**Table S1. The background information of sampling locations.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Number** | **Province** | **Location** | **Latitude** | **Longitude** | **Soil Type** | **Climate Type** |
| S1 | Fujian | Anxi County | 118.071667 | 25.200833 | Acrisol | Subtropical monsoon climate |
| S2 | Fujian | Ningde | 120.196944 | 27.333333 | Acrisol | Subtropical monsoon climate |
| S3 | Fujian | Wuyishan | 118.002222 | 27.725556 | Acrisol | Subtropical monsoon climate |
| S4 | Zhejiang | Hangzhou | 120.064722 | 30.185278 | Acrisol | Subtropical monsoon climate |
| S5 | Zhejiang | Wenzhou | 120.356935 | 27.575000 | Acrisol | Subtropical monsoon climate |
| S6 | Zhejiang | Taizhou | 121.225833 | 29.169167 | Acrisol | Subtropical monsoon climate |
| S7 | Zhejiang | Lishui | 119.649722 | 27.948611 | Acrisol | Subtropical monsoon climate |
| S8 | Jiangxi | Wuyuan County | 117.823611 | 29.350278 | Acrisol | Subtropical monsoon climate |
| S9 | Jiangxi | Nanchang | 115.121944 | 28.238889 | Acrisol | Subtropical monsoon climate |
| S10 | Jiangxi | Xiushui County | 114.527222 | 29.013056 | Acrisol | Subtropical monsoon climate |
| S11 | Anhui | Shexian County | 118.405556 | 29.643056 | Acrisol | Subtropical monsoon climate |
| S12 | Anhui | Huangshan | 118.278056 | 30.143333 | Acrisol | Subtropical monsoon climate |
| S13 | Anhui | Luan | 116.140833 | 31.414444 | Acrisol | Subtropical monsoon climate |
| S14 | Anhui | Ningguo | 118.653333 | 30.554167 | Acrisol | Subtropical monsoon climate |
| S15 | Hubei | Xianning | 113.733637 | 29.634722 | Acrisol | Subtropical monsoon climate |
| S16 | Hubei | Wuhan | 114.155105 | 30.292778 | Acrisol | Subtropical monsoon climate |
| S17 | Hunan | Changsha | 113.454679 | 28.558889 | Acrisol | Subtropical monsoon climate |
| S18 | Hunan | Xiangxi | 110.587222 | 28.455833 | Acrisol | Subtropical monsoon climate |
| S19 | Hunan | Yiyang | 111.594444 | 28.165000 | Acrisol | Subtropical monsoon climate |
| S20 | Guangxi | Wuzhou | 111.287222 | 23.792222 | Acrisol | Subtropical monsoon climate |
| S21 | Guangxi | Qinzhou | 109.058456 | 22.422778 | Acrisol | Subtropical monsoon climate |
| S22 | Guizhou | Zunyi | 107.613706 | 27.642778 | Alisol | Subtropical monsoon climate |
| S23 | Guizhou | Southwest Guizhou | 105.145556 | 25.773056 | Acrisol | Subtropical monsoon climate |
| S24 | Guizhou | Guiyang | 106.653889 | 26.511111 | Luvisol | Subtropical monsoon climate |
| S25 | Guizhou | Tongren | 109.281389 | 27.949722 | Luvisol | Subtropical monsoon climate |
| S26 | Sichuan | Dazhou | 107.599923 | 31.920985 | Luvisol | Subtropical monsoon climate |
| S27 | Sichuan | Leshan | 103.450000 | 29.688333 | Luvisol | Subtropical monsoon climate |
| S28 | Sichuan | Chengdu | 103.274722 | 30.169722 | Luvisol | Subtropical monsoon climate |
| S29 | Chongqing | Chongqing | 106.738000 | 29.469000 | Purplish soil | Subtropical monsoon climate |
| S30 | Henan | Xinyang | 113.793889 | 32.067778 | Luvisol | Subtropical monsoon climate |
| S31 | Henan | Tongbai County | 113.067222 | 32.463611 | Luvisol | Subtropical monsoon climate |
| S32 | Shanxi | Ankang | 108.300278 | 33.070833 | Luvisol | Subtropical monsoon climate |
| S33 | Shanxi | Hanzhong | 106.011318 | 32.015782 | Luvisol | Subtropical monsoon climate |
| S34 | Yunnan | Lincang | 99.812676 | 23.613057 | Acrisol | Subtropical monsoon climate |
| S35 | Yunnan | Puer | 110.981667 | 22.795000 | Acrisol | Subtropical monsoon climate |
| S36 | Shandong | Jinan | 116.941389 | 36.263333 | Fluvisol | Temperate monsoon climate |
| S37 | Shandong | Taian | 117.214722 | 36.238056 | Luvisol | Temperate monsoon climate |
| S38 | Shandong | Rizhao | 119.161389 | 35.320833 | Luvisol | Temperate monsoon climate |
| S39 | Zhejiang | Anji | 119.675425 | 30.640836 | Acrisol | Subtropical monsoon climate |
| S40 | Zhejiang | Chunan | 118.568350 | 29.415878 | Acrisol | Subtropical monsoon climate |
| S41 | Guangdong | Qingyuan | 112.290000 | 24.490000 | Acrisol | Subtropical monsoon climate |
| S42 | Guangdong | Meizhou | 116.120000 | 24.280000 | Acrisol | Subtropical monsoon climate |
| S43 | Guangdong | Guangzhou | 113.380000 | 23.320000 | Acrisol | Subtropical monsoon climate |
| S44 | Guangxi | Baise | 106.491111 | 24.395278 | Acrisol | Subtropical monsoon climate |
| S45 | Hubei | Enshi | 110.212778 | 30.162778 | Luvisol | Subtropical monsoon climate |

**Table S2. The topological characteristics of microbial co-occurrence network for microbiomes in various compartments.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Number of nodes** | **Number of links** | **Mean of degree** | **Diameter of network** | **Centrality** | **Transitivity** |
| **Young leaf** | 1000 | 2807 | 2.8 | 156.2 | 0.035 | 0.26 |
| **Old leaf** | 1000 | 1786 | 1.8 | 108.8 | 0.044 | 0.27 |
| **Root** | 1000 | 3191 | 3.2 | 121.0 | 0.016 | 0.38 |
| **Rhizosphere** | 1000 | 5435 | 5.4 | 122.1 | 0.016 | 0.29 |
| **Bulk soil** | 1000 | 4967 | 5.0 | 127.8 | 0.028 | 0.27 |