

Supplemental information for **Effects of microbial communities on elevational gradient adaptation strategies of *Pinus yunnanensis* Franch. and *Pinus densata* Mast. in a mixed zone**

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The following supporting information is available for this article:

Supplemental Figure S1. Workflow of sample collection.

Supplemental Figure S2. Sampling sites.

Supplemental Figure S3. Morphological features of pine needles at different elevations.

Supplemental Figure S4. Raincloud plot showing needle morphological features at different elevations.

Supplemental Figure S5. Rarefaction curves for different groups of samples.

Supplemental Figure S6. Composition and relative abundance of microbial communities at the phylum and genus levels.

Supplemental Figure S7. The distribution of samples at different altitudes on the PC1 axis analysed by PCoA.

Supplemental Figure S8. Variation in OTU abundance with altitudinal gradient.

Supplemental Figure S9. The different groups between the two types of pines at the OTU level and functions of bacteria at the KEGG 2 level.

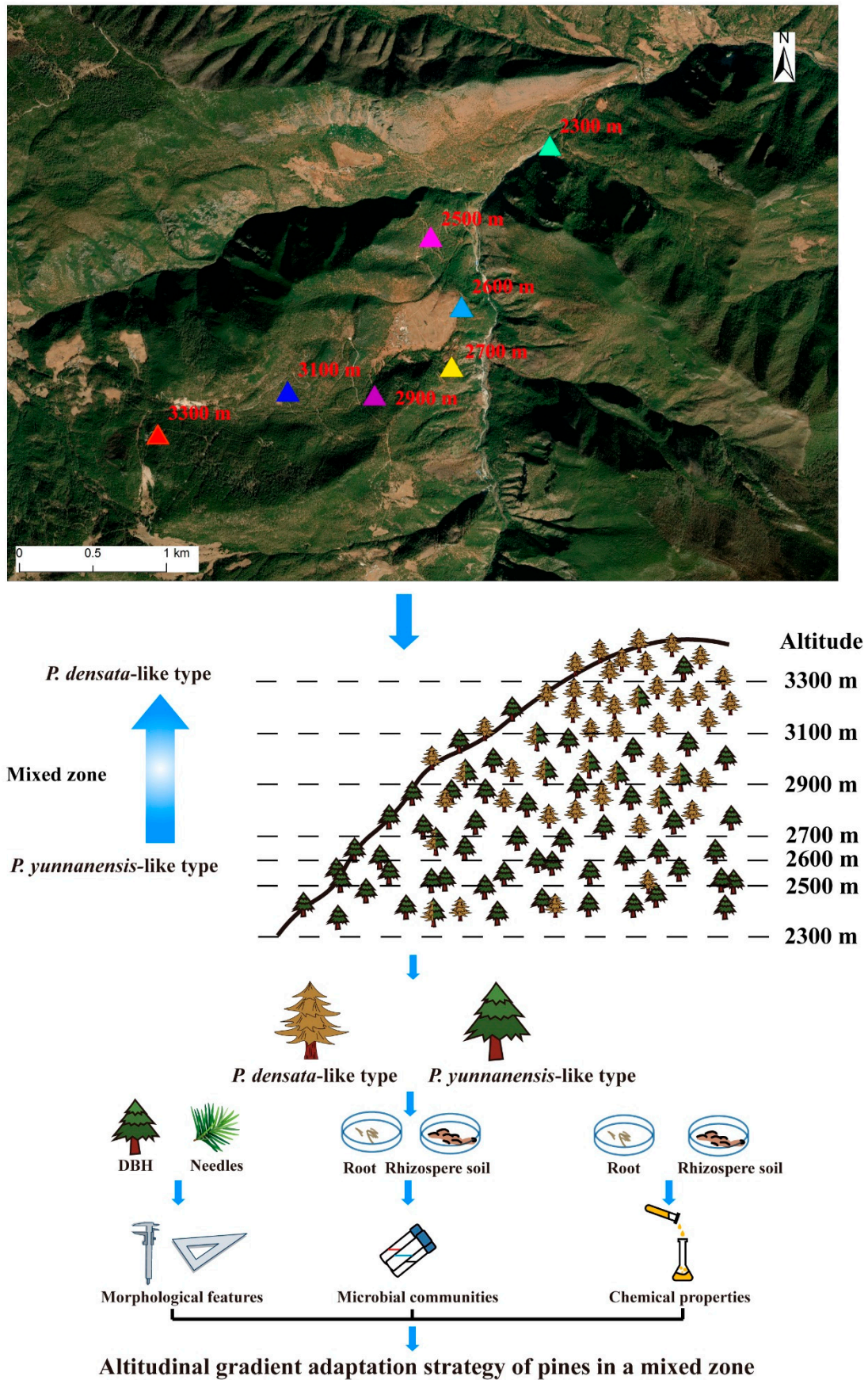
Supplemental Figure S10. The different groups between rhizosphere soil and roots at the OTU level and functions of bacteria at the KEGG 2 level.

Supplemental Figure S11. RDA/CCA of the microbial communities of different pine types.

Supplemental Figure S12. RDA/CCA of the microbial communities of rhizosphere soil and roots.

Supplementary Table S1. Sampling site information.

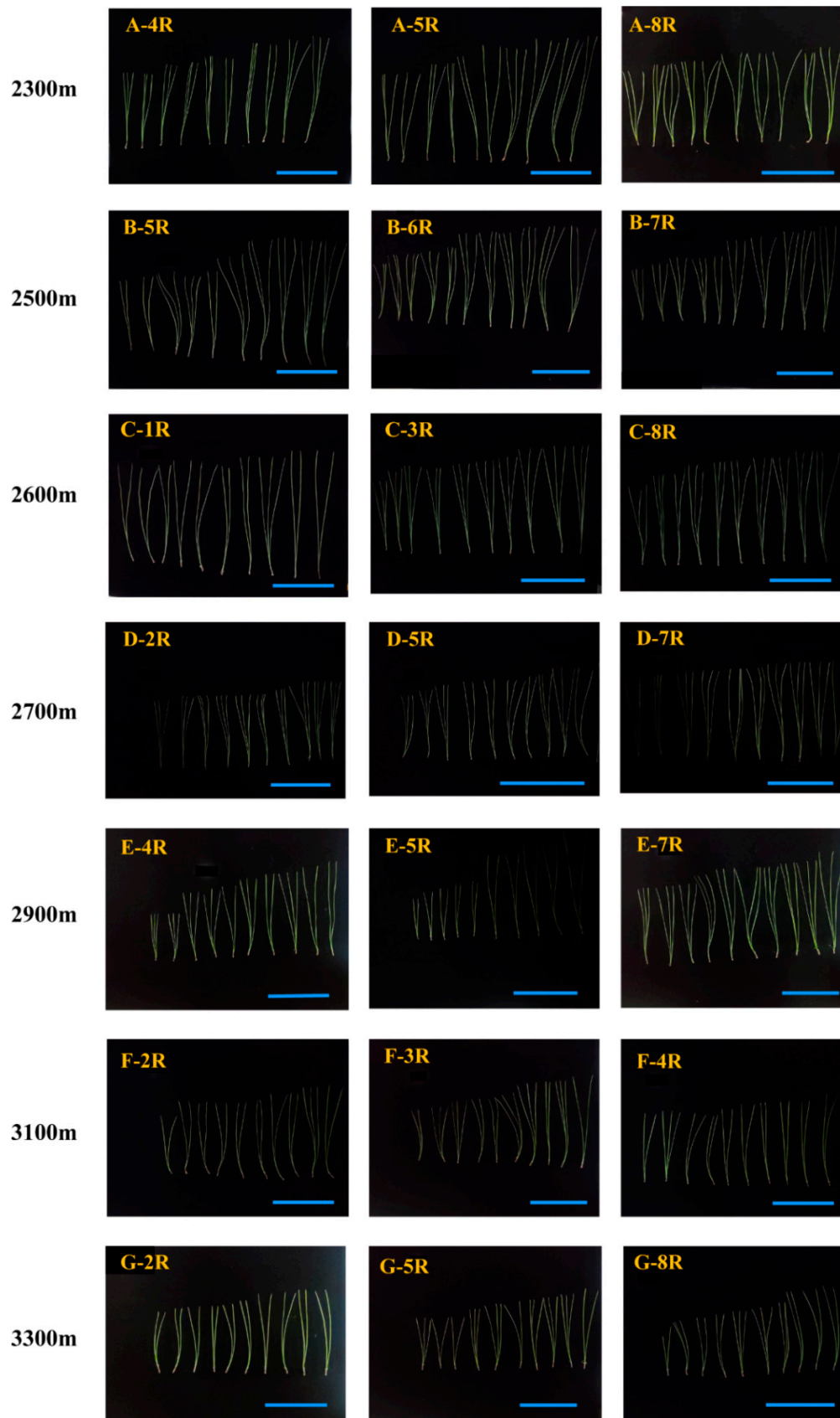
Supplementary Table S2. Plant information for sampling sites at different elevations.



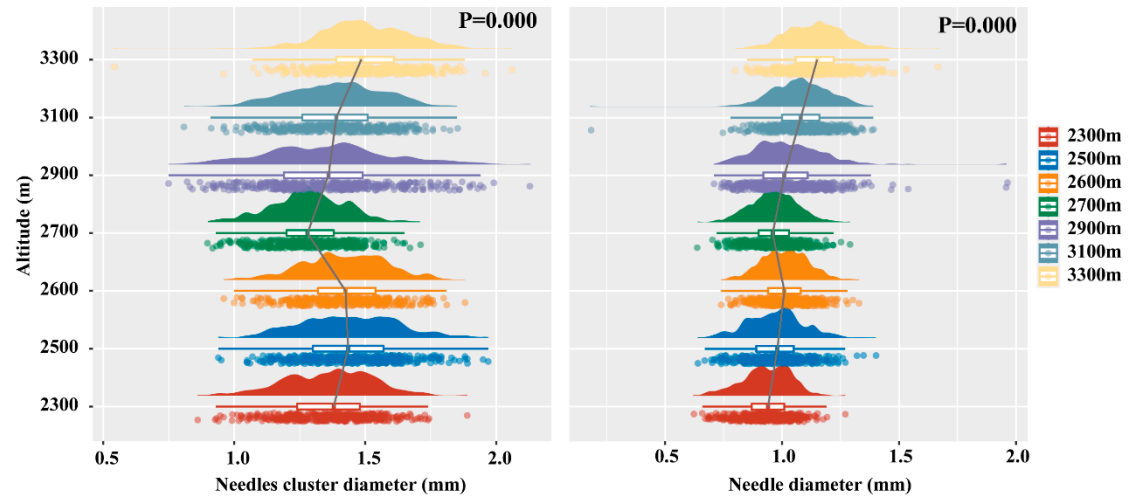
Supplemental Figure S1. Workflow of sample collection.



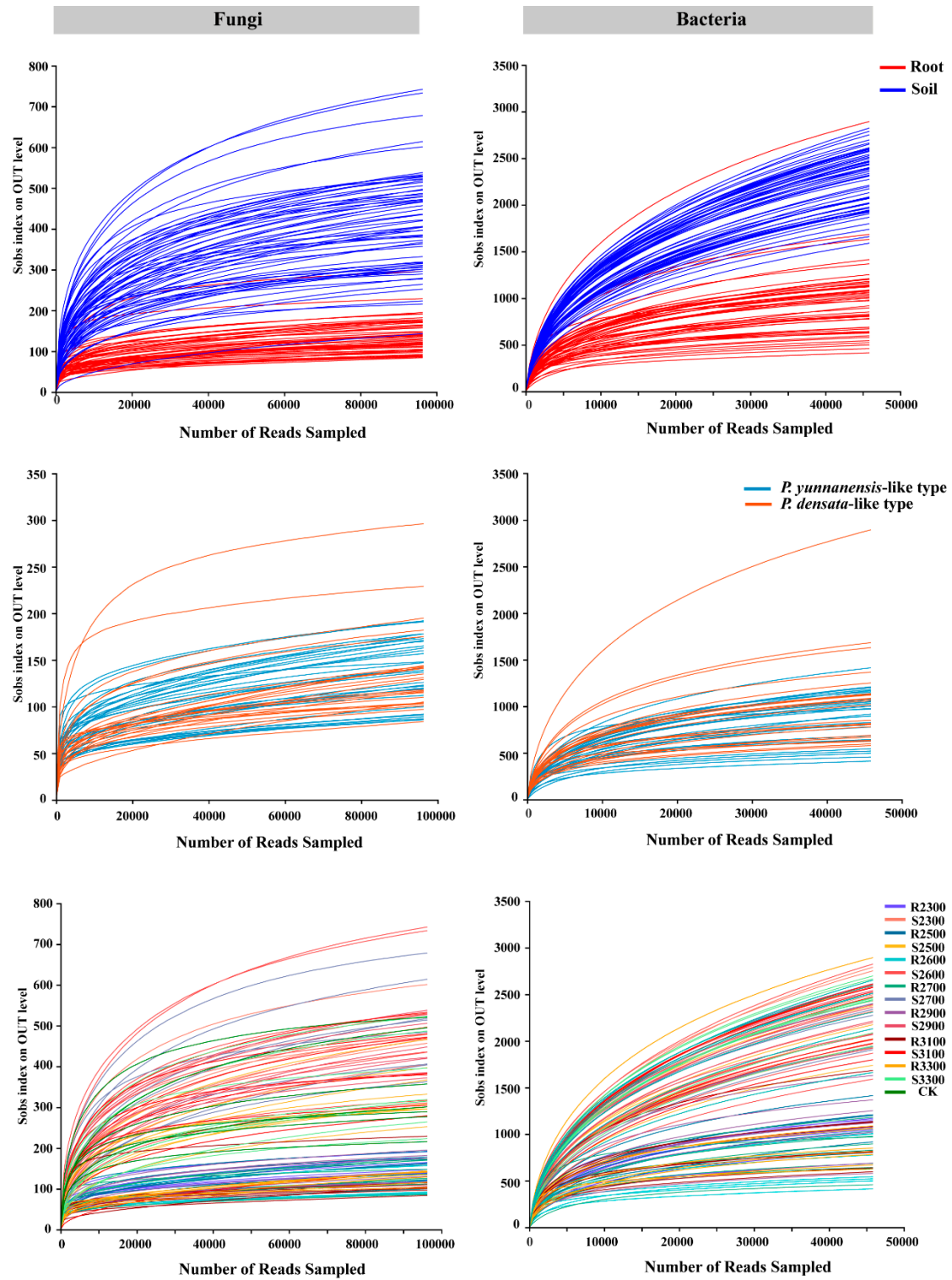
Supplemental Figure S2. Sampling sites. A, B, C: The pine forests used for sampling. D, E, F: The pine trees used to collect fine roots and rhizosphere soil. G, H: Fine roots and rhizosphere soil were collected.



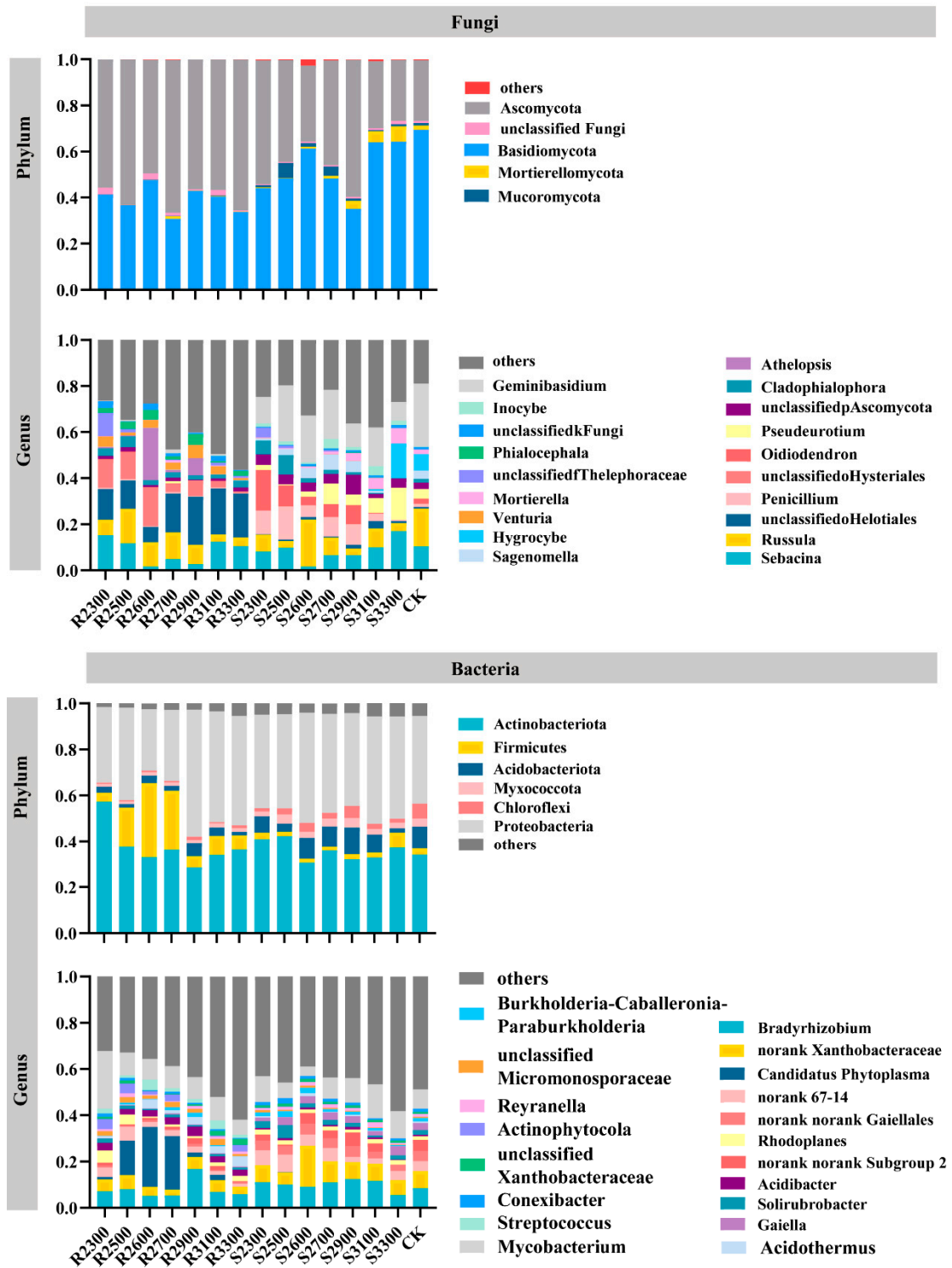
Supplemental Figure S3. Morphological features of pine needles at different elevations. The scale bars represent 10 cm.



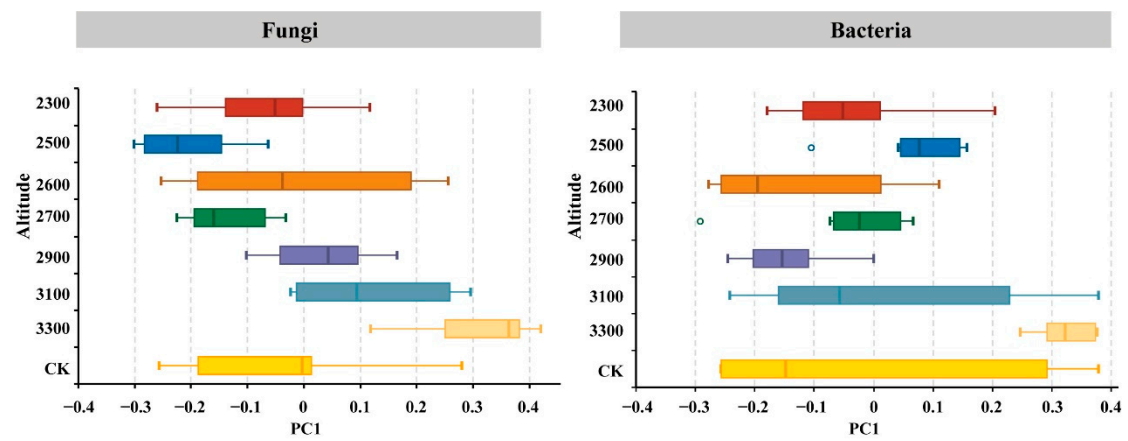
Supplemental Figure S4. Raincloud plot showing needle morphological features at different elevations. The half-violin diagram (cloud) shows the kernel density of the data distribution, and the scatter diagram (rain) shows the degree of dispersion. The raincloud plot also includes a box plot (umbrella) and lines (thunder) that link the medians of different groups.



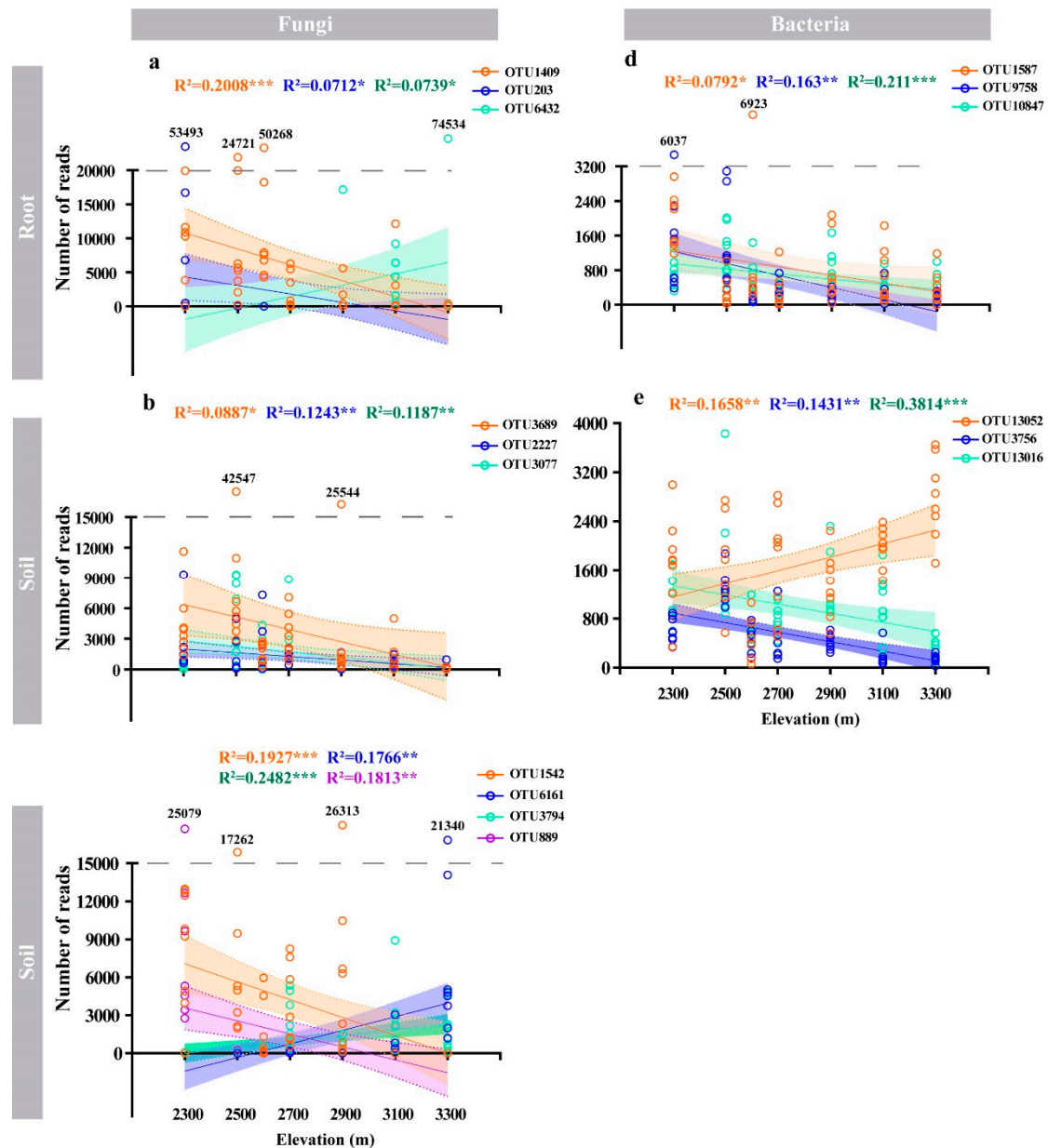
Supplemental Figure S5. Rarefaction curves for different groups of samples.



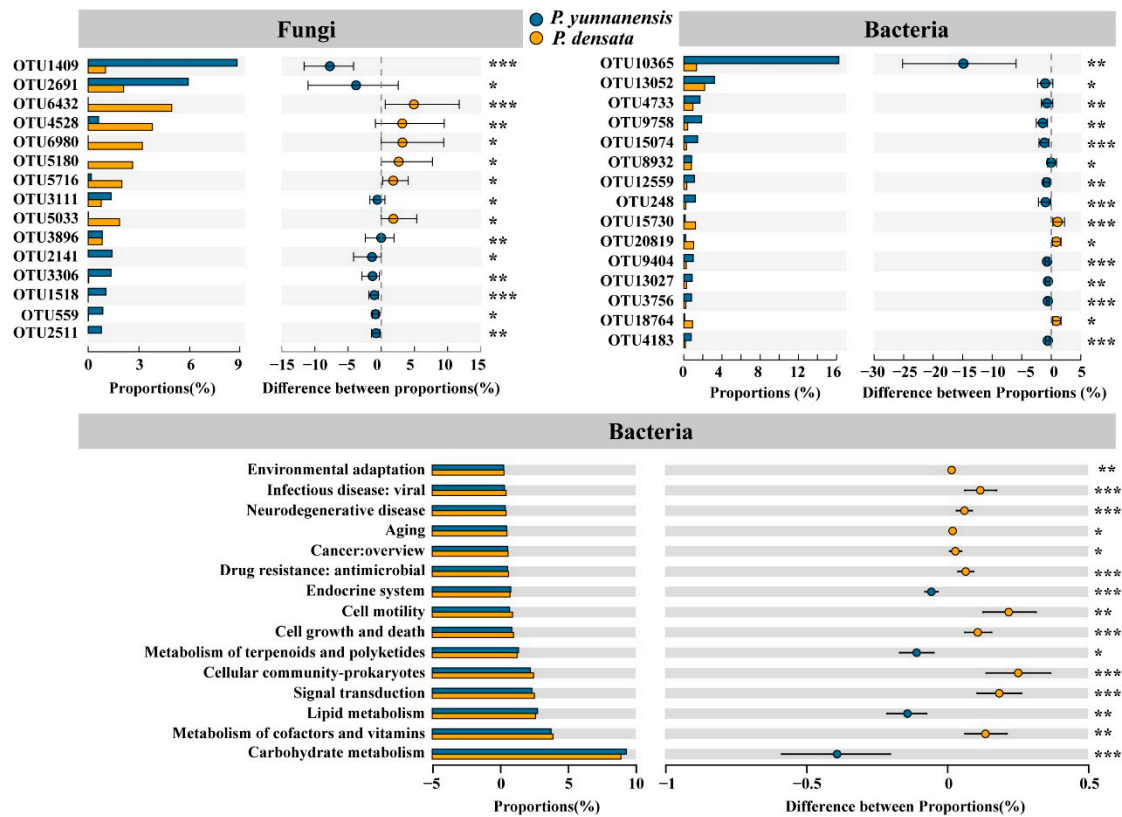
Supplemental Figure S6. Composition and relative abundance of microbial communities at the phylum and genus levels. Others represent the sum of the phyla or genera with a relative abundance less than 0.01.



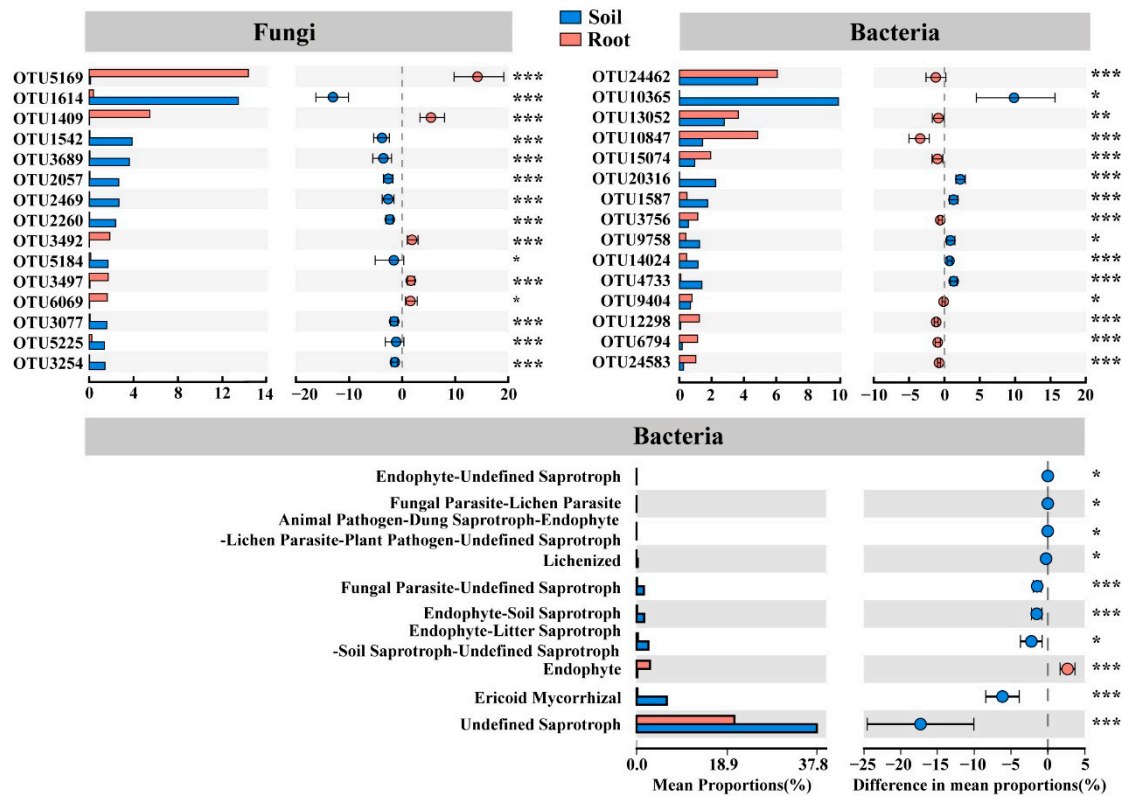
Supplemental Figure S7. The distribution of samples at different elevations on the PC1 axis analysed by PCoA.



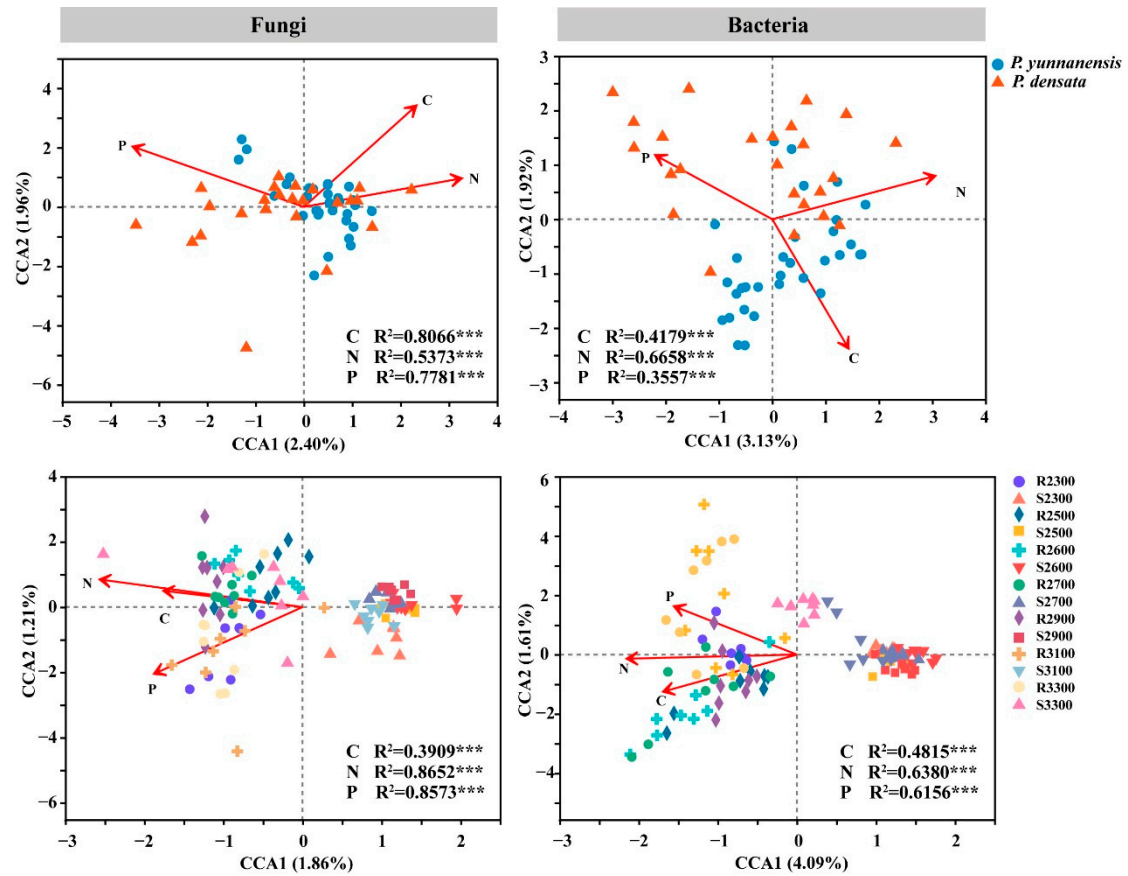
Supplemental Figure S8. Variation in OTU abundance with altitudinal gradient. The line indicates the linear regression fit, and the shaded band represents the 95% confidence level. R^2 was employed to determine the models that fit the whole altitudinal gradient. Significant difference: * $P \leq 0.05$, ** $P \leq 0.01$, *** $P \leq 0.001$.



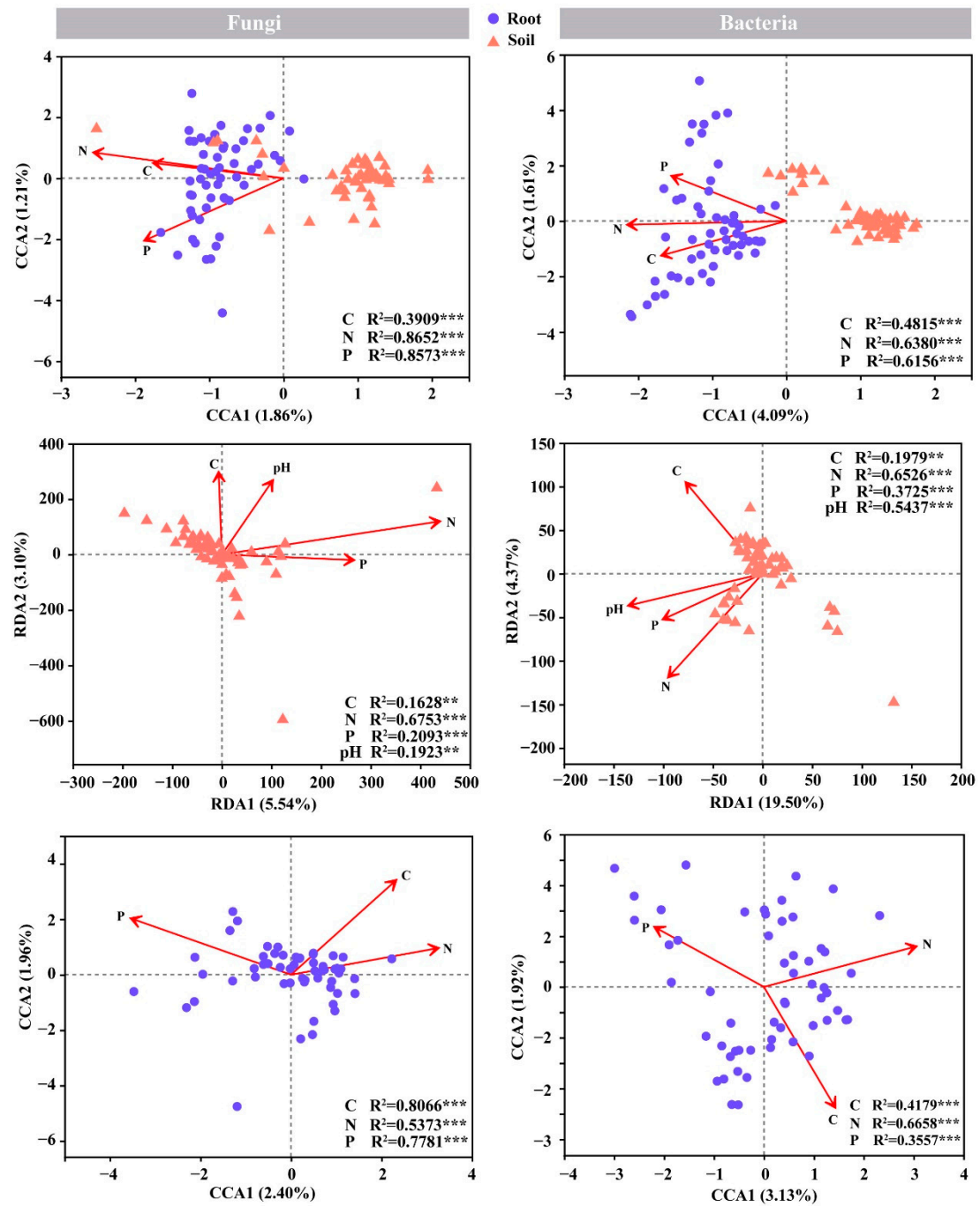
Supplemental Figure S9. The different groups between the two types of pines at the OTU level and functions of bacteria at the KEGG 2 level. Mann–Whitney U tests were used to evaluate differences in the abundance and functions of pine root endophytes. Significant difference: * $P \leq 0.05$, ** $P \leq 0.01$, *** $P \leq 0.001$.



Supplemental Figure S10. The different groups between rhizosphere soil and roots at the OTU level and functions of bacteria at the KEGG 2 level. Mann–Whitney U tests were used to evaluate differences in the abundance and functions of pine root endophytes. Significant difference: * $P \leq 0.05$, ** $P \leq 0.01$, *** $P \leq 0.001$.



Supplemental Figure S11. RDA/CCA of the microbial communities of different pine types. Soil properties and plant nutrient contents with significant relationships ($P < 0.05$) are indicated by red arrows, and the R^2 values are shown. Significant difference: $*** P \leq 0.001$.



Supplemental Figure S12. RDA/CCA of the microbial communities of rhizosphere soil and roots. Soil properties and plant nutrient contents with significant relationships ($P < 0.05$) are indicated by red arrows, and the R^2 values are shown. Significant difference: ** $P \leq 0.01$, *** $P \leq 0.001$.

Supplementary Table S1. Sampling site information.

Sampling sites	Longitude (E)	Latitude (N)	Elevation (m)
1	100°5'38.91"	27°45'44.42"	2300
2	100°4'51.76"	27°45'7.51"	2500
3	100°5'3.61"	27°44'39.69"	2600
4	100°5'0.32"	27°44'15.94"	2700
5	100°4'29.37"	27°44'4.31"	2900
6	100°3'55.51"	27°44'5.73"	3100
7	100°3'2.93"	27°43'49.49"	3300

Supplementary Table S2. Plant information for sampling sites at different elevations.

Species	Family	Cover degree (%)						
		2300m	2500m	2600m	2700m	2900m	3100m	3300m
<i>Pinus yunnanensis</i> -like type	Pinaceae	50	50	30	70	0	0	0
<i>Pinus densata</i> -like type	Pinaceae	0	0	0	0	30	50	30
<i>Quercus semecarpifolia</i>	Fagaceae	1	<1	<1	10	0	0	30
<i>Quercus aliena</i>	Fagaceae	1	0	0	0	0	0	0
<i>Coriaria nepalensis</i>	Coriariaceae	<1	<1	0	0	0	0	0
<i>Rhododendron simsii</i>	Ericaceae	1	<1	<1	5	0	40	<1
<i>Vaccinium fragile</i>	Ericaceae	20	10	25	10	10	0	0
<i>Indigofera tinctoria</i>	Leguminosa	1	0	0	0	0	0	0
<i>Campylotropis hirtella</i>	Leguminosa	10	15	5	3	0	0	0
<i>Quercus monimotricha</i>	Fagaceae	0	0	0	0	5	5	0
<i>Vaccinium</i> sp.	Ericaceae	0	0	0	0	<1	3	<1
<i>Pinus armandii</i>	Pinaceae	0	0	0	0	0	0	<1