

Supplementary Material - Mujica et al.

1 Analyses with the Species-level dataset

1.1 Clean dataset - excluding species with any remark

1.1.1 Boxplots using the clean species-level dataset

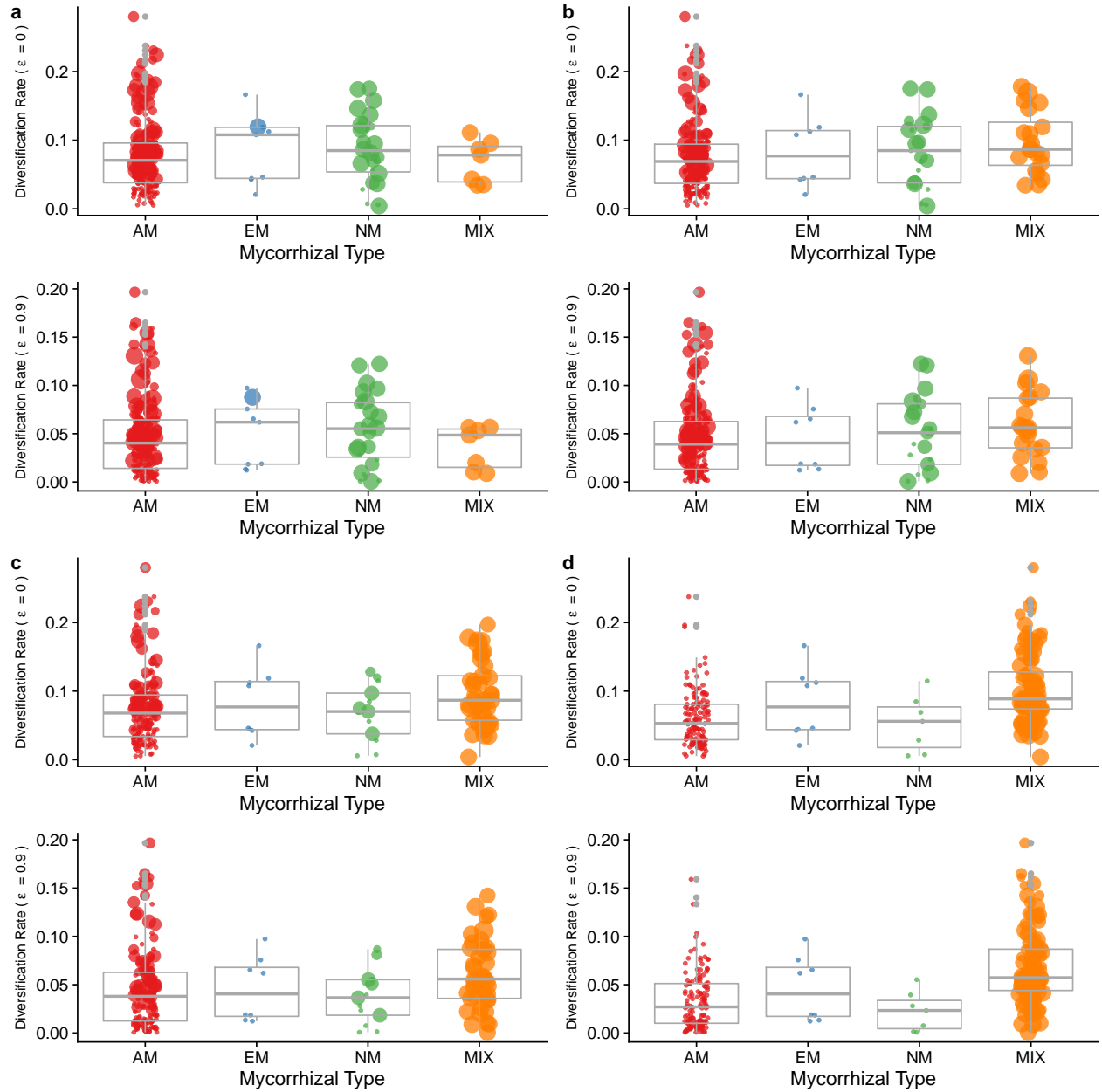


Figure S1: Relationship between mycorrhizal type and diversification rates using the thresholds (a) 50%, (b) 60%, (c) 80% and (d) 100% for MIX state assignment using the species-level dataset without remarks. Each panel shows diversification rate estimated with $\epsilon = 0$ (upper) and diversification rate estimated with $\epsilon = 0.9$ (lower). AM: Arbuscular mycorrhiza, EM: Ectomycorrhiza, NM: non-mycorrhizal and MIX (families with no dominance of any specific mycorrhizal association). The size of the points indicates the Mycorrhizal Type Diversity Index value for each lineage, indicating a predominance of larger indices with higher diversification rates.

1.1.2 Summary statistics using clean species-level dataset

1.1.2.1 phyANOVA

Table S1: Summary statistics for phyANOVA for both values of epsilon using the species-level dataset without remarks to test for significant differences in diversification rates. Significant values are highlighted in bold.

Threshold	e = 0		e = 0.9	
	F	p-value	F	p-value
50%	0.385	0.857	0.494	0.81
60%	1.538	0.371	0.928	0.633
80%	3.784	0.084	3.262	0.117
100%	24.583	0.001	27.097	0.001

1.1.2.2 Standard ANOVA

Table S2: Summary statistics for phyANOVA for both values of epsilon using the species-level dataset without remarks to test for significant differences in diversification rates. Significant values are highlighted in bold.

Threshold	e = 0		e = 0.9	
	F	p-value	F	p-value
50%	0.396	0.756	0.501	0.682
60%	1.563	0.199	0.948	0.418
80%	3.529	0.015	2.997	0.031
100%	23.996	0	26.323	0

1.1.3 Posthoc tests using clean species-level dataset

1.1.3.1 phyANOVA

Table S3: Pairwise Corrected p-values for phyANOVA using the species-level dataset without remarks. Significant values are highlighted in bold.

Threshold	Mycorrhizal Type	e = 0				e = 0.9			
		AM	EM	MIX	NM	AM	EM	MIX	NM
50%	AM	1	1	1	1	1	1	1	1
50%	EM	1	1	1	1	1	1	1	1
50%	MIX	1	1	1	1	1	1	1	1
50%	NM	1	1	1	1	1	1	1	1
60%	AM	1	1	0.264	1	1	1	0.69	1
60%	EM	1	1	1	1	1	1	1	1
60%	MIX	0.264	1	1	0.995	0.69	1	1	1
60%	NM	1	1	0.995	1	1	1	1	1
80%	AM	1	1	0.036	1	1	1	0.096	1
80%	EM	1	1	1	1	1	1	1	1
80%	MIX	0.036	1	1	0.1	0.096	1	1	0.096
80%	NM	1	1	0.1	1	1	1	0.096	1
100%	AM	1	0.726	0.006	0.726	1	0.747	0.006	0.747
100%	EM	0.726	1	0.616	0.684	0.747	1	0.376	0.747
100%	MIX	0.006	0.616	1	0.006	0.006	0.376	1	0.006
100%	NM	0.726	0.684	0.006	1	0.747	0.747	0.006	1

1.1.3.2 Standard ANOVA

Table S4: Pairwise Corrected p-values for standard ANOVA. Significant values are highlighted in bold.

Types	e = 0				e = 0.9			
	50%	60%	80%	100%	50%	60%	80%	100%
EM-AM	0.964	0.992	0.985	0.613	0.993	1	1	0.78
MIX-AM	0.995	0.146	0.012	0	0.858	0.348	0.036	0
NM-AM	0.776	0.938	0.911	0.808	0.831	0.974	0.778	0.626
MIX-EM	0.954	0.769	0.704	0.237	0.866	0.768	0.622	0.106
NM-EM	1	1	0.897	0.411	0.996	0.993	0.927	0.404
NM-MIX	0.892	0.632	0.09	0	0.663	0.78	0.081	0

1.1.4 Scatterplots

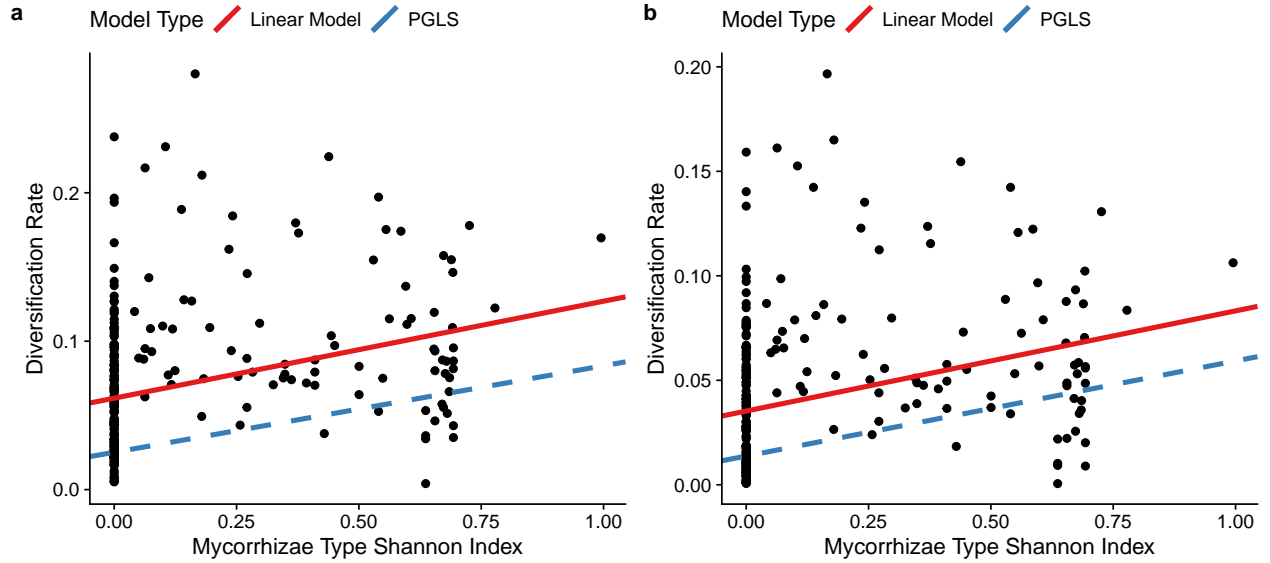


Figure S2: Scatterplots showing the relationship between mycorrhizal diversity index and diversification rates using the species-level dataset without remarks. Diversification rates were estimated with $e = 0$ (a) and with $e = 0.9$ (b). The red and blue lines indicate the results of a linear model and a phylogenetic generalized least squares (PGLS) fit, respectively.

Table S5: Summary statistics for the phylogenetic and parametric regressions using the species-level dataset without remarks. Significant values are highlighted in bold.

Model	e = 0		e = 0.9	
	p-value	R ²	p-value	R ²
PGLS	4.063e-07	0.08904	3.483e-07	0.09007
LM	1.676e-07	0.09458	2.844e-07	0.09109

1.2 Full species-level dataset - including species with any remark

1.2.1 Boxplots using full species-level dataset

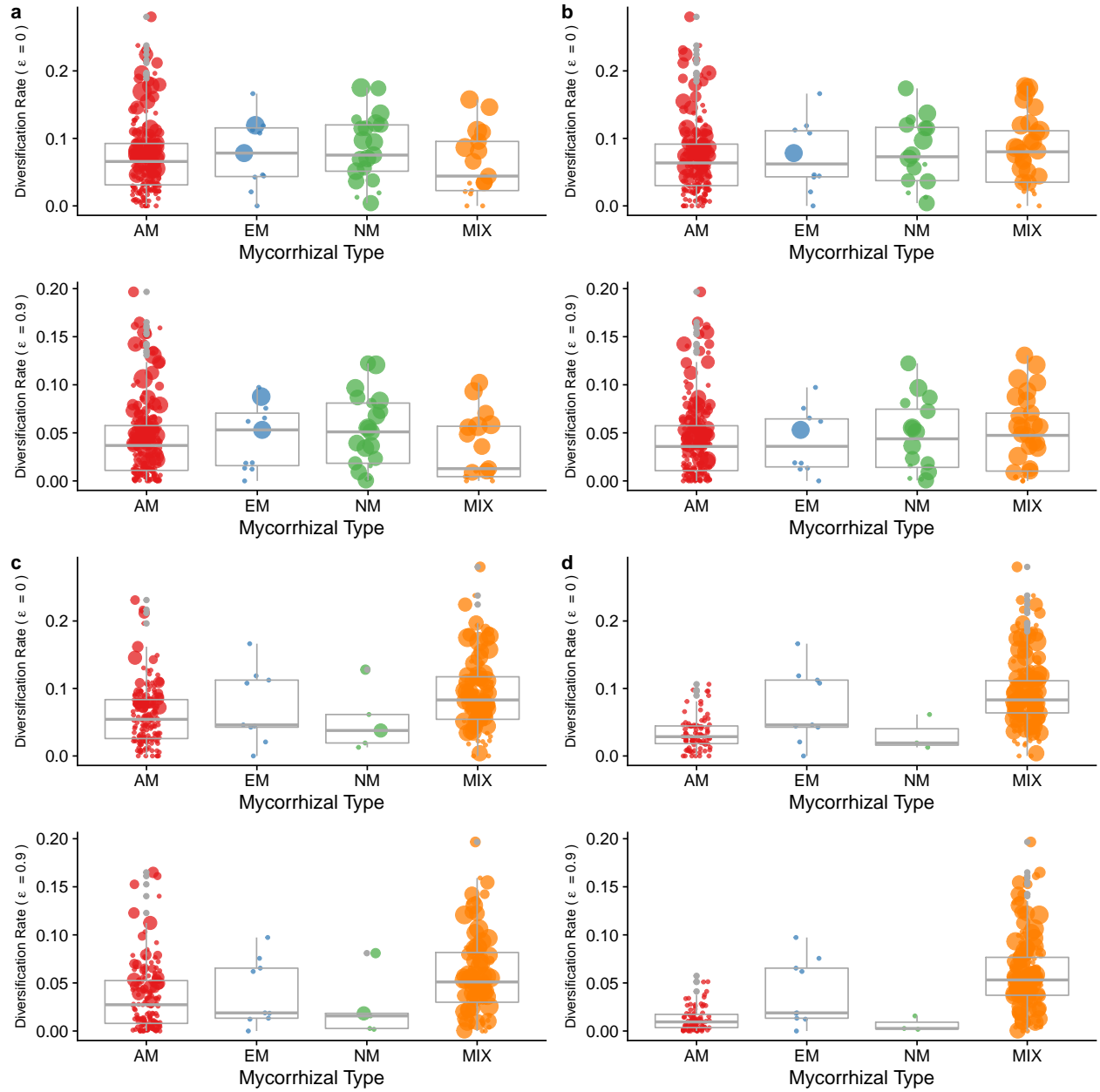


Figure S3: Relationship between mycorrhizal type and diversification rates using the thresholds (a) 50%, (b) 60%, (c) 80% and (d) 100% for MIX state assignment using the species-level dataset with remarks. Each panel shows diversification rate estimated with $\epsilon = 0$ (upper) and diversification rate estimated with $\epsilon = 0.9$ (lower). AM: Arbuscular mycorrhiza, EM: Ectomycorrhiza, NM: non-mycorrhizal and MIX (families with no dominance of any specific mycorrhizal association). The size of the points indicates the Mycorrhizal Type Diversity Index value for each lineage, indicating a predominance of larger indices with higher diversification rates.

1.2.2 Summary statistics using full species-level dataset

1.2.2.1 phyANOVA

Table S6: summary statistics for phyANOVA for both values of epsilon using the species-level dataset with remarks to test for differences in diversification rates. Significant values are highlighted in bold.

Threshold	e = 0		e = 0.9	
	F	p-value	F	p-value
50	0.691	0.703	0.666	0.676
60	0.511	0.787	0.324	0.869
80	8.571	0.001	8.425	0.001
100	36.44	0.001	43.806	0.001

1.2.2.2 Standard ANOVA

Table S7: summary statistics for phyANOVA for both values of epsilon using the species-level dataset with remarks to test for differences in diversification rates. Significant values are highlighted in bold.

Threshold	e = 0		e = 0.9	
	F	p-value	F	p-value
50	1.083	0.365	1.085	0.364
60	0.953	0.434	0.831	0.506
80	7.113	0	7.084	0
100	28.22	0	34.224	0

1.2.3 Posthoc tests using full species-level dataset

1.2.3.1 phyANOVA

Table S8: Pairwise Corrected p-values for phyANOVA using the species-level dataset with remarks. Significant values are highlighted in bold.

Threshold	Mycorrhizal Type	e = 0				e = 0.9			
		AM	EM	MIX	NM	AM	EM	MIX	NM
50%	AM	1	1	1	1	1	1	1	1
50%	EM	1	1	1	1	1	1	1	1
50%	MIX	1	1	1	0.918	1	1	1	0.924
50%	NM	1	1	0.918	1	1	1	0.924	1
60%	AM	1	1	1	1	1	1	1	1
60%	EM	1	1	1	1	1	1	1	1
60%	MIX	1	1	1	1	1	1	1	1
60%	NM	1	1	1	1	1	1	1	1
80%	AM	1	1	0.006	1	1	1	0.006	1
80%	EM	1	1	1	1	1	1	1	1
80%	MIX	0.006	1	1	0.255	0.006	1	1	0.145
80%	NM	1	1	0.255	1	1	1	0.145	1
100%	AM	1	0.18	0.006	0.922	1	0.2	0.006	0.742
100%	EM	0.18	1	0.728	0.531	0.2	1	0.408	0.408
100%	MIX	0.006	0.728	1	0.07	0.006	0.408	1	0.015
100%	NM	0.922	0.531	0.07	1	0.742	0.408	0.015	1

1.2.3.2 Standard ANOVA

Table S9: Pairwise Corrected p-values for standard ANOVA. Significant values are highlighted in bold.

Types	e = 0				e = 0.9			
	50%	60%	80%	100%	50%	60%	80%	100%
EM-AM	0.991	0.999	0.937	0.067	0.998	1	0.99	0.084
ER-AM	0.592	0.62	0.808	1	0.562	0.59	0.783	1
MIX-AM	0.97	0.805	0	0	0.906	0.874	0	0
NM-AM	0.763	0.958	0.996	1	0.85	0.995	0.968	0.998
ER-EM	0.561	0.663	0.649	0.527	0.593	0.723	0.735	0.601
MIX-EM	0.937	0.996	0.778	0.674	0.929	0.986	0.608	0.364
NM-EM	0.997	0.999	0.935	0.583	0.996	0.999	0.928	0.485
MIX-ER	0.838	0.407	0.12	0.05	0.87	0.413	0.113	0.029
NM-ER	0.352	0.501	0.979	1	0.368	0.561	0.993	0.999
NM-MIX	0.684	1	0.358	0.102	0.637	0.999	0.237	0.03

1.2.4 Scatterplots

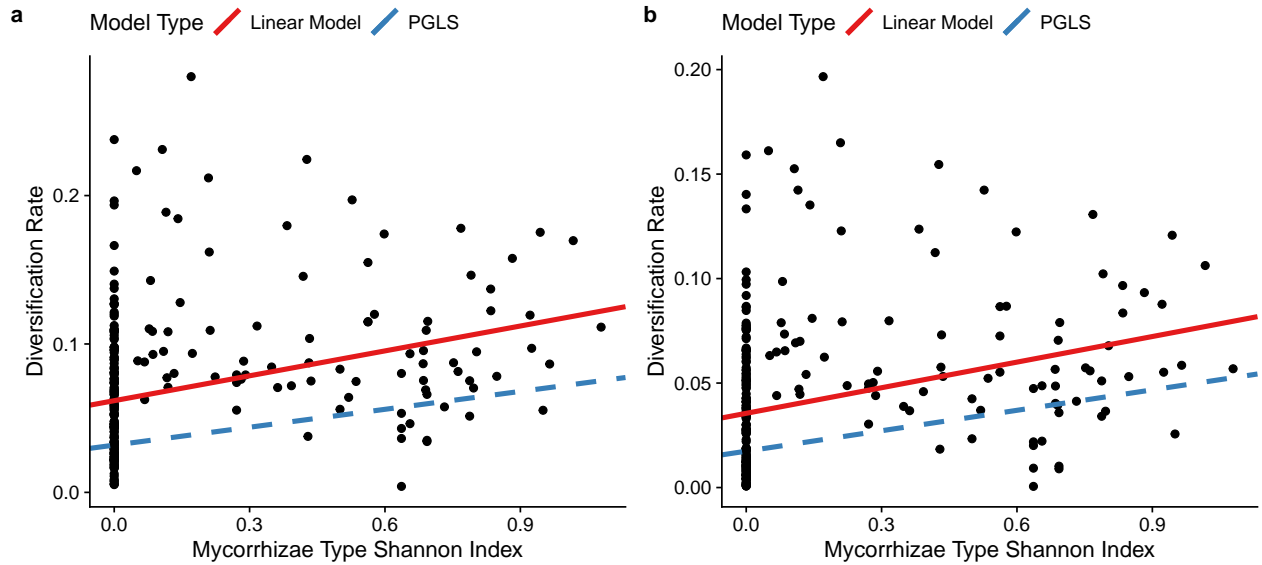


Figure S4: Scatterplots showing the relationship between mycorrhizal diversity index and diversification rates using the species-level dataset with remarks. Diversification rates were estimated with $e = 0$ (a) and with $e = 0.9$ (b). The red and blue lines indicate the results of a linear model and a phylogenetic generalized least squares (PGLS) fit, respectively.

Table S10: Summary statistics for the phylogenetic and parametric regressions using the species-level dataset with remarks. Significant values are highlighted in bold.

Model	e = 0		e = 0.9	
	p-value	R ²	p-value	R ²
PGLS	5.265e-05	0.06444	4.013e-05	0.06653
LM	2.528e-07	0.09354	4.977e-07	0.08898

2 Adding randomly 20\% of misassignment of mycorrhizal type

2.1 Regressions

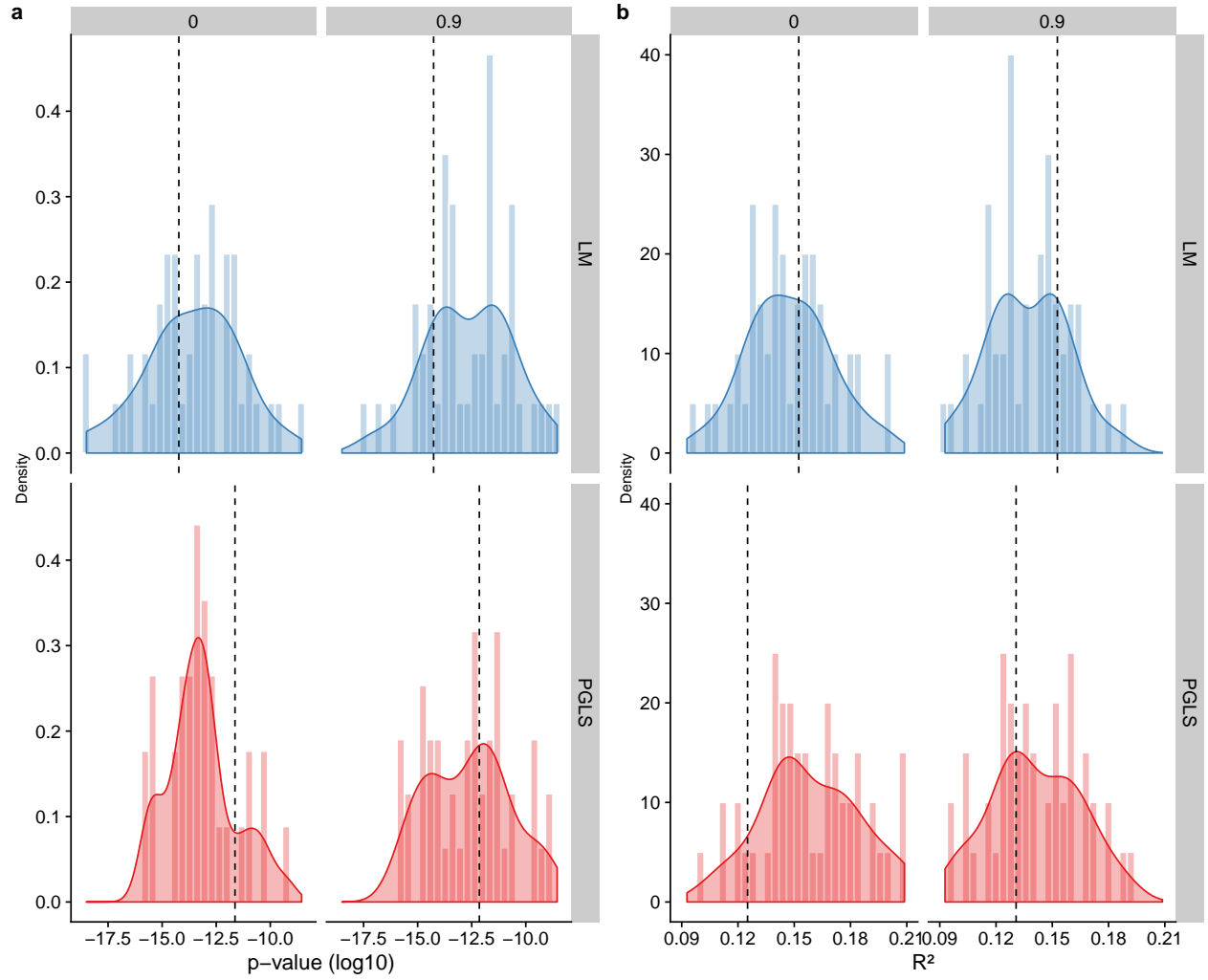


Figure S5: Distribution of (a) p-values and (b) R^2 values for the same analyses of the main paper, but using all 50 replicate datasets with mycorrhizal types for 20% of species randomly sampled. Dashed vertical lines represent the corresponding empirical value from the main analysis.

2.2 ANOVAs

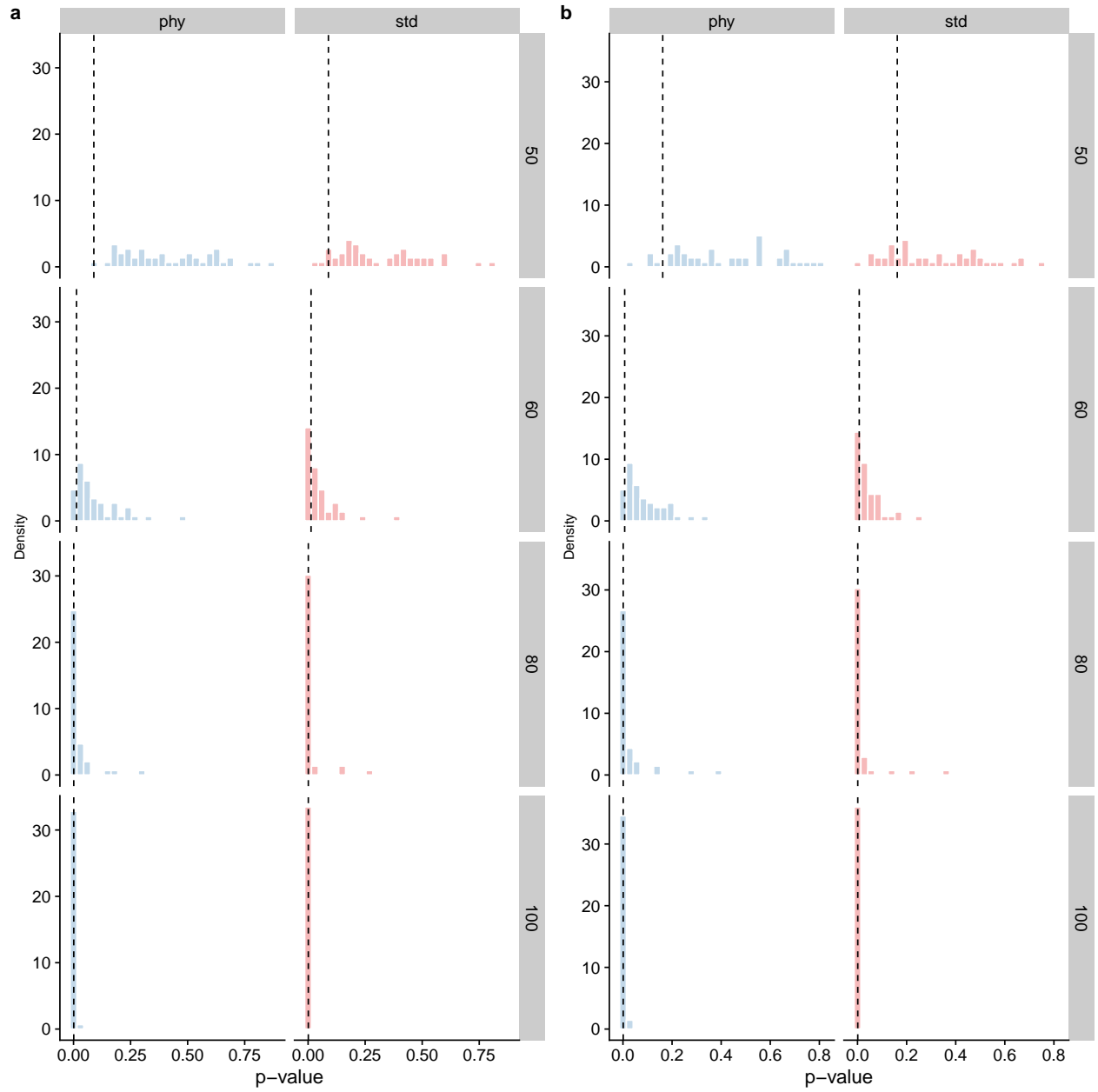


Figure S6: Distribution of p-values of (a) $e = 0$ and (b) $e = 0.9$ for the both phylogenetic and standard ANOVA, but using all 50 replicate datasets with mycorrhizal types for 20% of species randomly sampled. Dashed vertical lines represent the corresponding empirical value from the main analysis.

3 Analyses with the genus-level dataset

3.1 Analysis per genera excluding 100% MIX families

3.1.1 Boxplots using clean genus-level dataset

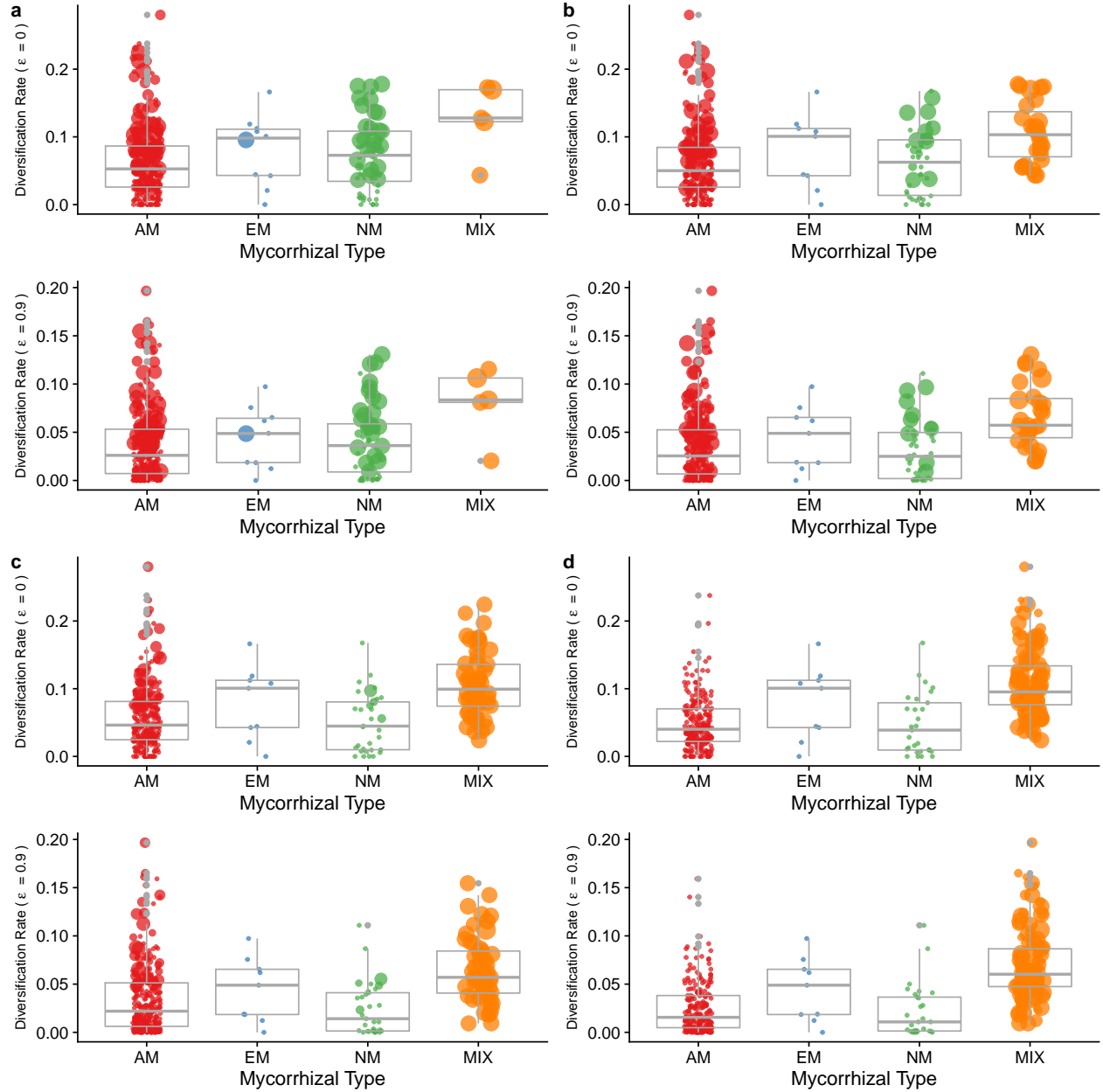


Figure S7: Relationship between mycorrhizal type and diversification rates using the genus-level dataset excluding 100% MIX families. a) diversification rate estimated with $e = 0$ and b) diversification rate estimated with $e = 0.9$. AM: Arbuscular mycorrhiza, EM: Ectomycorrhiza, NM: non-mycorrhizal and MIX (families with no dominance of any specific mycorrhizal association). The size of the points indicates the Mycorrhizal Type Diversity Index value for each lineage, indicating a predominance of larger indices with higher diversification rates.

Table S11: Mycorrhizal type assigned to each family based on 4 different percentage thresholds (50%, 60%, 80% and 100%) using the genus-level dataset excluding 100% MIX families. Significant values are highlighted in bold.

Threshold	AM	EM	ER	MIX	NM
50%	293	10	1	5	56
60%	286	9	1	27	42
80%	270	9	1	52	33
100%	228	9	1	98	29

3.1.2 Summary statistics using clean genus-level dataset

3.1.2.1 phyANOVA

Table S12: Summary statistics for phyANOVA for both values of epsilon using the genus-level dataset excluding 100% MIX families to test for differences in diversification rates. Significant values are highlighted in bold.

Threshold	e = 0		e = 0.9	
	F	p-value	F	p-value
50%	3.996	0.089	3.147	0.162
60%	7.255	0.013	7.35	0.007
80%	14.181	0.001	13.177	0.001
100%	44.007	0.001	52.476	0.001

3.1.2.2 Standard ANOVA

Table S13: summary statistics for standard ANOVA for both values of epsilon using the genus-level dataset excluding 100% MIX families to test for differences in diversification rates. Significant values are highlighted in bold.

Threshold	e = 0		e = 0.9	
	F	p-value	F	p-value
50%	3.996	0.008	3.147	0.025
60%	7.255	0	7.35	0
80%	14.181	0	13.177	0
100%	44.007	0	52.476	0

3.1.3 Posthoc tests

3.1.3.1 phyANOVA

Table S14: Pairwise Corrected p-values for phyANOVA using the genus-level dataset excluding 100% MIX families. Significant values are highlighted in bold.

Threshold	Mycorrhizal Type	e = 0				e = 0.9			
		AM	EM	MIX	NM	AM	EM	MIX	NM
50%	AM	1	0.858	0.042	0.747	1	1	0.048	1
50%	EM	0.858	1	0.716	0.858	1	1	0.62	1
50%	MIX	0.042	0.716	1	0.042	0.048	0.62	1	0.048
50%	NM	0.747	0.858	0.042	1	1	1	0.048	1
60%	AM	1	1	0.006	1	1	1	0.006	1
60%	EM	1	1	1	1	1	1	0.952	1
60%	MIX	0.006	1	1	0.006	0.006	0.952	1	0.006
60%	NM	1	1	0.006	1	1	1	0.006	1
80%	AM	1	1	0.006	1	1	1	0.006	1
80%	EM	1	1	1	1	1	1	1	1
80%	MIX	0.006	1	1	0.006	0.006	1	1	0.006
80%	NM	1	1	0.006	1	1	1	0.006	1
100%	AM	1	0.552	0.006	0.868	1	0.567	0.006	0.627
100%	EM	0.552	1	0.552	0.552	0.567	1	0.468	0.567
100%	MIX	0.006	0.552	1	0.006	0.006	0.468	1	0.006
100%	NM	0.868	0.552	0.006	1	0.627	0.567	0.006	1

3.1.3.2 Standard ANOVA

Table S15: Pairwise Corrected p-values for standard ANOVA using the genus-level dataset excluding 100% MIX families. Significant values are highlighted in bold.

Types	e = 0				e = 0.9			
	50%	60%	80%	100%	50%	60%	80%	100%
EM-AM	0.618	0.686	0.58	0.154	0.854	0.866	0.794	0.246
MIX-AM	0.018	0	0	0	0.025	0	0	0
NM-AM	0.364	1	0.783	0.997	0.663	0.94	0.456	0.924
MIX-EM	0.315	0.492	0.483	0.251	0.248	0.33	0.379	0.074
NM-EM	0.97	0.753	0.374	0.198	0.993	0.765	0.409	0.196
NM-MIX	0.09	0.002	0	0	0.083	0	0	0

3.2 Genus-level full dataset - including all families

3.2.1 Boxplots using genus-level full dataset

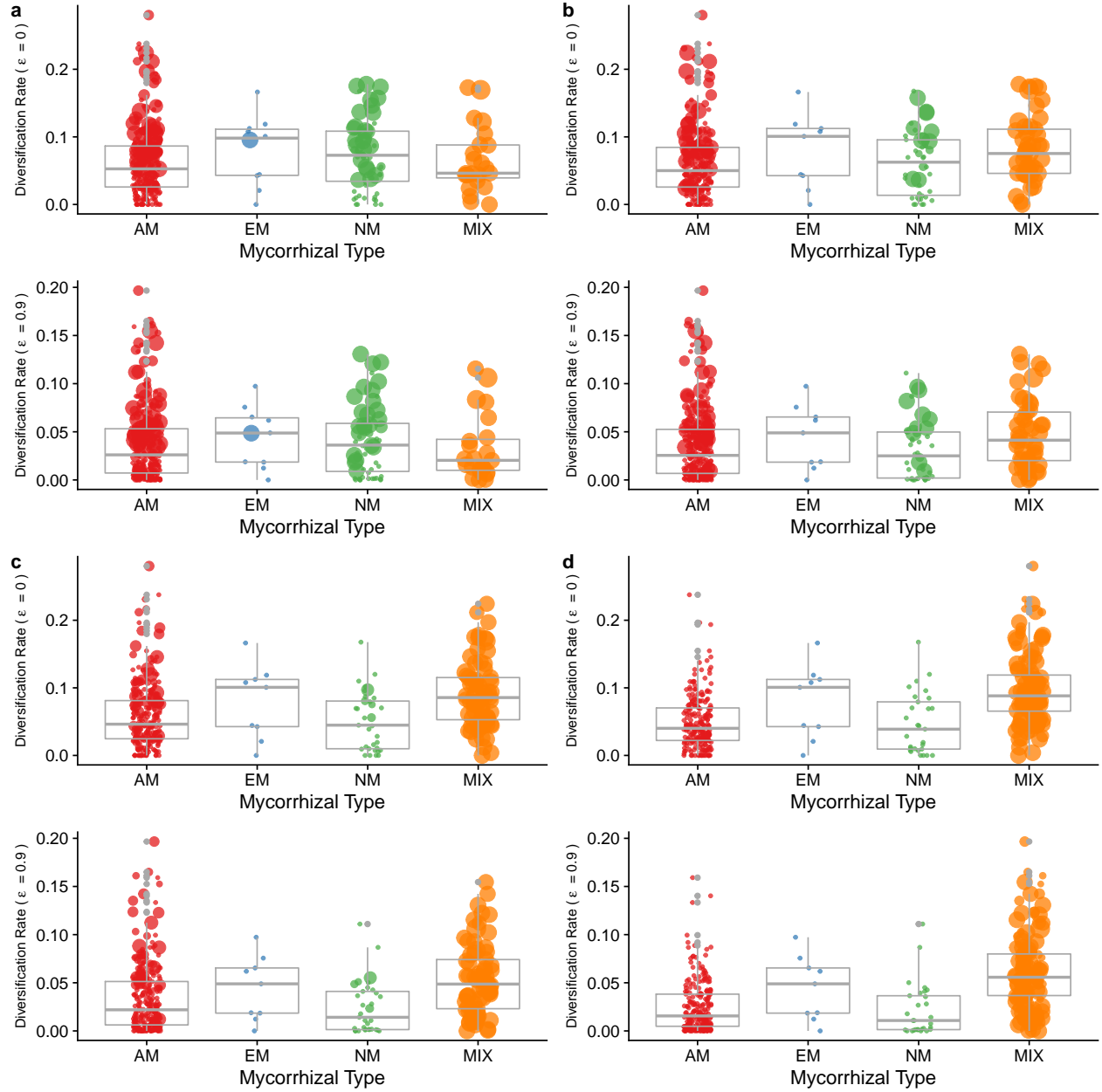


Figure S8: Relationship between mycorrhizal type and diversification rates using the thresholds (a) 50%, (b) 60%, (c) 80% and (d) 100% for MIX state assignment using the genus-level dataset including all families. Each panel shows diversification rate estimated with $\epsilon = 0$ (upper) and diversification rate estimated with $\epsilon = 0.9$ (lower). AM: Arbuscular mycorrhiza, EM: Ectomycorrhiza, NM: non-mycorrhizal and MIX (families with no dominance of any specific mycorrhizal association). The size of the points indicates the Mycorrhizal Type Diversity Index value for each lineage, indicating a predominance of larger indices with higher diversification rates.

3.2.2 Summary statistics

3.2.2.1 phyANOVA

Table S16: summary statistics for phyANOVA for both values of epsilon using the genus-level dataset including all families to test for differences in diversification rates. Significant values are highlighted in bold.

Threshold	e = 0		e = 0.9	
	F	p-value	F	p-value
50%	1.295	0.631	0.696	0.825
60%	2.842	0.244	2.153	0.402
80%	8.598	0.005	7.033	0.022
100%	33.621	0.001	37.429	0.001

3.2.2.2 Standard ANOVA

Table S17: summary statistics for standard ANOVA for both values of epsilon using the genus-level dataset including all families to test for differences in diversification rates. Significant values are highlighted in bold.

Threshold	e = 0		e = 0.9	
	F	p-value	F	p-value
50%	1.295	0.276	0.696	0.555
60%	2.842	0.038	2.153	0.093
80%	8.598	0	7.033	0
100%	33.621	0	37.429	0

3.2.3 Posthoc tests using genus-level full dataset

3.2.3.1 phyANOVA

Table S18: Pairwise Corrected p-values for phyANOVA using the genus-level dataset including all families. Significant values are highlighted in bold.

Threshold	Mycorrhizal Type	e = 0				e = 0.9			
		AM	EM	MIX	NM	AM	EM	MIX	NM
50%	AM	1	1	1	1	1	1	1	1
50%	EM	1	1	1	1	1	1	1	1
50%	MIX	1	1	1	1	1	1	1	1
50%	NM	1	1	1	1	1	1	1	1
60%	AM	1	1	0.355	1	1	1	0.665	1
60%	EM	1	1	1	1	1	1	1	1
60%	MIX	0.355	1	1	0.33	0.665	1	1	0.348
60%	NM	1	1	0.33	1	1	1	0.348	1
80%	AM	1	1	0.01	1	1	1	0.03	1
80%	EM	1	1	1	1	1	1	1	1
80%	MIX	0.01	1	1	0.006	0.03	1	1	0.018
80%	NM	1	1	0.006	1	1	1	0.018	1
100%	AM	1	0.64	0.006	0.878	1	0.796	0.006	0.796
100%	EM	0.64	1	0.864	0.64	0.796	1	0.796	0.796
100%	MIX	0.006	0.864	1	0.006	0.006	0.796	1	0.006
100%	NM	0.878	0.64	0.006	1	0.796	0.796	0.006	1

3.2.3.2 Standard ANOVA

Table S19: Pairwise Corrected p-values for standard ANOVA. Significant values are highlighted in bold.

Types	e = 0				e = 0.9			
	50%	60%	80%	100%	50%	60%	80%	100%
EM-AM	0.616	0.689	0.587	0.171	0.852	0.869	0.8	0.278
MIX-AM	0.988	0.032	0	0	0.986	0.103	0	0
NM-AM	0.362	1	0.787	0.997	0.661	0.941	0.467	0.931
MIX-EM	0.833	0.998	0.937	0.62	0.815	0.991	0.909	0.367
NM-EM	0.97	0.755	0.382	0.216	0.993	0.769	0.419	0.226
NM-MIX	0.907	0.186	0.001	0	0.763	0.139	0.001	0

3.2.4 Scatterplots using genus-level full dataset

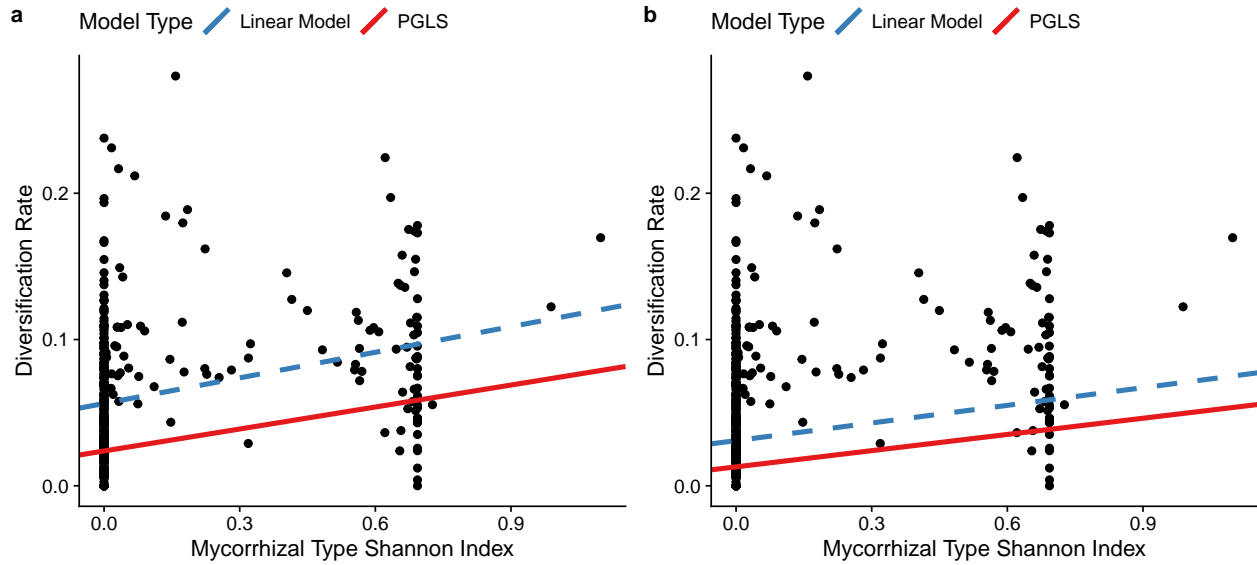


Figure S9: Scatterplots showing the relationship between mycorrhizal diversity index and diversification rates using the genus-level dataset including all families. Diversification rates were estimated with $e = 0$ (a) and with $e = 0.9$ (b). The red and blue lines indicate the results of a linear model and a phylogenetic generalized least squares (PGLS) fit, respectively.

Table S20: Summary statistics for the phylogenetic and parametric regressions using the genus-level dataset including all families. Significant values are highlighted in bold.

Model	e = 0		e = 0.9	
	p-value	R ²	p-value	R ²
PGLS	4.637e-08	0.07343	6.858e-08	0.07157
LM	6.325e-10	0.09319	4.512e-09	0.08402

4 Phylogenetic signal of diversification rates, age, and richness

Table S21: P-values for test of phylogenetic signal (D) of each mycorrhizal type using the genus-level dataset including all families. Significant values are highlighted in bold.

Threshold	model	AM	EM	MIX	NM
50%	random	0	0	0.842	0
50%	BM	0.899	0.969	0.043	0.832
60%	random	0	0	0.031	0
60%	BM	0.88	0.949	0.215	0.852
80%	random	0	0	0	0
80%	BM	0.821	0.956	0.228	0.747
100%	random	0	0	0.247	0
100%	BM	0.083	0.958	0	0.643

Table S22: Phylogenetic signal of the four response variables using the genus-level dataset including all families. Significant values are highlighted in bold.

Variable	Lambda
r (epsilon = 0)	0.475
r (epsilon = 0.9)	0.358
Stem Age	1
Richness	1e-06

5 Replicating main analyses with tree from Harris and Davies (2016)

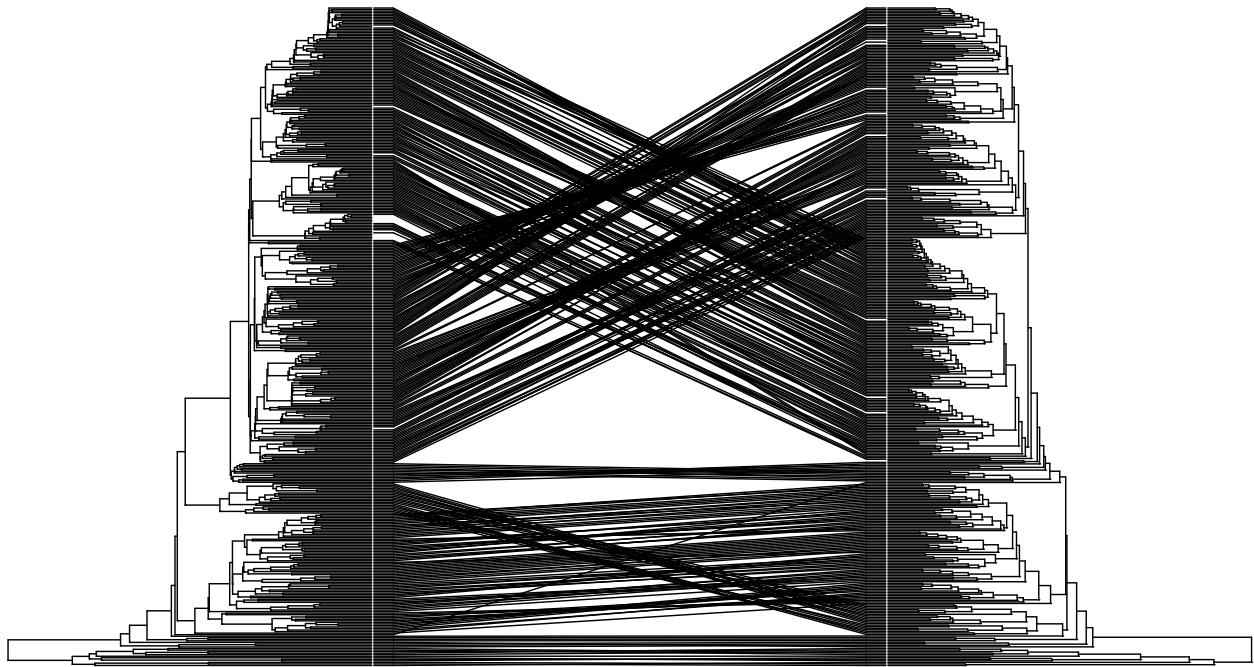


Figure S10: Association between placement of families in both Zanne's (left) and Harris and Davies' (right) phylogenies, indicating differences in the topologies.

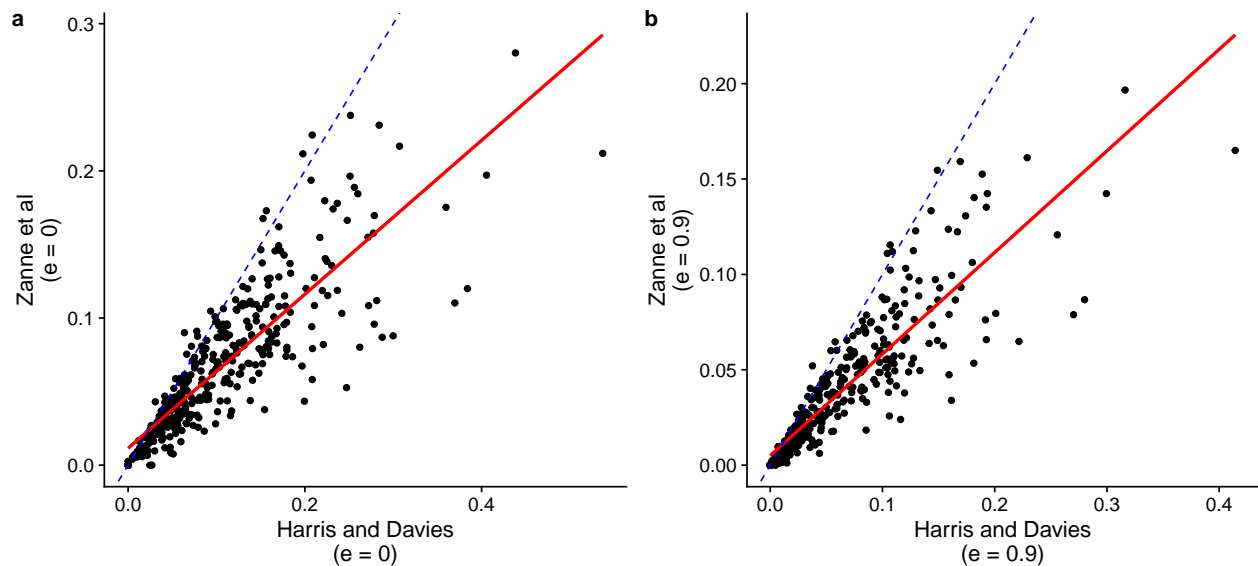


Figure S11: Relationship between net diversification calculated in our study and with the rates from Harris and Davies (2016). The rates were estimated by the authors using the same source for species richness as the main analysis, and the stem ages were obtained from their phylogeny. a: $e = 0$; b: $e = 0.9$. Red lines: LM fit; blue dashed lines: identity fit.

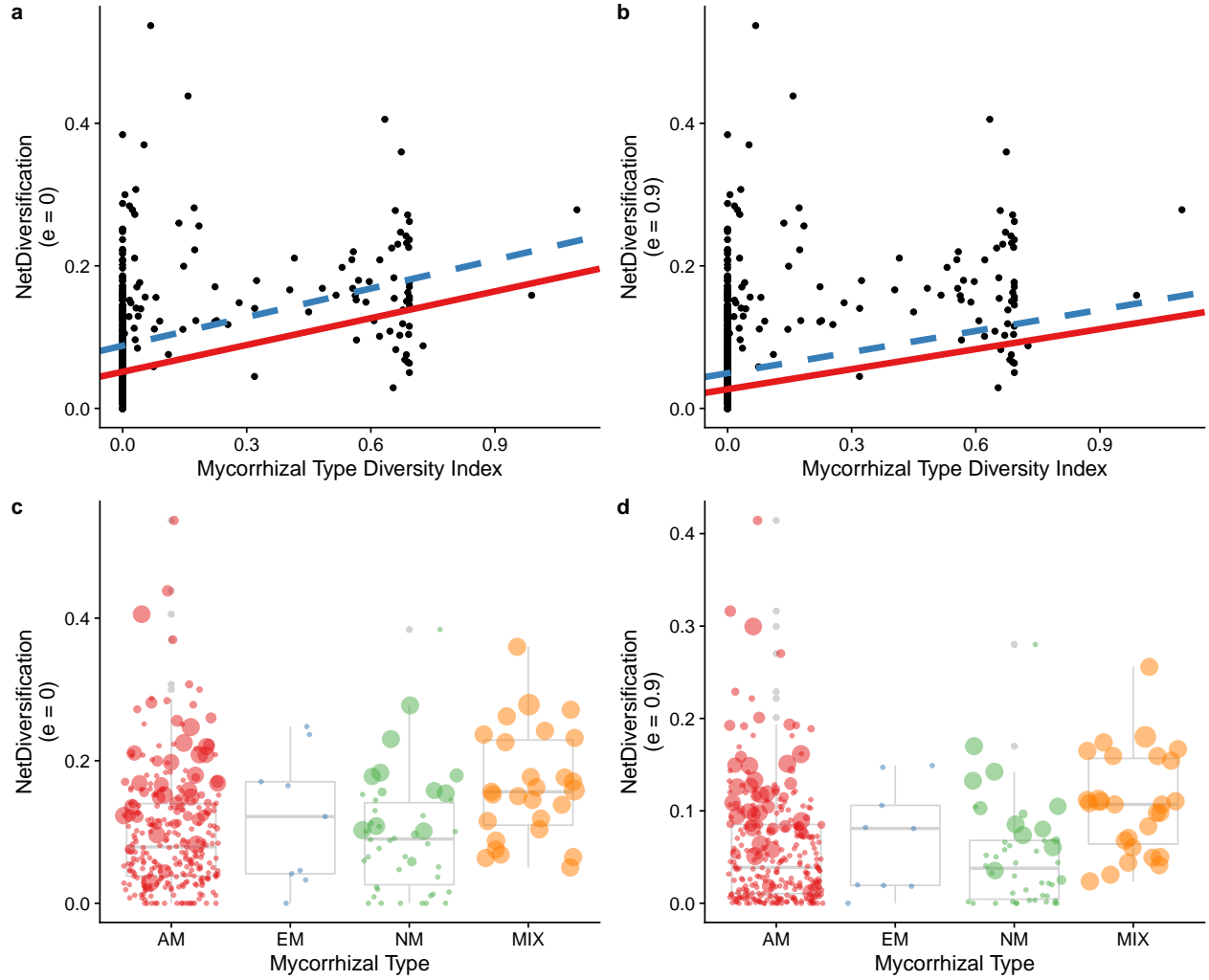


Figure S12: Main analyses replicated using Harris and Davies (2016) phylogeny. The rates were estimated by the authors using the same source for species richness as the main analysis, and the stem ages were obtained from their phylogeny. Panels a and c: $e = 0$; panels b and d: $e = 0.9$. Red lines: PGLS fit; blue dashed lines: LM fit.

Table S23: Summary statistics for linear models and ANOVA using Harris and Davies (2016) phylogeny.

model	pvalue.r0	R2.r0	pvalue.r09	R2.r09	pvalue.r0.1	pvalue.r09.1
Phylogenetic	2.724e-13	0.135	3.581e-13	0.134	0.0005	0.0003
Linear	1.345e-14	0.146	1.228e-14	0.147	0.019	0.02