

1    **SUPPORTING INFORMATION**

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20    simple regression analyses, considering only trees without gymnosperm neighbors.

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26 **Appendix S1.** Details on the Rennes Forest and the species composition of trees surrounding the  
27 focal oaks studied.

28 The Forest of Rennes is dating back to at least the 12th century. As with all forests in Western  
29 and Central Europe, this forest is under the influence of human activities, such as wood  
30 management and the effects of surrounding agricultural land use. The Forest of Rennes is split  
31 into parcels, mostly managed, following the shelterwood cutting system (Borghetti & Giannini  
32 2001). Each parcel is planted typically either with oak (*Quercus petraea* or *Q. robur*) or pine  
33 (*Pinus sylvestris*). As in numerous European temperate forests, the other main tree species in the  
34 neighborhood of our focal oaks are *Ilex aquifolium*, *Fagus sylvatica*, *Castanea sativa*, *Ulmus*  
35 *minor*, *Alnus glutinosa*, *Sorbus torminalis*, *Corylus avellana*, *Carpinus betulus*, *Populus tremula*,  
36 *Salix caprea*, *Abies alba*, *Rhamnus frangula*, *Tilia cordata*, *Betula pendula*, *Prunus avium*,  
37 *Malus sylvestris* and *Pyrus pyraster*. All these species are native to Europe and were in contact  
38 with the focal oaks.

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40 **Table S1.** Phylogenetic distance between oak and neighboring species

41 The below table gives phylogenetic distance in million years before present between oak and the  
 42 other tree species in the communities. Distance corresponds to the smaller of the two crown ages  
 43 of the two lineages involved (i.e. of oak and of the other tree species) at the corresponding  
 44 phylogenetic rank (inferred from Magallon *et al.* 1999; Manos *et al.* 1999; Wikström *et al.* 2001;  
 45 APG 2003, and 2009; Poinar *et al.* 2007). This table is extracted from Vialatte *et al.* 2010 and  
 46 Yguel *et al.* 2011. See Methods for further explanations.

Species	Phylogenetic rank of separation with oak					distance	
<i>Chamaecyparis lawsoniana</i>	Spermatophytes	-	-	-	-	140	
<i>Pinus sylvestris</i>	Spermatophytes	-	-	-	-	140	
<i>Abies alba</i>	Spermatophytes	-	-	-	-	140	
<i>Ilex aquifolium</i>	Angiosperms	Asterids	-	-	-	128	
<i>Tilia cordata</i>	Angiosperms	Rosids	Malvids	-	-	89.5	
<i>Salix caprea</i>	Angiosperms	Rosids	Fabids	Malpighiales	-	68	
<i>Populus tremula</i>	Angiosperms	Rosids	Fabids	Malpighiales	-	68	
<i>Rhamnus frangula</i>	Angiosperms	Rosids	Fabids	Rosales	-	58.5	
<i>Prunus avium</i>	Angiosperms	Rosids	Fabids	Rosales	-	58.5	
<i>Sorbus torminalis</i>	Angiosperms	Rosids	Fabids	Rosales	-	58.5	
<i>Pyrus pyraster</i>	Angiosperms	Rosids	Fabids	Rosales	-	58.5	
<i>Malus spp.</i>	Angiosperms	Rosids	Fabids	Rosales	-	58.5	
<i>Ulmus minor</i>	Angiosperms	Rosids	Fabids	Rosales	-	58.5	
<i>Alnus glutinosa</i>	Angiosperms	Rosids	Fabids	Fagales	Betulaceae	54	
<i>Corylus avellana</i>	Angiosperms	Rosids	Fabids	Fagales	Betulaceae	54	
<i>Betula pendula</i>	Angiosperms	Rosids	Fabids	Fagales	Betulaceae	54	
<i>Carpinus betulus</i>	Angiosperms	Rosids	Fabids	Fagales	Betulaceae	54	
<i>Fagus sylvatica</i>	Angiosperms	Rosids	Fabids	Fagales	Fagaceae	Fagus	40
<i>Castanea sativa</i>	Angiosperms	Rosids	Fabids	Fagales	Fagaceae	Castanea	40

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69 **Table S2.** Relationship between soil humidity or pH and enzymatic activity excluding two  
70 outliers.

71 These analyses compare to Appendix S5 where the two outliers were not excluded. Note that  
72 conclusion on the effect of phylogenetic isolation remain unchanged.

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74 **a.** Effect of soil humidity in March and April on EMf enzymatic activity in March and April in  
75 simple regression analyses (excluding two outliers).

Effect of soil humidity on:	March				April			
	Df	T	P	R <sup>2</sup>	Df	T	P	R <sup>2</sup>
EMf β-glucuronidase activity	18	1.10	0.28	0.06	18	-2.98	7*10 <sup>-3</sup>	0.33
EMf Laccase activity	18	-3.09	6*10 <sup>-3</sup>	0.34	18	-2.13	0.04	0.20
EMf β-glucosidase activity	18	1.48	0.15	0.10	18	0.58	0.56	0.01

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78 **b.** Effect of pH in March and April on EMf enzymatic activity in March and April in simple  
79 regression analyses (excluding two outliers).

Effect of pH on:	March				April			
	Df	T	P	R <sup>2</sup>	Df	T	P	R <sup>2</sup>
EMf β-glucuronidase activity	18	1.24	0.23	0.07	18	-2.11	0.04	0.19
EMf Laccase activity	18	-2.30	0.03	0.22	18	-1.29	0.21	0.08
EMf β-glucosidase activity	18	1.44	0.16	0.10	18	0.43	0.66	0.01

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82   **c.** Effect of phylogenetic isolation and abiotic conditions on EMf  $\beta$ -glucuronidase activity in  
83   March excluding two outliers. Multiple models including phylogenetic isolation were tested,  
84   accounting for variables that were at least marginally significant in simple regression analysis.  
85   Tolerances characterize the mutual independence among independent variables (i.e. 1 if an  
86   independent variable is entirely uncorrelated to the other independent covariables).

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*Effect on EMf  $\beta$ -glucuronidase activity (March)*

		Df	T	p	Standardized regression coeffcient	Tolerance
Model 1	Phylogenetic isolation		0.19	0.84	0.05	0.63
p=0.63	Soil humidity (March)	16	0.59	0.56	0.18	0.60
r <sup>2</sup> =0.09	pH		0.78	0.44	0.21	0.72
Model 2	Phylogenetic isolation		-0.08	0.93	-0.02	0.80
p=0.49	pH	17	1.04	0.31	0.27	0.80
r <sup>2</sup> =0.07						

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98    **d.** Effect of phylogenetic isolation and abiotic conditions on EMf  $\beta$ -glucuronidase activity in  
 99    April excluding two outliers. Multiple models including phylogenetic isolation were tested,  
 100   accounting for variables that were at least marginally significant in simple regression analysis.  
 101   Tolerances characterize the mutual independence among independent variables (i.e. 1 if an  
 102   independent variable is entirely uncorrelated to the other independent covariables).

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*Effect on EMf  $\beta$ -glucuronidase activity (April)*

		Standardized			
		Df	T	p	regression coefficient
Model 1  p=1*10 <sup>-7</sup>  r <sup>2</sup> =0.90	Phylogenetic isolation	15	8.71	2*10 <sup>-7</sup>	0.89
	Soil humidity (April)		-0.10	0.92	-0.01
	Soil temperature (April)		1.17	0.25	0.10
	pH		0.02	0.98	2*10 <sup>-3</sup>
Model 2  p=1*10 <sup>-8</sup>  r <sup>2</sup> =0.90	Phylogenetic isolation	16	10.25	1*10 <sup>-8</sup>	0.90
	Soil temperature (April)		1.22	0.23	0.10
	pH		0.007	0.99	6*10 <sup>-4</sup>
	Phylogenetic isolation		9.20	8*10 <sup>-8</sup>	0.89
Model 3  p=1*10 <sup>-8</sup>  r <sup>2</sup> =0.90	Soil humidity (April)	16	-0.10	0.92	-9*10 <sup>-3</sup>
	Soil temperature (April)		1.25	0.22	0.10
					0.81

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111 e. Effect of phylogenetic isolation and abiotic conditions on EMf Laccase activity in March  
 112 excluding two outliers. Multiple models including phylogenetic isolation were tested, accounting  
 113 for variables that were at least marginally significant in simple regression analysis. Tolerances  
 114 characterize the mutual independence among independent variables (i.e. 1 if an independent  
 115 variable is entirely uncorrelated to the other independent covariables).

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*Effect on EMf laccase activity (March)*

		Df	T	p	Standardized regression coeffcient	Tolerance
Model 1	Phylogenetic isolation		2.55	0.02	0.52	0.63
$p=5*10^{-3}$	Soil humidity (March)	15	-1.36	0.19	-0.30	0.51
$r^2=0.60$	Soil temperature (March)		-1.07	0.29	-0.20	0.73
	pH		-0.87	0.39	-0.16	0.70
Model 2	Phylogenetic isolation		3.42	$3*10^{-3}$	0.64	0.78
$p=4*10^{-3}$	Soil temperature (March)	16	-0.59	0.56	-0.10	0.84
$r^2=0.55$	pH		-1.18	0.25	-0.22	0.74
Model 3	Phylogenetic isolation		2.86	0.01	0.56	0.66
$p=2*10^{-3}$	Soil humidity (March)	16	-1.61	0.12	-0.35	0.54
$r^2=0.58$	Soil temperature (March)		-0.95	0.35	-0.17	0.74

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124 f. Effect of phylogenetic isolation and abiotic conditions on EMf Laccase activity in April  
 125 excluding two outliers. Multiple models including phylogenetic isolation were tested, accounting  
 126 for variables that were at least marginally significant in simple regression analysis. Tolerances  
 127 characterize the mutual independence among independent variables (i.e. 1 if an independent  
 128 variable is entirely uncorrelated to the other independent covariables).

*Effect on EMf laccase activity (April)*

		Df	T	p	Standardized	Tolerance
		regression				
		coeffcient				
Model 1  P=4*10 <sup>-5</sup>  r <sup>2</sup> =0.79	Phylogenetic isolation		6.49	1*10 <sup>-5</sup>	0.99	0.57
	Soil humidity (April)	15	0.50	0.62	0.07	0.62
	Soil temperature (April)		-0.68	0.50	-0.09	0.76
	pH		0.62	0.53	0.08	0.71
Model 2  P=1*10 <sup>-5</sup>  r <sup>2</sup> =0.79	Phylogenetic isolation		7.26	2*10 <sup>-6</sup>	0.96	0.73
	Soil temperature (April)	16	-0.74	0.46	-0.09	0.76
	pH		0.74	0.46	0.09	0.74
	Soil humidity (April)		-0.88	0.38	-0.11	0.81
Model 3  P=1*10 <sup>-5</sup>  r <sup>2</sup> =0.79	Phylogenetic isolation		6.63	5*10 <sup>-6</sup>	0.97	0.60
	Soil humidity (April)	16	0.63	0.53	0.09	0.64
	Soil temperature (April)					
	Soil pH					

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130 **Table S3.** Effect of phylogenetic isolation, enzymatic activities and the interaction term on the  
131 budburst phenology analysed without any transformation of the data.

132 Multiple regression analyses explaining budburst phenology by the effect of phylogenetic  
133 isolation, activity of enzymes showing significant relationship to budburst in simple regression  
134 analysis, and the interaction term between both. Data are not centered by their means. Tolerances  
135 characterize the mutual independence among independent variables (i.e. 1 if an independent  
136 variable is entirely uncorrelated to the other independent covariables).

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*Effect on budburst phenology*

		P Standardized				
		Df	T	(one	regression	Tolerance
				tailed)	coeffcient	
Model 1	Phylogenetic isolation[V1]		0.41	0.34	0.66	0.01
P=0.06	EMf β-glucuronidase (April)[V2]	18	1.49	0.07	0.89	0.10
r <sup>2</sup> =0.31	V1* V2		-0.69	0.24	-1.05	0.01
Model 2	Phylogenetic isolation[V1]		0.73	0.23	2.12	0.004
P=0.03	EMf Laccase (March) )[V2]	18	1.77	0.04	0.81	0.16
R <sup>2</sup> =0.37	V1*V2		-0.72	0.24	-2.27	0.003
Model 3	Phylogenetic isolation[V1]		1.91	0.03	3.33	0.01
P=0.04	EMf Laccase (April) [V2]	18	0.93	0.18	0.38	0.20
R <sup>2</sup> =0.32	V1*V2		-1.85	0.04	-3.23	0.01

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140 **Table S4.** Effect of phylogenetic isolation, abiotic conditions and focal oak species on EMf  
141 abundance in simple and multiple regression analyses

142 **a.** Simple regression analyses testing the effect of phylogenetic isolation, focal oak species, and  
143 abiotic conditions on EMf abundance in March and April. Nutritional status of fresh oak litter,  
144 and the soil microbial biomass and activity are considered indicative of the abiotic environment  
145 soil fertility.

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Effect on EMf abundance

Independent variable	March				April			
	Df	T	P	R <sup>2</sup>	Df	T	P	R <sup>2</sup>
Phylogenetic isolation	20	1.99	0.06	0.16	20	2.16	0.04	0.18
Soil pH	20	-1.48	0.15	0.09	20	-0.27	0.78	3*10 <sup>-3</sup>
Soil temperature	20	-0.41	0.68	8*10 <sup>-3</sup>	20	0.37	0.71	6*10 <sup>-3</sup>
Soil humidity	20	-1.55	0.13	0.10	20	0.61	0.54	0.01
Air temperature	13	-0.99	0.33	0.07	13	0.55	0.58	0.02
Air humidity	13	0.39	0.69	0.01	13	0.71	0.48	0.03
Tree pair	11	F=1.35	0.31	NA	11	F=0.53	0.83	NA
Focal oak species	20	F=5.22	0.03	NA	20	F=0.03	0.85	NA
N concentration (fresh oak litter)	20	-0.23	0.81	2*10 <sup>-3</sup>	20	-0.46	0.64	0.01
C concentration (fresh oak litter)	20	0.44	0.66	9*10 <sup>-3</sup>	20	-0.46	0.64	0.01
C/N concentration (fresh oak litter)	20	0.67	0.50	0.02	20	0.26	0.79	3*10 <sup>-3</sup>
Soil microbial biomass (August)	20	-1.30	0.20	0.07	20	0.35	0.72	6*10 <sup>-3</sup>
Soil microbial activity (August)	20	4*10 <sup>-3</sup>	0.99	1*10 <sup>-6</sup>	20	0.47	0.63	0.01
Soil microbial biomass (February)	20	0.79	0.43	0.03	20	0.07	0.94	2*10 <sup>-4</sup>
Soil microbial activity (February)	20	-0.91	0.36	0.04	20	-0.54	0.59	0.01

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151 **b.** Multiple regression analyses testing the effect of phylogenetic isolation on EMf abundance in  
 152 March accounting for the effect of different combinations of abiotic conditions. Multiple  
 153 combinations of independent variables are tested, accounting for variables that were at least  
 154 marginally significant in simple regression analysis. Tolerances characterize the mutual  
 155 independence among independent variables (i.e. 1 if an independent variable is entirely  
 156 uncorrelated to the other independent covariates).

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*Effect on EMf abundance (March)*

		Df	T	p	Standardized	Tolerance
regression						
coeffcient						
Model 1  p=0.10  r <sup>2</sup> =0.35	Phylogenetic isolation		1.20	0.24	0.33	0.77
	Focal oak species	17	-1.78	0.09	-0.46	0.55
	Soil humidity (March)		-0.76	0.45	-0.19	0.25
	pH		0.50	0.61	0.22	0.20
Model 2  p=0.06  r <sup>2</sup> =0.32	Phylogenetic isolation		1.75	0.09	0.34	0.97
	Focal oak species	18	-1.62	0.12	-0.37	0.70
	pH		-0.24	0.80	-0.05	0.69
Model 3  p=0.05  r <sup>2</sup> =0.34	Phylogenetic isolation		1.48	0.15	0.30	0.86
	Focal oak species	18	-1.93	0.06	-0.38	0.94
	Soil humidity (March)		-0.63	0.53	-0.13	0.84
Model 4  p=0.02  r <sup>2</sup> =0.32	Phylogenetic isolation	19	1.83	0.08	0.34	0.97
	Focal oak species		-2.13	0.04	-0.40	0.97

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163 **c.** Multiple regression analyses testing the effect of phylogenetic isolation on EMf abundance in  
 164 April accounting for the effect of different combination of abiotic conditions. Multiple  
 165 combinations of independent variables are tested, accounting for variables that were at least  
 166 marginally significant in simple regression analysis. Tolerances characterize the mutual  
 167 independence among independent variables (i.e. 1 if an independent variable is entirely  
 168 uncorrelated to the other independent covariables).

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*Effect on EMf abundance (April)*

		Df	T	p	Standardized regression coeffcient	Tolerance
Model 1	Phylogenetic isolation		3.33	0.003	0.67	0.80
p=0.03	Focal oak species	17	1.23	0.23	0.27	0.66
r <sup>2</sup> =0.44	Soil humidity (April)		2.70	0.01	0.74	0.43
	pH		-2.06	0.05	-0.60	0.37
Model 2	Phylogenetic isolation		2.08	0.05	0.44	0.97
p=0.23	Focal oak species	18	0.57	0.57	0.14	0.70
r <sup>2</sup> =0.20	pH		-0.27	0.78	-0.06	0.69
Model 3	Phylogenetic isolation		2.71	0.01	0.58	0.84
p=0.08	Focal oak species	18	0.15	0.87	0.03	0.93
r <sup>2</sup> =0.30	Soil humidity (April)		1.63	0.11	0.35	0.80
Model 4	Phylogenetic isolation		3.13	0.005	0.63	0.81
p=0.02	Soil humidity (April)	18	2.46	0.02	0.66	0.45
r <sup>2</sup> =0.39	pH		-1.64	0.11	-0.41	0.52

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172 **Table S5.** Effect of phylogenetic isolation, abiotic conditions and focal oak species on enzymatic  
 173 activity of EMf in simple and multiple regression analyses

174 **a.** Simple regression analyses testing the effect of phylogenetic isolation and abiotc conditions  
 175 on  $\beta$ -glucuronidase activity in March and April. Nutritional status of fresh oak litter, and the soil  
 176 microbial biomass and activity are considered indicative of the abiotic environment soil fertility.

Independent variable	Effect on EMf $\beta$ -glucuronidase activity			
	March		April	
	Df	T	P	R <sup>2</sup>
Phylogenetic isolation	20	-0.73	0.47	0.02
Soil pH	20	0.70	0.49	0.02
Soil temperature	20	-0.84	0.41	0.03
Soil humidity	20	0.11	0.35	0.04
Air temperature	13	1.49	0.15	0.14
Air humidity	13	-2.13	0.05	0.26
Tree pair	11	F=0.13	0.99	NA
Focal oak species	20	F=1.25	0.27	NA
N concentration (fresh oak litter)	20	0.30	0.76	4*10 <sup>-3</sup>
C concentration (fresh oak litter)	20	1.33	0.19	0.08
C/N concentration (fresh oak litter)	20	0.88	0.38	0.03
Soil microbial biomass (August)	20	-1,01	0,32	0.04
Soil microbial activity (August)	20	-2,18	0,04	0.19
Soil microbial biomass (February)	20	-0.35	0.72	6*10 <sup>-3</sup>
Soil microbial activity (February)	20	-0.70	0.49	0.02

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181 b. Multiple regression analyses testing the effect of phylogenetic isolation on EMf  $\beta$ -  
 182 glucuronidase activity in March, accounting for the effect of different combinations of abiotic  
 183 conditions. Multiple combinations of independent variables are tested, accounting for variables  
 184 that were at least marginally significant in simple regression analysis. Tolerances characterize  
 185 the mutual independence among independent variables (i.e. 1 if an independent variable is  
 186 entirely uncorrelated to the other independent covariables).

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*Effect on EMf  $\beta$ -glucuronidase activity (March)*

		Df	T	p	Standardized	Tolerance
regression						
coeffcient						
Model 1	Phylogenetic isolation		-0.41	0.68	-0.10	0.82
p=0.80	pH	18	0.03	0.97	0.01	0.35
r <sup>2</sup> =0.05	Soil humidity (March)		0.38	0.70	0.15	0.31
Model 2	Phylogenetic isolation		-0.62	0.54	-0.14	0.97
p=0.06	pH	19	0.58	0.56	0.13	0.97
r <sup>2</sup> =0.32						
Model 3	Phylogenetic isolation		-0.88	0.39	-0.23	0.85
p=0.11	Air humidity (March)	12	-1.63	0.12	-0.42	0.85
r <sup>2</sup> =0.30						

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191 c. Multiple regression analyses testing the effect of phylogenetic isolation on EMf  $\beta$ -  
 192 glucuronidase activity in April, accounting for the effect of different combinations of abiotic  
 193 conditions, accounting for variables that were at least marginally significant in simple regression  
 194 analysis. Multiple combinations of independent variables are tested. Tolerances characterize the

195 mutual independence among independent variables (i.e. 1 if an independent variable is entirely  
 196 uncorrelated to the other independent covariables).

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*Effect on EMf  $\beta$ -glucuronidase activity (April)*

			Standardized			
			Df	T	p	regression
						coefficient
Model 1  P= $2 \times 10^{-8}$  $r^2=0.90$	Phylogenetic isolation	17	10.96	$3 \times 10^{-9}$	0.95	0.75
	Soil humidity (April)		0.64	0.52	0.06	0.44
	Soil temperature (April)		0.80	0.43	0.07	0.85
	pH		0.15	0.87	0.01	0.52
Model 2  P= $3 \times 10^{-9}$  $r^2=0.90$	Phylogenetic isolation	18	11.64	$8 \times 10^{-10}$	0.93	0.86
	Soil temperature (April)		0.74	0.46	0.05	0.87
	pH		0.82	0.41	0.06	0.97
	Phylogenetic isolation		11.42	$1 \times 10^{-9}$	0.95	0.77
Model 3  P= $2 \times 10^{-9}$  $r^2=0.90$	Soil humidity (April)	18	1.05	0.30	0.08	0.82
	Soil temperature (April)		0.83	0.41	0.06	0.85
	Phylogenetic isolation		9.22	$1 \times 10^{-6}$	0.89	0.73
	Air temperature (April)		-1.22	0.24	-0.117	0.73
Model 5  P= $3 \times 10^{-7}$  $r^2=0.91$	Phylogenetic isolation	12	9.87	$4 \times 10^{-7}$	0.90	0.82
	Air humidity (April)		1.11	0.28	0.10	0.82
	Phylogenetic isolation		11.82	$3 \times 10^{-10}$	0.92	0.88
	Soil microbial biomass (February)		-0.71	0.48	-0.05	0.88

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202 **d.** Effect of phylogenetic isolation and abiotic conditions on EMf Laccase activity in March and  
 203 April, tested by simple regression analyses. Nutritional status of fresh oak litter, and the soil  
 204 microbial biomass and activity are considered indicative of the abiotic environment soil fertility.

*Effect on EMf laccase activity*

Independent variable	March				April			
	Df	T	P	R <sup>2</sup>	Df	T	P	R <sup>2</sup>
Phylogenetic isolation	20	4.92	8*10 <sup>-5</sup>	0.54	20	8.61	3*10 <sup>-8</sup>	0.78
pH	20	-0.55	0.58	0.01	20	-0.71	0.48	0.01
Soil temperature	20	0.58	0.56	0.01	20	0.85	0.40	0.03
Soil humidity	20	-1.5	0.13	0.10	20	-1.44	0.16	0.09
Air temperature	13	-1.89	0.08	0.21	13	-1.56	0.14	0.15
Air humidity	13	1.51	0.15	0.15	13	2.23	0.04	0.27
Tree pair	11	F=0.26	0.97	NA	11	F=0.50	0.85	NA
Focal oak species	20	F=0.25	0.61	NA	20	F=0.28	0.60	NA
N concentration (fresh oak litter)	20	0.14	0.88	1*10 <sup>-3</sup>	20	0.36	0.72	6*10 <sup>-3</sup>
C concentration (fresh oak litter)	20	-0.36	0.71	6*10 <sup>-3</sup>	20	0.13	0.89	8*10 <sup>-4</sup>
C/N concentration (fresh oak litter)	20	-0.86	0.39	0.03	20	-0.84	0.41	0.03
Soil microbial biomass (August)	20	-1.17	0.25	0.06	20	0.14	0.88	1*10 <sup>-3</sup>
Soil microbial activity (August)	20	-0.20	0.83	2*10 <sup>-3</sup>	20	1.03	0.31	0.05
Soil microbial biomass (February)	20	-1.13	0.27	0.06	20	-1.21	0.23	0.06
Soil microbial activity (February)	20	-0.50	0.61	0.01	20	-0.35	0.72	6*10 <sup>-3</sup>

205

206 **e.** Multiple regression analyses testing the effect of phylogenetic isolation on EMf Laccase  
 207 activity in March, accounting for the effect of different combinations of abiotic conditions.  
 208 Multiple combinations of independent variables are tested, accounting for variables that were at  
 209 least marginally significant in simple regression analysis. Tolerances characterize the mutual

210 independence among independent variables (i.e. 1 if an independent variable is entirely  
 211 uncorrelated to the other independent covariables).

*Effect on EMf laccase activity (March)*

		Df	T	P	Standardized	Tolerance
regression						
coeffcient						
Model 1	Phylogenetic isolation		4.02	$8 \cdot 10^{-4}$	0.70	0.82
$P=4 \cdot 10^{-3}$	Soil humidity (March)	17	-0.86	0.39	-0.25	0.27
$r^2=0.57$	Soil temperature (March)		-0.66	0.51	-0.11	0.80
	pH		0.63	0.53	0.17	0.34
Model 2	Phylogenetic isolation		4.59	$2 \cdot 10^{-4}$	0.75	0.92
$P=1 \cdot 10^{-3}$	Soil temperature (March)	18	-0.39	0.70	-0.06	0.91
$r^2=0.55$	pH		-0.09	0.92	-0.01	0.95
Model 3	Phylogenetic isolation		4.30	$4 \cdot 10^{-4}$	0.72	0.85
$P=1 \cdot 10^{-3}$	Soil humidity (March)	18	-0.60	0.55	-0.10	0.78
$r^2=0.56$	Soil temperature (March)		-0.55	0.58	-0.09	0.84
Model 4	Phylogenetic isolation	12	3.33	$5 \cdot 10^{-3}$	0.65	0.87
$P=4 \cdot 10^{-3}$	Air temperature (March)		-1.16	0.26	-0.22	0.87
$r^2=0.59$						

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 215 **f.** Multiple regression analyses testing the effect of phylogenetic isolation on EMf Laccase  
 216 activity in April, accounting for the effect of different combinations of abiotic conditions.  
 217 Multiple combinations of independent variables are tested, accounting for variables that were at  
 218 least marginally significant in simple regression analysis. Tolerances characterize the mutual  
 219 independence among independent variables (i.e. 1 if an independent variable is entirely  
 220 uncorrelated to the other independent covariables).

*Effect on EMf laccase activity (April)*

		Df	T	P	Standardized regression coeffcient	Tolerance
Model 1	Phylogenetic isolation		7.93	$4*10^{-7}$	0.96	0.75
$P=5*10^{-6}$	Soil humidity (April)	17	0.63	0.53	0.10	0.44
$r^2=0.81$	Soil temperature (April)		-1.19	0.24	-0.13	0.85
	pH		-0.61	0.54	-0.08	0.52
Model 2	Phylogenetic isolation		8.36	$1*10^{-7}$	0.93	0.86
$P=1*10^{-6}$	Soil temperature (April)	18	-1.30	0.20	-0.14	0.87
$r^2=0.80$	pH		-0.25	0.79	-0.03	0.97
Model 3	Phylogenetic isolation		8.06	$2*10^{-7}$	0.94	0.77
$P=1*10^{-6}$	Soil humidity (April)	18	0.29	0.76	0.03	0.82
$r^2=0.80$	Soil temperature (April)		-1.23	0.23	-0.13	0.85
Model 4	Phylogenetic isolation	12	5,44	$1*10^{-4}$	0.79	0.79
$p=8*10^{-5}$	Air humidity (April)		1.32	0.20	0.19	0.79
$r^2=0.79$						

224 **g.** Effect of phylogenetic isolation and abiotic conditions on EMf  $\beta$ -glucosidase activity in  
 225 March and April, in simple regression analyses. Nutritional status of fresh oak litter, and the soil  
 226 microbial biomass and activity are considered indicative of the abiotic environment soil fertility.

*Effect on EMF  $\beta$ -glucosidase activity*

Independent variable	March				April			
	Df	T	P	R <sup>2</sup>	Df	T	P	R <sup>2</sup>
Phylogenetic isolation	20	-0.98	0.33	0.04	20	-1.43	0.16	0.09
pH	20	0.93	0.36	0.04	20	0.91	0.37	0.04
Soil temperature	20	-2.12	0.04	0.18	20	-0.43	0.66	$9*10^{-3}$

Soil humidity	20	1.26	0.21	0.07	20	0.92	0.36	0.04
Air temperature	12	-0.51	0.61	0.01	12	-1.56	0.14	0.15
Air humidity	12	2.15	0.05	0.26	12	0.40	0.68	0.01
Tree pair	11	F=0.88	0.57	NA	11	F=0.61	0.77	NA
Focal oak species	20	F=1.30	0.26	NA	20	F=1.29	0.26	NA
N concentration (fresh oak litter)	20	0.76	0.45	0.02	20	0.29	0.79	$4*10^{-3}$
C concentration (fresh oak litter)	20	1.07	0.29	0.05	20	0.34	0.73	$6*10^{-3}$
C/N concentration (fresh oak litter)	20	-0.58	0.56	0.01	20	-0.26	0.79	$3*10^{-3}$
Soil microbial biomass (August)	20	-0.84	0.40	0.03	20	-1.56	0.13	0.10
Soil microbial activity (August)	20	-0.88	0.38	0.03	20	-1.34	0.19	0.08
Soil microbial biomass (February)	20	1.64	0.11	0.11	20	-0.53	0.59	0.01
Soil microbial activity (February)	20	0.58	0.56	0.01	20	0.70	0.48	0.02

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231 **h.** Multiple regression analyses testing the effect of phylogenetic isolation on EMf  $\beta$ -glucosidase  
 232 activity in March, accounting for the effect of different combinations of abiotic conditions.  
 233 Multiple combinations of independent variables are tested, accounting for variables that were at  
 234 least marginally significant in simple regression analysis. Tolerances characterize the mutual  
 235 independence among independent variables (i.e. 1 if an independent variable is entirely  
 236 uncorrelated to the other independent covariables).

237

*Effect on EMF  $\beta$ -glucosidase activity (March)*

		Df	T	P	Standardized regression coeffcient	Tolerance
	Model 1					
P=0.37	Phylogenetic isolation		-0.42	0.67	-0.10	0.82
$r^2=0.21$	Soil humidity (March)	17	-0.03	0.97	-0.01	0.27
	Soil temperature (March)		-1.60	0.12	-0.38	0.80
	pH		0.35	0.72	0.13	0.34
	Model 2					
P=0.22	Phylogenetic isolation		-0.45	0.65	-0.09	0.92
$r^2=0.21$	Soil temperature (March)	18	-1.75	0.09	-0.38	0.91
	pH		0.56	0.57	0.12	0.95
	Model 3					
P=0.23	Phylogenetic isolation		-0.37	0.71	-0.08	0.85
$r^2=0.20$	Soil humidity (March)	18	0.43	0.67	0.10	0.78
	Soil temperature (March)		-1.60	0.12	-0.36	0.84
	Model 4					
P=0.11	Soil temperature (March)	19	-1.88	0.07	-0.40	0.93
$r^2=0.20$	Phylogenetic isolation		-0.53	0.60	-0.11	0.93
	Model 5					
P=0.10	Phylogenetic isolation		-0.93	0.37	-0.24	0.85
$r^2=0.31$	Air humidity (March)	12	2.33	0.03	0.60	0.85

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241 **i.** Multiple regression analyses testing the effect of phylogenetic isolation on EMf Glucosidase  
 242 activity in April, accounting for the effect of different combinations of abiotic conditions.  
 243 Multiple combinations of independent variables are tested, accounting for variables that were at  
 244 least marginally significant in simple regression analysis. Tolerances characterize the mutual  
 245 independence among independent variables (i.e. 1 if an independent variable is entirely  
 246 uncorrelated to the other independent covariables).

247

248

*Effect on EMF  $\beta$ -glucosidase activity (April)*

		Df	T	p	Standardized	Tolerance
regression						
coeffcient						
Model 1	Phylogenetic isolation		-1.13	0.27	-0.29	0.75
P=0.68	Soil humidity (April)	17	-0.08	0.93	-0.02	0.44
r <sup>2</sup> =0.11	Soil temperature (April)		0.08	0.93	0.02	0.85
	pH		0.56	0.58	0.17	0.52
Model 2	Phylogenetic isolation		-1.21	0.24	-0.28	0.86
P=0.50	Soil temperature (April)	18	0.09	0.92	0.02	0.87
r <sup>2</sup> =0.11	pH		0.70	0.49	0.15	0.97
Model 3	Phylogenetic isolation		-1.29	0.21	-0.28	0.97
P=0.30	pH	19	0.71	0.48	0.15	0.97
r <sup>2</sup> =0.11						

249

250 **Table S6.** Effect of phylogenetic isolation, abiotic conditions abundance and enzymatic activity  
 251 of EMf on budburst phenology in simple regression analyses. Nutritional status of fresh oak  
 252 litter, and the soil microbial biomass and activity are considered indicative of the abiotic  
 253 environment soil fertility.

254

Effect on budburst phenology

Independent variable	Df	T	P	R <sup>2</sup>
Phylogenetic isolation of host plant	20	2.34	0.02	0.21
EMf β-glucuronidase activity (March)	20	-0.51	0.61	0.01
EMf β-glucuronidase activity (April)	20	2.82	0.01	0.28
EMf Laccase activity (March)	20	3.30	0.003	0.35
EMf Laccase activity (April)	20	2.40	0.02	0.22
EMf β-glucosidase (March)	20	0.12	0.89	0.0008
EMf β-glucosidase activity (April)	20	-0.31	0.75	0.004
EMf Abundance (March)	20	3.05	0.01	0.31
EMf Abundance (April)	20	0.81	0.42	0.03
Soil temperature (March)	20	1.23	0.23	0.07
Soil humidity (March)	20	-1.59	0.13	0.11
Air temperature (March)	13	-1,98	0,06	0.23
Air humidity (March)	13	0,76	0,45	0.04

Soil temperature (April)	20	1.24	0.23	0.07
Soil humidity (April)	20	-1.87	0.08	0.14
Air temperature (April)	13	-2,04	0,06	0.24
Air humidity (April)	13	0.76	0,45	0.04
pH	20	-0.47	0.64	0.01
N concentration (fresh oak litter)	20	0.39	0.69	$7*10^{-3}$
C concentration (fresh oak litter)	20	0.32	0.74	$5*10^{-3}$
C/N concentration (fresh oak litter)	20	-0.51	0.61	0.01
Soil microbial biomass (August)	20	-1.75	0.09	0.13
Soil microbial activity (August)	20	-0.51	0.61	0.01
Soil microbial biomass (February)	20	-0.37	0.71	$6*10^{-3}$
Soil microbial activity (February)	20	0.17	0.86	$1*10^{-3}$

256 **Table S7. Variables significantly related to phylogenetic isolation; the effect of accounting**  
 257 **for percentage of oaks as co-variable.**

258

259 **a.** Multiple regression analysis testing the effect of phylogenetic isolation on EMf abundance in  
 260 April including percentage of oaks as co-variable. Tolerances characterize the mutual  
 261 independence among independent variables (i.e. 1 if an independent variable is entirely  
 262 uncorrelated to the other independent covariables).

263

*Effect on EMf abundance (April)*

		Df	T	p	Standardized regression coeffcient	Tolerance
R <sup>2</sup> =0.24	Percentage of oaks	19	0.006	0,99	0.002	0.19
P=0.07	Phylogenetic isolation	19	0.93	0,36	0.43	0.19

264

265

266 **b.** Multiple regression analysis testing the effect of phylogenetic isolation on EMf  $\beta$ -  
 267 glucuronidase activity in April, including percentage of oaks as co-variable. Tolerances  
 268 characterize the mutual independence among independent variables (i.e. 1 if an independent  
 269 variable is entirely uncorrelated to the other independent covariables).

270

*Effect on EMf  $\beta$ -glucuronidase activity (April)*

		Df	T	p	Standardized regression coeffcient	Tolerance
P=4*10-10	Percentage of oaks	19	0.76	0.45	-0.12	0.19
R <sup>2</sup> =0.89	Phylogenetic isolation	19	4.97	8*10-5	0.83	0.19

271

272

273 c. Multiple regression analysis testing the effect of phylogenetic isolation on EMf Laccase  
 274 activity in March, including percentage of oaks as co-variable. Tolerances characterize the  
 275 mutual independence among independent variables (i.e. 1 if an independent variable is entirely  
 276 uncorrelated to the other independent covariables).

*Effect on EMf laccase activity (March)*

		Df	T	P	Standardized	Tolerance
regression						
coeffcient						
R <sup>2</sup> =0.61	Percentage oaks	19	-1.86	0.07	-0.60	0.19
P=1*10-4	Phylogenetic isolation	19	0.62	0.53	0.20	0.19

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280 d. Multiple regression analysis testing the effect of phylogenetic isolation on EMf Laccase  
 281 activity in April, with percentage of oaks as co-variables. Tolerances characterize the mutual  
 282 independence among independent variables (i.e. 1 if an independent variable is entirely  
 283 uncorrelated to the other independent covariables).

284

*Effect on EMf laccase activity (April)*

		Df	T	P	Standardized	Tolerance
regression						
coeffcient						
P=7*10-8	Percentage oaks	19	-1.89	0.07	-0.41	0.19
R <sup>2</sup> =0.82	Phylogenetic isolation	19	2.33	0.03	0.51	0.19

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287 e. Multiple regression analysis testing the effect of phylogenetic isolation on budburst  
 288 phenology, including percentage of oaks as co-variable. Tolerances characterize the mutual  
 289 independence among independent variables (i.e. 1 if an independent variable is entirely  
 290 uncorrelated to the other independent covariables).

291

*Effect on budburst phenology*

P=0.05	R <sup>2</sup> =0.26	Phylogenetic isolation	Df	T	P	Standardized	Tolerance
							regression
		Percentage oaks	19	-1.14	0.26	0.51	0.19

292

293 f. Multiple regression analysis testing the effect of phylogenetic isolation and Laccase activity in  
 294 April and the interaction terms on the budburst phenology, including percentage of oaks and its  
 295 interaction with Laccase activity as co-variables. Data are centered by their means.  
 296 Tolerances characterize the mutual independence among independent variables (i.e. 1 if an  
 297 independent variable is entirely uncorrelated to the other independent covariables).

298

*Effect on budburst phenology(with transformation)*

P=0.07	R <sup>2</sup> =0.43	Percentage of oaks [V1]	Df	T	P	Standardized	Tolerance
				(One-tailed)	regression	coffcient	
		V1*V2					
		EMf Laccase (April) [V2]	-0.10	0.45	-0.05	0.13	
		Phylogenetic isolation [V3]	-0.59	0.27	-0.35	0.10	
		V1*V2	1.42	0.08	0.99	0.07	
		V2*V3	-1.41	0.08	-0.85	0.09	
			-2.01	0.03	-1.28	0.08	

299

300

301 g. As f, but data are not centered by their means (without transformation).

302

*Effect on budburst phenology (without transformation)*

	P	Standardized			
		Df	T	(one tailed)	regression coefficient
					Tolerance
	Percentage of oaks [V1]	1.29	0.10	3.66	$4 \times 10^{-3}$
P=0.07	EMf Laccase (April) [V2]	1.51	0.07	3.18	$7 \times 10^{-3}$
R <sup>2</sup> =0.43	Phylogenetic isolation [V3]	2.06	0.02	6.99	$3 \times 10^{-3}$
	V1*V2	-1.41	0.08	-2.71	$9 \times 10^{-3}$
	V2*V3	-2.01	0.03	-8.23	$2 \times 10^{-3}$

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310 **Table S8.** Effect of phylogenetic isolation on abiotic conditions. Nutritional status of fresh oak  
 311 litter, and the soil microbial biomass and activity are considered indicative of the abiotic  
 312 environment soil fertility.

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*Effect of phylogenetic isolation on* Df T P R<sup>2</sup>

Soil pH	20	-0.71	0.48	0.02
Soil pH (Without the two outliers)	18	-2.11	0.04	0.19
Soil temperature (March)	20	1.17	0.25	0.06
Soil humidity (March)	20	-1.71	0.10	0.12
Soil humidity March (Without the two outliers)	18	-2.99	7*10 <sup>-3</sup>	0.33
Air temperature (March)	13	-1.38	0.18	0.12
Air humidity (March)	13	1.46	0.16	0.14
Soil temperature (April)	20	1.68	0.10	0.12
Soil humidity (April)	20	-1.93	0.06	0.15
Soil humidity April (Without the two outliers)	18	-3.10	6*10 <sup>-3</sup>	0.34
Air temperature (April)	13	-2.18	0.04	0.26
Air humidity (April)	13	1.68	0.11	0.17
N concentration (fresh oak litter)	20	-0.25	0.80	3*10 <sup>-3</sup>
C concentration (fresh oak litter)	20	0.76	0.45	0.02
C/N concentration (fresh oak litter)	20	-0.53	0.60	0.01
Soil microbial biomass (August)	20	1*10 <sup>-3</sup>	0.99	1*10 <sup>-6</sup>
Soil microbial activity (August)	20	0.81	0.42	0.03
Soil microbial biomass (February)	20	-1.58	0.12	0.11
Soil microbial activity (February)	20	-0.65	0.51	0.02

314

315

316

317 **Table S9.** Effect of phylogenetic isolation on enzymatic activity of EMf in March and April, in  
 318 simple regression analyses, considering only trees without gymnosperm neighbors.  
 319 Note that two out of three enzymatic activities that show significant relationships to phylogenetic  
 320 isolation across all trees also do so here – despite the much smaller size of the sample analyzed  
 321 and the much smaller variance of the independent variable.

<i>Effect of phylogenetic isolation on:</i>	March				April			
	Df	T	P	R <sup>2</sup>	Df	T	P	R <sup>2</sup>
EMf β-glucuronidase activity	7	0.29	0.77	0.01	7	6.08	4*10 <sup>-4</sup>	0.84
EMf Laccase activity	7	0.15	0.88	3*10 <sup>-3</sup>	7	5.24	1*10 <sup>-3</sup>	0.79
EMf β-glucosidase activity	7	0.20	0.84	5*10 <sup>-3</sup>	7	0.36	0.72	0.01

322