter cancerogenus*  
*Pseudomonas oryzihabitans; Pseudomonas straminea; Pseudomonas azotifigens*  
*Acinetobacter baumannii*  
*Pantoea agglomerans; Pantoea intestinalis*  
*Methylobacterium goesingense; Methylobacterium hispanicum*  
*Sphingomonas roseiflava; Sphingomonas phyllosphaerae*  
*Beijerinckia fluminensis*  
*Paracoccus yeei*  
*Pigmentiphaga daeguensis*  
*Ochrobactrum pseudintermedium*

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Hunan

*Mastigocoleus testarum*  
*Siccibacter colletis*  
*Atlantibacter hermannii*  
*Klebsiella*  
*Salmonella enterica*  
*Leclercia adecarboxylata*  
*Enterobacter soli; Enterobacter xiangfangensis*  
*Pseudomonas oryzihabitans; Pseudomonas straminea; Pseudomonas parafulva*  
*Acinetobacter johnsonii*  
*Pantoea agglomerans; Pantoea dispersa*  
*Sphingomonas roseiflava; Sphingomonas phyllosphaerae; Sphingomonas sanguinis*  
*Methylobacterium hispanicum*

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Sichuan

*Mastigocoleus testarum*

*Atlantibacter hermannii*  
*Salmonella enterica*  
*Leclercia adecarboxylata*  
*Enterobacter soli*  
*Pseudomonas oryzihabitans; Pseudomonas parafulva*  
*Acinetobacter johnsonii*  
*Methylobacterium goesingense*  
*Ochrobactrum anthropi; Ochrobactrum lupini*  
*Pantoea agglomerans; Pantoea dispersa*  
*Sphingomonas roseiflava*

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*Mastigocoleus testarum*  
*Atlantibacter hermannii*  
*Citrobacter murliniae*  
*Aurantimonas phyllosphaerae*  
*Arthospira platensis*  
*Chroococcidiopsis thermalis*  
*Salmonella enterica*  
*Kluyvera intermedia*  
*Stenotrophomonas maltophilia*  
Chongqing      *Serratia proteamaculans*  
*Leclercia adecarboxylata*  
*Enterobacter soli; Enterobacter cancerogenus*  
*Pseudomonas oryzihabitans; Pseudomonas punonensis*  
*Pantoea agglomerans*  
*Methylobacterium goesingense*  
*Sphingomonas roseiflava; Sphingomonas aurantiaca; Sphingomonas phyllosphaerae; Sphingomonas cynarae; Sphingomonas aerolata; Sphingomonas yunnanensis*  
*Ochrobactrum anthropi; Ochrobactrum lupini*

*Acinetobacter guillouiae; Acinetobacter bereziniae*

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*Mastigocoleus testarum*

*Salmonella enterica*

*Leclercia adecarboxylata*

Henan

*Pseudomonas oryzihabitans*

*Pantoea agglomerans*

*Methylobacterium goesingense; Methylobacterium hispanicum;*

*Methylobacterium brachiatum; Methylobacterium mesophilicum*

*Enterobacter xiangfangensis*

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*Mastigocoleus testarum*

*Escherichia vulneris*

*Franconibacter helveticus*

*Atlantibacter hermannii*

*Stenotrophomonas maltophilia*

*Salmonella enterica*

*Leclercia adecarboxylata*

Heilongjiang      *Enterobacter soli; Enterobacter xiangfangensis; Enterobacter cancerogenus*

*Pantoea agglomerans; Pantoea intestinalis; Pantoea dispersa*

*Pseudomonas oryzihabitans*

*Methylobacterium goesingense; Methylobacterium brachiatum;*

*Methylobacterium mesophilicum*

*Sphingomonas roseiflava*

*Beijerinckia fluminensis*

*Agrobacterium larrymoorei*

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**Table S4.** Lists of beneficial genera uniquely present in particular provinces.

Province	Genus	Function	Relative abundance
Yunnan	<i>Ochrobactrum</i>	Heavy metals detoxification, and nitrogen fixation	24.91%
	<i>Agrobacterium</i>	Degradation of pesticides	
Guizhou	<i>Acinetobacter</i>	Degradation of PAHs and nicotine, heavy metals detoxification	23.63%
Fujian	<i>Franconibacter</i>	Degradation of alkane	23.02%
	<i>Beijerinckia</i>	Nitrogen fixation	
	<i>Paracoccus</i>	Degradation of formaldehyde	
	<i>Acinetobacter</i>	Degradation of PAHs and nicotine, heavy metals detoxification	
	<i>Pigmentiphaga</i>	Degradation of PAHs, pesticides and nicotine	
Hunan	<i>Ochrobactrum</i>	Degradation of PAHs	19.11%
	<i>Acinetobacter</i>	Degradation of PAHs and nicotine, heavy metals detoxification	
Sichuan	<i>Acinetobacter</i>	Degradation of PAHs and nicotine, heavy metals detoxification	33.23%
	<i>Ochrobactrum</i>	Degradation of pesticides	
Chongqing	<i>Acinetobacter</i>	Degradation of PAHs and nicotine, heavy metals detoxification	34.98%
	<i>Ochrobactrum</i>	Degradation of pesticides	
	<i>Serratia</i>	Heavy metals detoxification,nitrogen fixation	
Heilongjiang	<i>Agrobacterium</i>	Degradation of pesticides	39.80%
	<i>Beijerinckia</i>	Nitrogen fixation	

**Table S5.** Information about environmental factors (longitude, latitude, annual average temperature, annual precipitation, and altitude) for each sampling location.

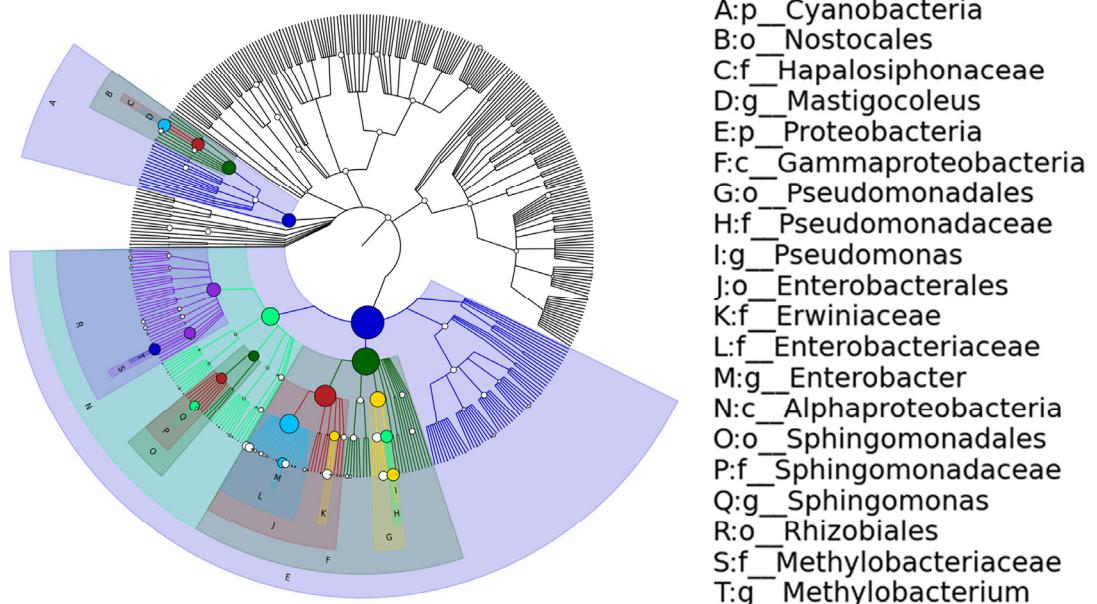
No.	Sample	Longitude (E)	Latitude (N)	Annual average temperature (°C)	Annual precipitation (mm)	Altitude (m)
1	YNJD-1	99.2	23.2	17.7	1747.2	1502.4
2	YNJD-2	99.2	23.2	17.7	1747.2	1502.4
3	YNJD-3	99.2	23.2	17.7	1747.2	1502.4
4	YNJD-4	99.2	23.2	17.7	1747.2	1502.4
5	YNMD-1	99.4	23.9	17.8	1148.9	1695.0
6	YNMD-2	99.4	23.9	17.8	1148.9	1695.0
7	YNMD-3	99.4	23.9	17.8	1148.9	1695.0
8	YNMLG-1	99.4	23.9	17.8	1148.9	1695.0
9	YNMLG-2	99.4	23.9	17.8	1148.9	1695.0
10	YNMLG-3	99.4	23.9	17.8	1148.9	1695.0
11	YNLJ-1	100.2	26.9	12.9	980.3	2393.2
12	YNLJ-2	100.2	26.9	12.9	980.3	2393.2
13	YNHP-1	101.3	26.6	19.6	1087.8	1244.8

14	YNHP-2	101.3	26.6	19.6	1087.8	1244.8
15	YNHP-3	101.3	26.6	19.6	1087.8	1244.8
16	YNCX-1	101.3	25.2	14.8	843.2	1859.0
17	YNCX-2	101.3	25.2	14.8	843.2	1859.0
18	YNCX-3	101.3	25.2	14.8	843.2	1859.0
19	SCPZH-1	101.9	27.1	20.9	838.7	1156.0
20	SCPZH-2	101.9	27.1	20.9	838.7	1156.0
21	SCPZH-3	101.9	27.1	20.9	838.7	1156.0
22	YNXD-1	102.9	26.9	11.8	674.6	1949.5
23	YNXD-2	102.9	26.9	11.8	674.6	1949.5
24	YNXD-3	102.9	26.9	11.8	674.6	1949.5
25	YNQJ	103.5	25.5	15.1	944.8	1898.7
26	GZWN-1	104.1	26.9	10.8	859.4	2237.5
27	GZWN-2	104.1	26.9	10.8	859.4	2237.5
28	YNWS-1	104.4	23.0	18.4	974.6	1271.6
29	YNWS-2	104.4	23.0	18.4	974.6	1271.6
30	YNWS-3	104.4	23.0	18.4	974.6	1271.6

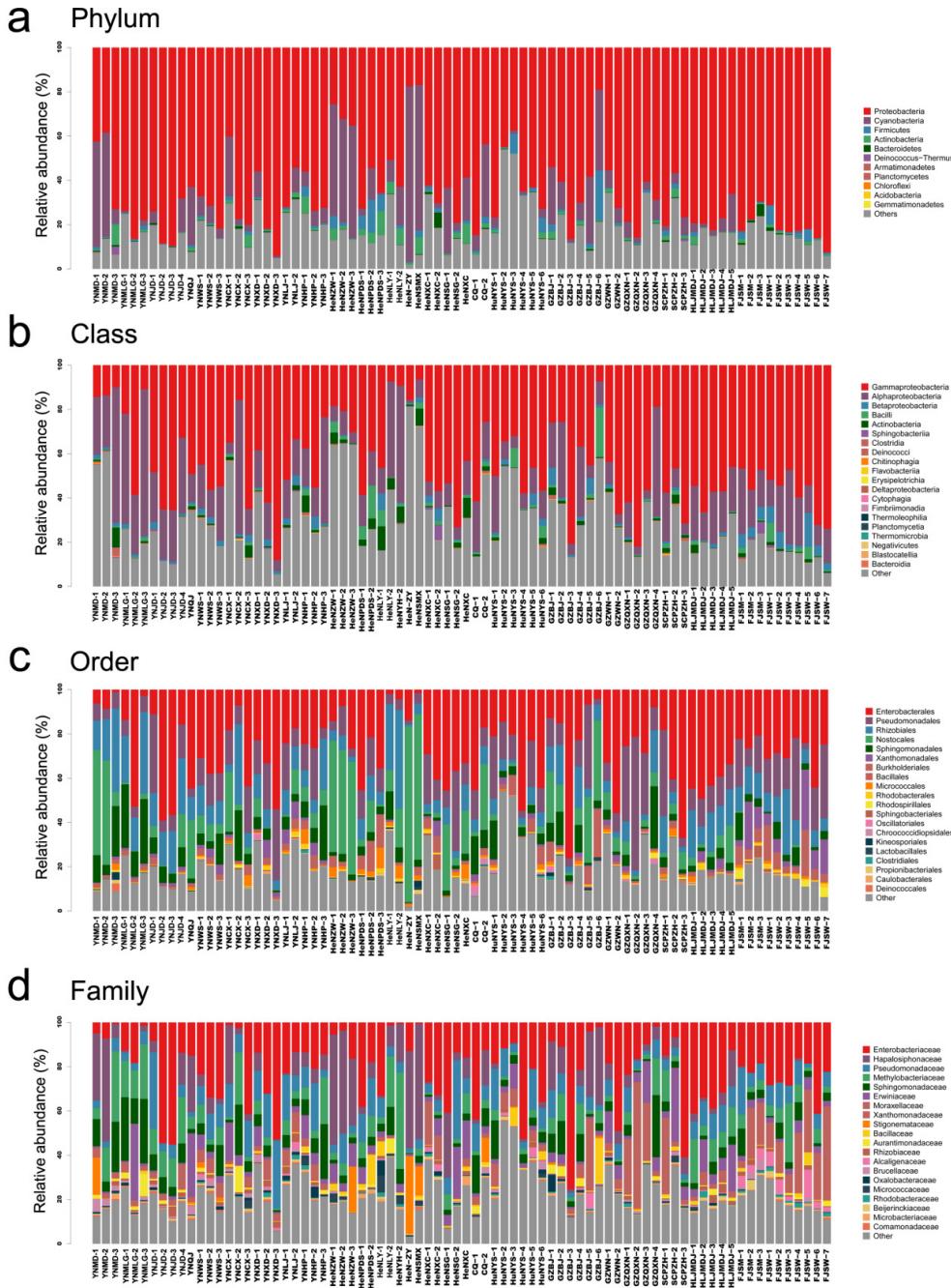
31	GZQXN-4	104.9	25.1	18.3	1476.7	1626.0
32	GZQXN-1	104.9	25.5	13.9	1353.8	1626.0
33	GZQXN-2	104.9	25.5	13.9	1353.8	1626.0
34	GZQXN-3	104.9	25.5	13.9	1353.8	1626.0
35	GZBJ-6	105.3	27.3	13.0	865.9	1510.6
36	GZBJ-5	105.4	26.8	13.0	865.9	1510.6
37	GZBJ-1	105.6	27.1	12.1	1085.4	1510.6
38	GZBJ-2	105.6	27.1	12.1	1085.4	1510.6
39	GZBJ-3	105.6	27.1	12.1	1085.4	1510.6
40	GZBJ-4	105.7	27.0	13.0	865.9	1510.6
41	CQ-1	108.8	29.5	17.5	1126.4	259.1
42	CQ-2	108.8	29.5	15.7	1172.8	259.1
43	HeN-ZY	110.7	34.3	13.5	598.7	662.0
44	HeNSMX	111.2	34.8	14.4	516.6	410.1
45	HeNLY-1	111.6	34.4	13.9	568.4	154.5
46	HeNLY-2	111.6	34.4	13.9	568.4	154.5
47	HeNSG-1	111.8	32.9	15.2	793.4	129.8

48	HeNSG-2	111.8	32.9	15.2	793.4	129.8
49	HeNZW-1	111.8	34.4	14.7	630.1	154.5
50	HeNZW-2	111.8	34.4	14.7	630.1	154.5
51	HeNZW-3	111.8	34.4	14.7	630.1	154.5
52	HuNYS-1	112.8	26.0	18.4	1503.4	184.9
53	HuNYS-2	112.8	26.0	18.4	1503.4	184.9
54	HuNYS-3	112.8	26.0	18.4	1503.4	184.9
55	HuNYS-4	112.8	26.0	18.4	1503.4	184.9
56	HuNYS-5	112.8	26.0	18.4	1503.4	184.9
57	HuNYS-6	112.8	26.0	18.4	1503.4	184.9
58	HeNPDS-1	113.2	33.8	14.8	783.4	84.7
59	HeNPDS-2	113.2	33.8	14.8	783.4	84.7
60	HeNPDS-3	113.2	33.8	14.8	783.4	84.7
61	HeNXC	113.5	33.9	14.9	754.3	86.0
62	HeNXC-1	113.6	33.9	14.6	733.5	71.9
63	HeNXC-2	113.6	33.9	14.6	733.5	71.9
64	FJSW-2	117.5	27.3	18.2	1840.9	191.5

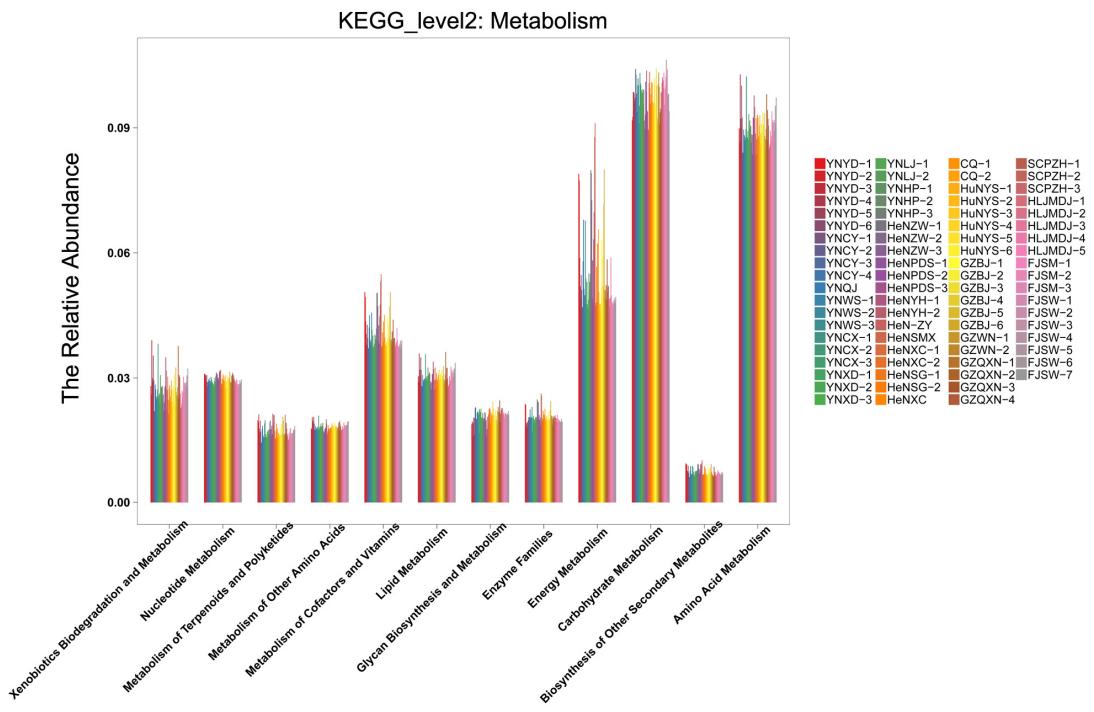
65	FJSW-1	117.5	27.3	18.2	1840.9	191.5
66	FJSW-3	117.5	27.3	18.2	1840.9	191.5
67	FJSW-5	117.5	27.3	18.2	1840.9	191.5
68	FJSW-6	117.5	27.3	18.2	1840.9	191.5
69	FJSW-7	117.5	27.3	18.2	1840.9	191.5
70	FJSW-4	117.5	27.3	18.2	1840.9	191.5
71	FJSM-1	117.6	26.3	19.6	1665.2	421.0
72	FJSM-2	117.6	26.3	19.6	1665.2	421.0
73	FJSM-3	117.6	26.3	19.6	1665.2	421.0
74	HLJMDJ-1	129.6	44.6	4.8	561.2	241.4
75	HLJMDJ-2	129.6	44.6	4.8	561.2	241.4
76	HLJMDJ-3	129.6	44.6	4.8	561.2	241.4
77	HLJMDJ-4	129.6	44.6	4.8	561.2	241.4
78	HLJMDJ-5	129.6	44.6	4.8	561.2	241.4



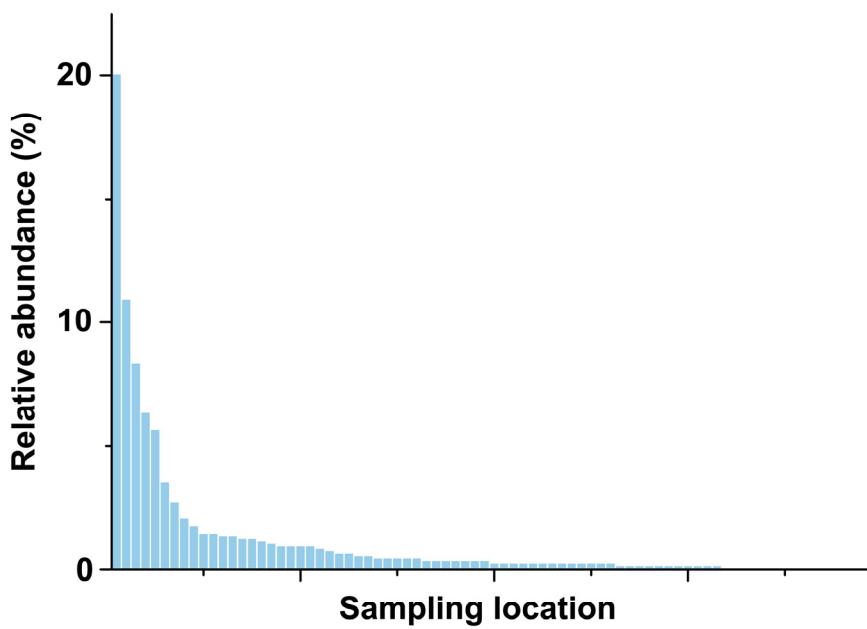
**Figure S1.** Classification tree for all samples, visualized using GraPhlAn.



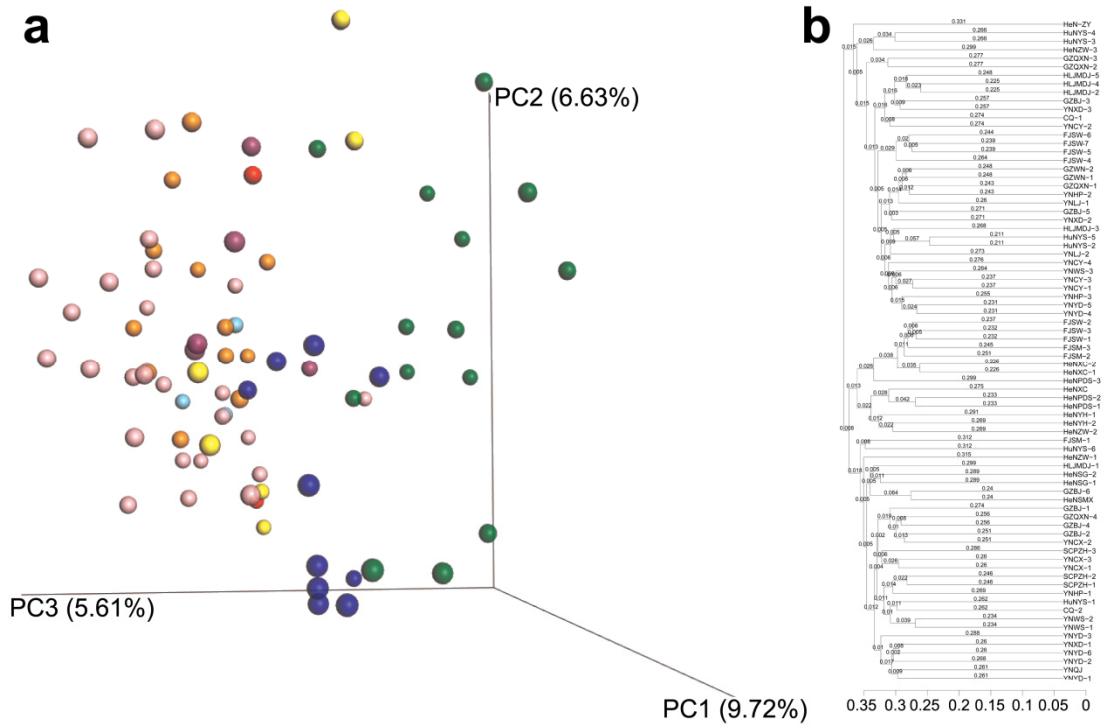
**Figure S2.** The community compositions at different levels. **(A)** The community compositions at the phylum-level. **(B)** The community compositions at the class-level. **(C)** The community compositions at the order-level. **(D)** The community compositions at the family-level.



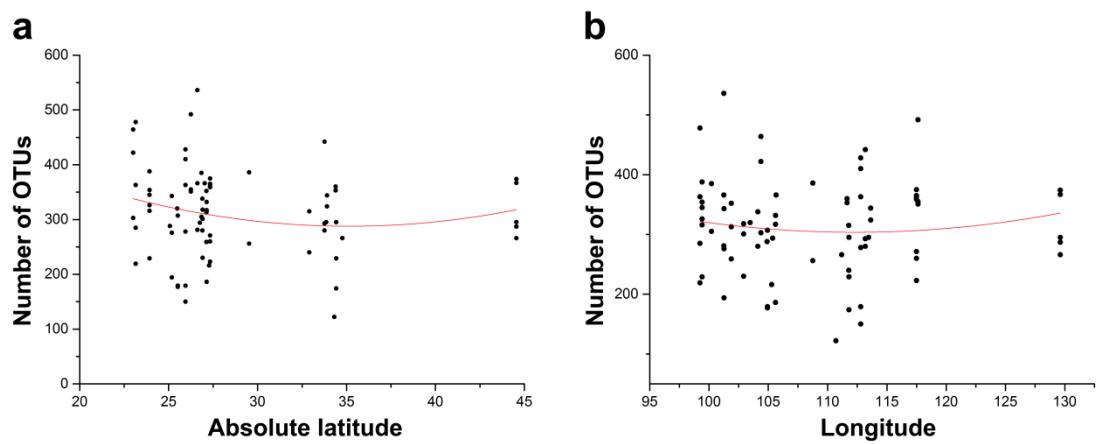
**Figure S3.** PICRUSt predicted the KEGG-level abundance distributions.



**Figure S4.** Relative abundance of *Bacillus* of each sample.



**Figure S5.** The results of PcoA analysis of unweighted Unifrac distance and unweighted pair-group method with arithmetic means.



**Figure S6.** Distribution of microbial diversity. **(A)** Latitudinal distribution of microbial diversity. **(B)** longitudinal distribution of microbial diversity.