

# Electronic Supplements

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## Report from a mycodiversity hotspot – macrofungi on decaying trunks of Norway spruce in the Białowieża virgin forest, Poland

by

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### Abbreviations

**BP33–BP64**: codes of studied spruce trunks; **DBH**: diameter at breast height; **DD**: Daniel Dvořák; **E0**: moss cover; **E2**: canopy of shrubs and young trees up to a height of 5 m; **E3**: canopy of mature trees; **E32**: total E2 and E3 canopy; **herb.**: herbarium; **HLI**: heat load index; **JB**: Jan Běťák; **JH**: Jan Holec; **MB**: Miroslav Beran; **MK**: Martin Kříž; **PCA**: principle component analysis; **spec**: total number of species on each individual trunk; **I, II, III, IV, V** (Latin numerals): particular decay stages of studied trunks.

A. Position of studied trunks of Norway spruce (*Picea abies*) and basic data on their study.  
 For detailed trunk parameters, see Electronic Supplement B.

Trunk code	Coord. N	Coord. E	Białowieża forest section	Date of study	Monitored by
BP33	52°42.855	23°53.525	402C	18.09.2017	JB, DD
BP34	52°42.953	23°53.614	402C	18.09.2017	MK
BP35	52°42.955	23°53.618	402C	18.09.2017	MB
BP36	52°43.003	23°53.569	402C	18.09.2017	JB
BP37	52°43.166	23°53.509	402A	18.09.2017	JH, MB
BP38	52°44.616	23°54.459	319C	19.09.2017	MK
BP39	52°44.710	23°54.401	318D	19.09.2017	JH
BP40	52°44.782	23°54.448	319C	19.09.2017	MB
BP41	52°44.752	23°54.241	318D	19.09.2017	JB
BP42	52°45.113	23°54.330	288D	19.09.2017	DD
BP43	52°44.875	23°54.493	319A	19.09.2017	MB
BP44	52°45.202	23°54.450	289C	19.09.2017	DD
BP45	52°43.405	23°50.727	370C	20.09.2017	JH
BP46	52°43.414	23°50.732	370C	20.09.2017	MB
BP47	52°43.422	23°50.696	370C	20.09.2017	MK
BP48	52°43.350	23°50.887	399A	20.09.2017	MB, MK, JH
BP49	52°44.198	23°49.617	340	20.09.2017	JB
BP50	52°44.306	23°49.614	340	20.09.2017	DD
BP51	52°46.349	23°51.564	225C	21.09.2017	MB
BP52	52°45.763	23°51.062	255C	21.09.2017	JB
BP53	52°46.045	23°50.432	254B	21.09.2017	DD
BP54	52°45.978	23°50.481	254D	21.09.2017	JB
BP55	52°46.313	23°51.427	224D	21.09.2017	JH
BP56	52°46.334	23°51.509	224D	21.09.2017	MK
BP57	52°46.145	23°51.405	225B	21.09.2017	JH
BP58	52°43.410	23°54.458	374C	22.09.2017	JH, MK, MB
BP59	52°43.438	23°54.466	374C	22.09.2017	MB
BP60	52°43.455	23°54.298	373D	22.09.2017	MK, MB
BP61	52°43.516	23°54.210	373D	22.09.2017	JB
BP62	52°43.580	23°54.190	373D	22.09.2017	JH
BP63	52°43.406	23°54.085	373D	22.09.2017	JB
BP64	52°43.376	23°53.255	372D	22.09.2017	DD

B. Parameters of studied trunks of Norway spruce (*Picea abies*) and the total number of fungal species found on them. For parameter definitions see Material and methods.

Trunk code	Length (m)	Diameter et breast height (DBH) (cm)	Parts (1: trunk, 2: trunk + stump)	Stump height (m)	Orientation from base to top (in azimuth degrees)	Decay stage	Contact with the soil (%)	Bark cover (%)	Moss cover (%)	Tree layer (E3) cover (%)	Shrub layer (E2) cover (%)	Total tree + shrub cover (E32) (%)	Total number of fungal species
BP33	30	55	2	0.2	83	III	100	0	90	65	8	70	27
BP34	26	45	2	2.5	65	III	100	0	90	50	15	60	40
BP35	37	70	2	0.5	315	V	100	0	50	70	20	80	15
BP36	32.5	105	2	2	90	II	20	0	7	45	30	65	32
BP37	27	50	2	0.5	140	III	15	0	10	35	5	37	27
BP38	28	50	2	0.9	155	II	5	3	2	45	2	47	14
BP39	38.2	110	2	3	135	II	95	0	40	55	5	57	34
BP40	25.5	60	2	2.7	160	IV	100	0	60	60	5	62	20
BP41	34	80	2	1.8	255	II	5	10	30	35	30	50	44
BP42	30	60	2	1.2	150	II	10	3	5	20	25	35	46
BP43	28	70	2	1.5	190	IV	100	0	80	40	30	60	32
BP44	24	85	2	5	130	IV	100	0	20	20	15	30	34
BP45	35	75	1	0	90	III	80	2	60	60	30	70	23
BP46	33.2	65	1	0	65	I	2	10	0	35	5	37	11
BP47	21	55	2	1.2	305	V	100	0	40	60	10	65	14
BP48	33.5	80	2	1.2	110	II	15	30	45	30	20	37	38
BP49	32	60	2	2.5	170	IV	100	0	90	50	20	60	37
BP50	32	100	1	0	20	III	80	2	30	50	40	75	55
BP51	27.5	55	1	0	125	IV	95	0	70	65	5	67	17
BP52	38	75	2	2	50	I	5	2	30	5	10	12	15
BP53	31	70	2	4	185	III	50	10	70	80	60	90	63
BP54	23	65	2	1	150	V	100	0	10	90	40	95	24
BP55	21	50	2	0.8	160	I	100	95	2	35	5	37	18
BP56	27	50	2	2.1	85	V	100	0	10	70	5	72	16
BP57	28	65	2	0.2	155	IV	100	0	70	65	10	70	24
BP58	31	70	2	1.4	65	I	50	8	0	85	5	87	23
BP59	20	50	2	1	290	V	100	0	60	40	25	60	15
BP60	28	35	2	0.5	20	I	10	30	0	50	5	52	12
BP61	33	110	2	4.5	200	III	90	30	40	65	30	80	57
BP62	35	70	2	1.7	120	III	98	0	60	60	10	65	35
BP63	37	70	2	1.6	130	I	10	10	0	20	5	22	20
BP64	26	55	2	0.3	100	V	100	0	80	50	5	50	26



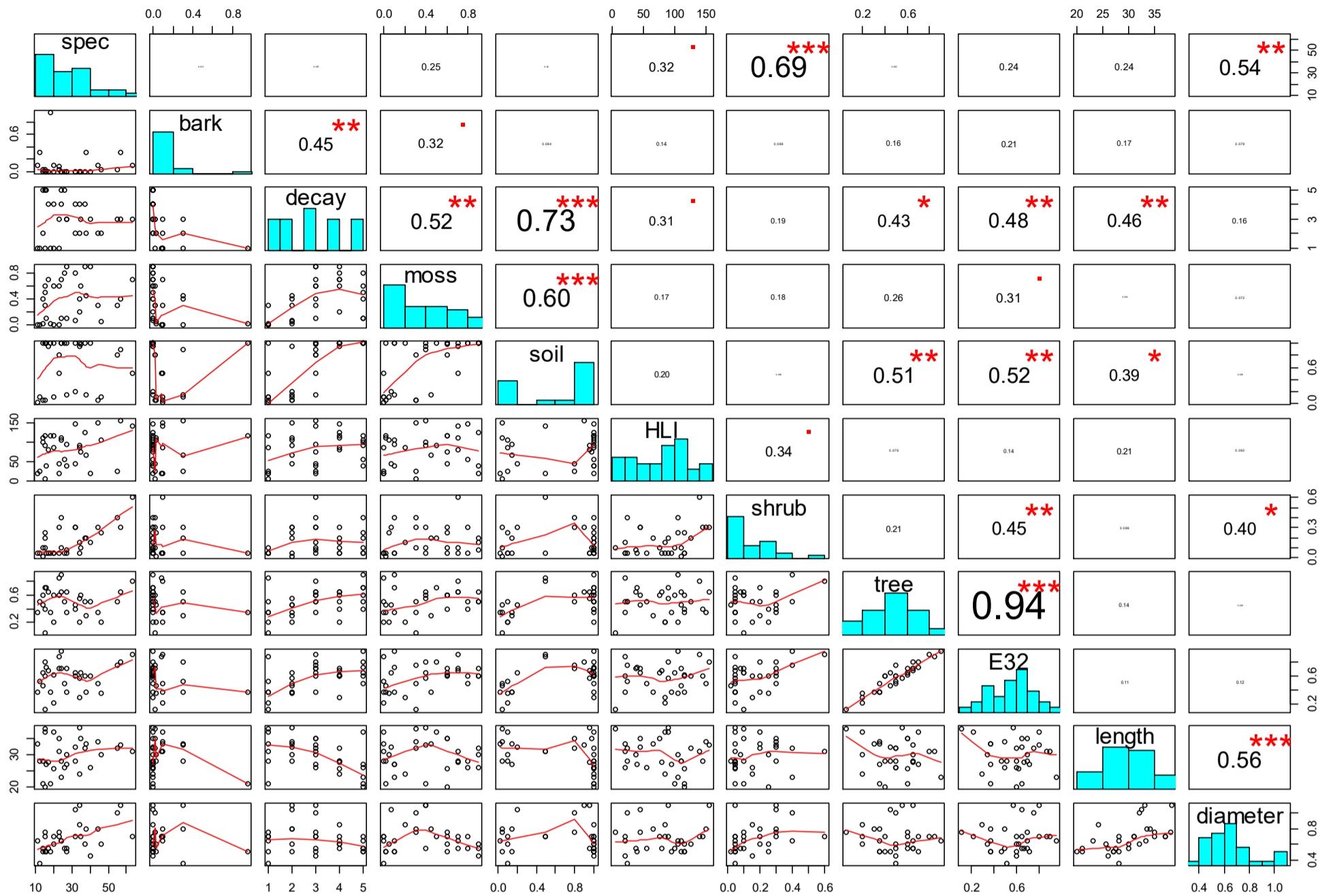
Species ↓	Trunks →	Σ	BP33	BP34	BP35	BP36	BP37	BP38	BP39	BP40	BP41	BP42	BP43	BP44	BP45	BP46	BP47	BP48	BP49	BP50	BP51	BP52	BP53	BP54	BP55	BP56	BP57	BP58	BP59	BP60	BP61	BP62	BP63	BP64	RL	
Cystolepiota seminuda (Lasch) Bon		2		+										+																						
Dacrymyces chrysospermus Berk. & M.A. Curtis		1																											+						V	
Dacrymyces stillatus Nees		14		+		+	+	+	+		+	+				+			+			+	+						+		+					
<b>Dacrymyces tortus</b> (Willd.) Fr.		1							+																										E	
<b>Dacrymyces variisporus</b> McNabb		1																										+							E	
Dacryobolus karstenii (Bres.) Oberw. ex Parmasto		2									+																				+				E	
Deconica phyllogena (Peck) Noordel.		1																+																		
Dichostereum boreale (Pouzar) Ginns & M.N.L. Lefebvre		5									+							+		+			+													
Entoloma byssisedum (Pers.) Donk		1										+																							R	
Entoloma lampropus (Fr.) Hesler		3																			+				+										V	
Entoloma politum (Pers.) Donk		1			+																															
Entoloma rhodocalix (Lasch) M.M. Moser		2												+															+							
Entoloma sp. (MB 9/20/17-15)		1														+																				
Exidia pithya Fr.		3																				+							+				+			
Exidiopsis calcea (Pers.) K. Wells		16				+		+	+		+	+			+			+		+	+	+			+			+		+	+	+	+		V	
Fomitopsis pinicola (Sw.) P. Karst.		18	+	+		+	+	+	+		+	+			+					+	+	+	+					+			+	+	+	+		
Fomitopsis rosea (Alb. & Schwein.) P.Karst.		12				+	+	+	+		+	+						+			+	+	+		+						+	+			E	
Galerina camerina (Fr.) Kühner		1											+																							
Galerina hypnorum (Schränk) Kühner		8	+			+							+						+		+								+			+		+		
Galerina marginata (Batsch) Kühner		8		+										+	+	+		+	+	+												+				
Galerina triscopa (Fr.) Kühner		25	+	+		+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	R	
Galerina vittiformis f. bispora A.H. Sm. & Singer		1		+																																
Gerronema xanthophyllum (Bres.) Norvell, Redhead & Ammirati		1																+																	R	
Globulicium hiemale (Laurila) Hjortstam		3				+					+												+													
Gloeocystidiellum sibiricum Parmasto		1																													+					
Gloeophyllum abietinum (Bull.) P. Karst.		1																+																		
Gloeophyllum odoratum (Wulfen) Imazeki		2									+													+												
Gloiothele citrina (Pers.) Ginns & G.W. Freeman		7					+		+		+	+											+	+							+					
Gymnopilus penetrans (Fr.) Murrill		2														+					+															
Gymnopilus picreus (Pers.) P. Karst.		1											+																						E	
Gymnopus confluens (Pers.) Antonín, Halling & Noordel.		1																		+																
Gyromitra infula (Schaeff.) Quél.		1																															+		V	
<b>Hebeloma hiemale</b> Bres., aff. (MB 9/22/17-21)		1																											+							
Hebeloma sordescens Vesterh., cf.		2																		+																
Hebeloma sp. (subsect. Crustuliniformia, DD BIA_44/15)		1												+																						
Helvella ephippium Lév.		2																					+												R	
Helvella macropus (Pers.) P. Karst., agg.		2	+							+																										
Henningsomyces puber (Romell ex W.B. Cooke) D.A. Reid		4		+		+							+																			+				
Heterobasidion annosum (Fr.) Bref., agg.		6		+												+	+			+	+							+								
Hohenbuehelia mustialaensis (P. Karst.) Thorn, cf.		1						+																												
Humaria hemisphaerica (F.H. Wigg.) Fuckel		9		+	+		+		+			+		+												+			+							
Hydropus floccipes (Fr.) Singer		1																	+																	
Hydropus marginellus (Pers.) Singer		5								+	+				+					+				+											E	
Hygrophoropsis aurantiaca (Wulfen) Maire		2											+											+												
Hymenochaete cinnamomea (Pers.) Bres.		1																						+											E	
Hymenochaete fuliginosa (Pers.) Lév.		2						+															+												E	
Hyphoderma argillaceum (Bres.) Donk		1										+																								
<b>Hyphoderma definitum</b> (H.S. Jacks.) Donk		1																			+															
Hyphoderma involutum (H.S. Jacks. & Dearden) Hjortstam & Ryvarde		1																			+															
<b>Hyphoderma pallidum</b> (Bres.) Donk		1	+																																	
Hyphoderma praetermissum (P. Karst.) J. Erikss. & Å. Strid		4		+			+	+																+												
Hyphoderma puberum (Fr.) Wallr.		1									+																									
Hyphoderma sp. (DD: 3 collections)		1																				+														
Hyphodontia altaica Parmasto		1																					+													
Hyphodontia alutacea (Fr.) J. Erikss.		1																				+														
Hyphodontia breviseta (P. Karst.) J. Erikss.		8				+				+	+	+										+			+						+					
Hyphodontia crustosa (Pers.) J. Erikss.		2																				+										+				
Hyphodontia nespori (Bres.) J. Erikss. & Hjortstam		3										+			+							+														
Hyphodontia pallidula (Bres.) J. Erikss.		13		+		+		+		+	+	+			+							+	+					+	+	+						
Hyphodontia spathulata (Schrad.) Parmasto		8				+										+		+	+	+											+	+				
Hypholoma capnoides (Fr.) P. Kumm.		1													+																					
Hypholoma fasciculare (Huds.) P. Kumm.		1																					+													
Hypholoma lateritium (Schaeff.) P. Kumm.		1																				+														
Hypocrea pulvinata Fuckel, cf. (not collected)		1																																		
Hypocrea strictipilosa P. Chaverri & Samuels		1																																		
<b>Hypocrea subalpina</b> Petrak		1																	+																	
Hypochnicium wakefieldiae (Bres.) J. Erikss.		4				+																+														
Imleria badia (Fr.) Vizzini		3																											+							
Junghuhnia collabens (Fr.) Ryvarde		4																											+					+	E	
Laccaria amethystina Cooke		15	+	+	+	+			+		+	+	+			+	+	+			+							+		+		+				
Laccaria laccata (Scop.) Cooke		17	+	+	+	+		+	+																											



Species ↓	Trunks →	Σ	BP33	BP34	BP35	BP36	BP37	BP38	BP39	BP40	BP41	BP42	BP43	BP44	BP45	BP46	BP47	BP48	BP49	BP50	BP51	BP52	BP53	BP54	BP55	BP56	BP57	BP58	BP59	BP60	BP61	BP62	BP63	BP64	RL	
Tomentella bryophila (Pers.) M.J. Larsen		2	+									+		+																						
<b>Tomentella lapida</b> (Pers.) Stalpers		2	+	+																																
<b>Tomentella pallidomarginata</b> H.S. Yuan, X. Lu & Y.C. Dai, <b>new to Poland</b>		1												+																						
<b>Tomentella punicea</b> (Alb. & Schwein.) J. Schröt.		1										+																								
Tomentella sp.1 (AJ-2020-241)		1		+																																
Tomentella stiposa (Link) Stalpers		2												+														+								
Tomentella sublilacina (Ellis & Holw.) Wakef., agg.		14	+		+	+			+		+		+	+				+				+	+		+		+				+		+			
<b>Tomentella subtestacea</b> Bourdot & Galzin, cf. (DD BIA 42/28)		1										+																								
Tomentella terrestris (Berk. & Broome) M.J. Larsen		1																								+										
Trechispora araneosa (Höhn. & Litsch.) K.H. Larss.		3												+			+																	+		
<b>Trechispora confinis</b> (Bourdot & Galzin) Liberta		1				+																														
Trechispora farinacea (Pers.) Liberta		6				+					+											+	+									+				
Trechispora hymenocystis (Berk. & Broome) K.H. Larss.		7	+			+					+		+	+						+		+														
<b>Trechispora microspora</b> (P. Karst.) Liberta		2																		+					+											
Trechispora mollusca (Pers.) Liberta		3													+					+													+			
Tremella encephala Willd.		1																																+		
Trichaptum abietinum (Pers. ex J.F. Gmel.) Ryvarden		6										+									+				+			+					+			
Tricholomopsis decora (Fr.) Singer		2									+		+																							R
Tricholomopsis rutilans (Schaeff.) Singer		1																									+									
Tricholomopsis sulphureoides (Peck) Singer		1																				+														
Tubulicrinis borealis J. Erikss.		1																				+														E
Tulasnella albida Bourdot & Galzin		1										+																								
Tylospora fibrillosa (Burt) Donk		2	+											+																						E
Xenasmata fibrillosa (Hallenb.) Stalpers		1																						+												
Xenasmata vaga (Fr.) Stalpers		3											+												+								+			
<b>Xenosperma ludibundum</b> (D.P. Rogers & Liberta) Oberw. ex Jülich, <b>new to Poland</b>		1										+																								
Xerocomellus pruinatus (Fr.) Šutara		1																							+											
Xeromphalina campanella (Batsch) Kühner & Maire		7							+				+	+					+	+		+									+					

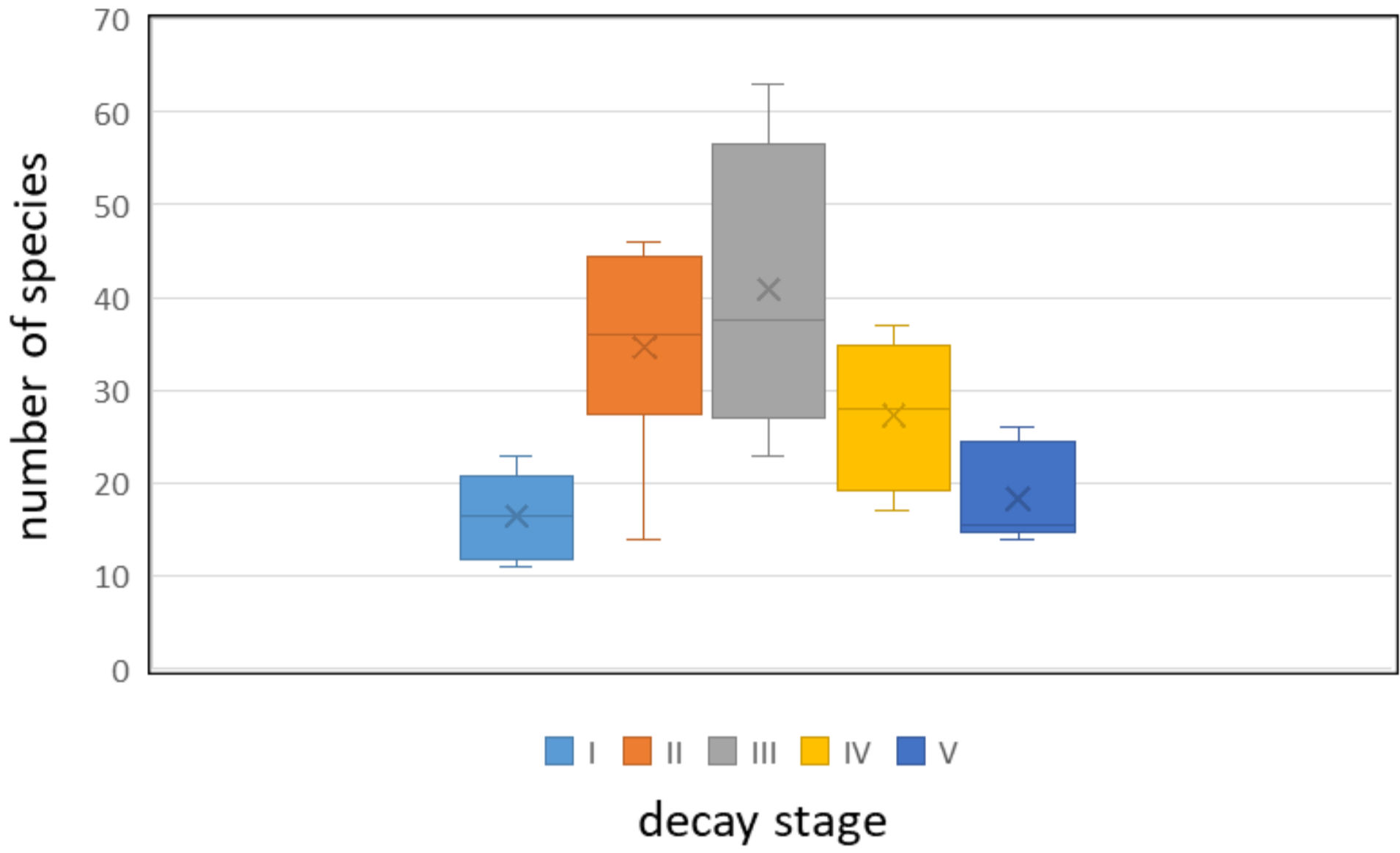
**D.** Matrix plot of fungal species richness with trunk and habitat parameters, their pair-wise Pearson's correlation coefficients, and their significance values (\*\* $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$ , red dot  $p < 0.1$ ).

Abbreviations. **bark**: bark cover (proportion,  $<0,1>$ ); **decay**: decay stage (1-5 = I-V); **diameter**: diameter at breast height (m); **E32**: total canopy cover = E3 + E2 ( $<0,1>$ ); **HLI**: heat load index; **length**: length of fallen tree (m); **moss**: cover of mosses ( $<0,1>$ ); **shrub**: canopy of shrubs and young trees up to a height of 5 m = E2 ( $<0,1>$ ); **soil**: contact with the soil ( $<0,1>$ ); **spec**: total number of fungal species on studied trunk; **tree**: canopy of mature trees = E3 ( $<0,1>$ ). For definitions see Material and methods, for data see Electronic Supplement B.

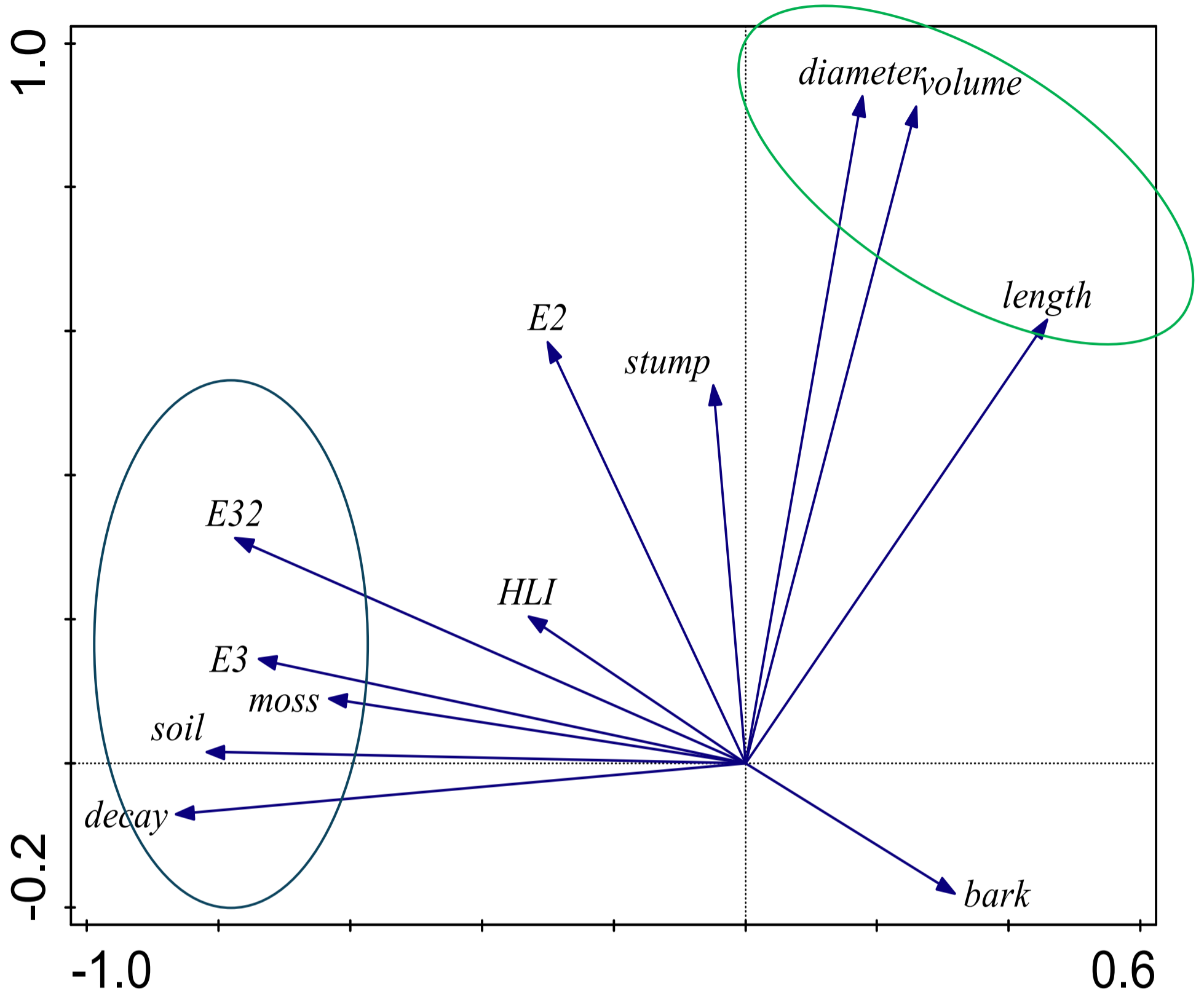


E. Range of species numbers on trunks of decay stages I–V.

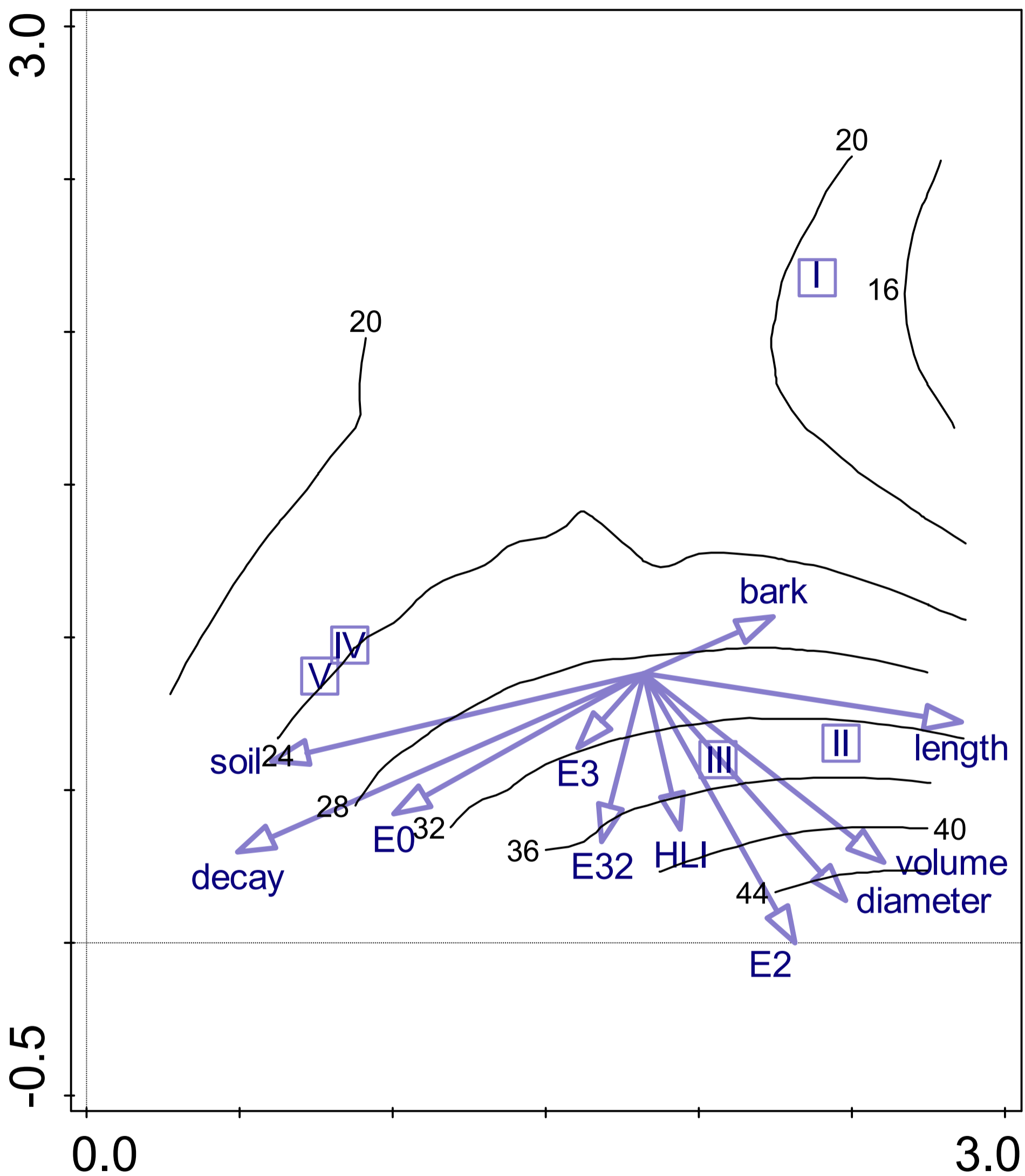
Explanations: **box** – interquartile range (3rd quartile – 1st quartile); **line inside the box** – median; **x** – mean value; **lines above and under box** – minimum, maximum (lowest and greatest values).



**F.** Unconstrained ordination biplot (PCA) of trunk parameters showing common effects of the parameters. The angle between arrows indicates pair-wise correlations, which are negative in opposite direction. The first (horizontal) axis highlights tree and tree+shrub vegetation covers (E3, E32) positively correlated with decay trajectory, trunk soil connection and moss cover, and negatively with bark cover. The second (vertical) orthogonal axis covers the collinear trunk dimension parameters (diameter, volume, length). For explanations see Abbreviations and Electronic Supplement D.



G. Detrended correspondence analysis (DCA) of all fungal species on 32 trunks with species richness and passively projected trunk/habitat parameters. First and second axes explain 14.1% of total species variation (see Fig. 5). Species richness is expressed by isolines plotted into the same space, defined by fungal assemblages on individual trunks (see analogous Figs. 5A, B in the main paper). For explanations see Abbreviations and Electronic Supplement D.



**H.** Multiple-regression models (GLM, GAM) focused on species richness of fungi recorded on 32 trunks. Comparison with null model (null) contains all significant predictors. Abbreviations: **Gaussian** – Gaussian distribution, **Poisson** – Poisson distribution, **sqrt** – square root transformation, **Estim** – estimated coefficient, **d.f.** – residual degrees of freedom, **Dev** – deviance, **%** – proportion of deviance explained by fitted model, **ResD** – residual deviance, **AIC** – *Akaike Information Criterion* value, ^ polynomial term, \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ , **s** – spline smoother. Marks + and – indicate positive / negative effects of environmental variables to response (fungal species number).

Model		Terms for fungal richness	Estim	d.f.	Dev	%	ResD	AIC
<b>GLM</b>	<b>Gaussian</b>	~+1	28.4	31	2048			227.9
	null	sqrt(~+1)	5.18	31	48.4			108.0
	optimized	sqrt(~ 7.6 shrub*** +3.2 decay –0.2 decay^2*** +4.9 diameter	3.67	27		73.1	13.0	73.9
	minimal	sqrt(~ 9.5 shrub*** –3.9 DECAy(I+IV+V)***	5.1	29		62.8	17.9	80.3
<b>GAM</b>	optimized	sqrt(~ 8.9 shrub*** +s(decay)** +4.9 diameter	3.6	26.7		73.4		76.8
	minimal	sqrt(~ 9.0 shrub*** + s(decay)***	4.4	27.7		70.4		75.8
<b>Poisson</b>	null	~+1	3.34	31	196			360.6
	optimized	~ 4.05 shrub*** + 2.56 decay –1.15 decay^2*** +3.18 diameter*	2.74	27		74.9	49.2	221.8

The collinearity was detected within separate groups of predictors, therefore we used both the forward selection and backward elimination of variables considering also second-degree polynomials (if they were significant) to construct the models. First, we checked for collinearity within separate predictors by computing Pearson pair-wise correlation matrix and using PCA ordination with centering and standardization of explanatory variables. Then we computed the **null** model (with just one parameter, the mean of response) and tested all single predictors to ascertain their relative importance. We included significant terms and explored their partial effect influencing species richness models using stepwise forward selection procedure (Legendre et Legendre 2012: 562). The effect of adding or removing individual terms and their polynomials was continuously assessed by change in explained deviance using *Akaike Information Criterion* values (*AIC*, Venables et Ripley 2003). Because this progress is order-dependent, we carefully built the **optimized** model. Alternatively, the **minimal** (adequate) models were computed using the backward elimination procedure of simplification by removing the non-significant and least significant terms (for model simplification strategy see Crawley 2013: 391–395). The analysis of deviance and reduction of *AIC* was used in each step of model selection to decide if adding/dropping variable provides a better model. The minimal adequate model could be more parsimonious compared to the optimized one, because some predictors may finally contribute little after inclusion/exclusion of some other variables. Due to the non-linear response of residuals and complex effect of trunk parameters, we tried to improve the systematic part of GLM models by optimizing non-parametric smooth term's complexity using additive modeling (GAM, library mgcv, Wood 2017).

#### References

- Crawley M.J. (2013): *The R Book*, Second edition. – Wiley, Chichester.  
Legendre P., Legendre L. (2012): *Numerical Ecology*. Third English edition. – Elsevier B.V.  
Venables W.N., Ripley B.D. (2003): *Modern Applied Statistics with S*. Fourth edition. – Springer.  
Wood S.N. (2017): *Generalized additive models*, 2nd edition. – CRC Press, Boca Raton.

I. Range of ratio between species number on individual trunks during the autumn visit only and four visits per year. Based on published data from Boubínský prales (Boubín 2015; Holec et al. 2020; Boubín 2020; Holec et al. 2022) and Zámecký les (Holec et al. 2024).

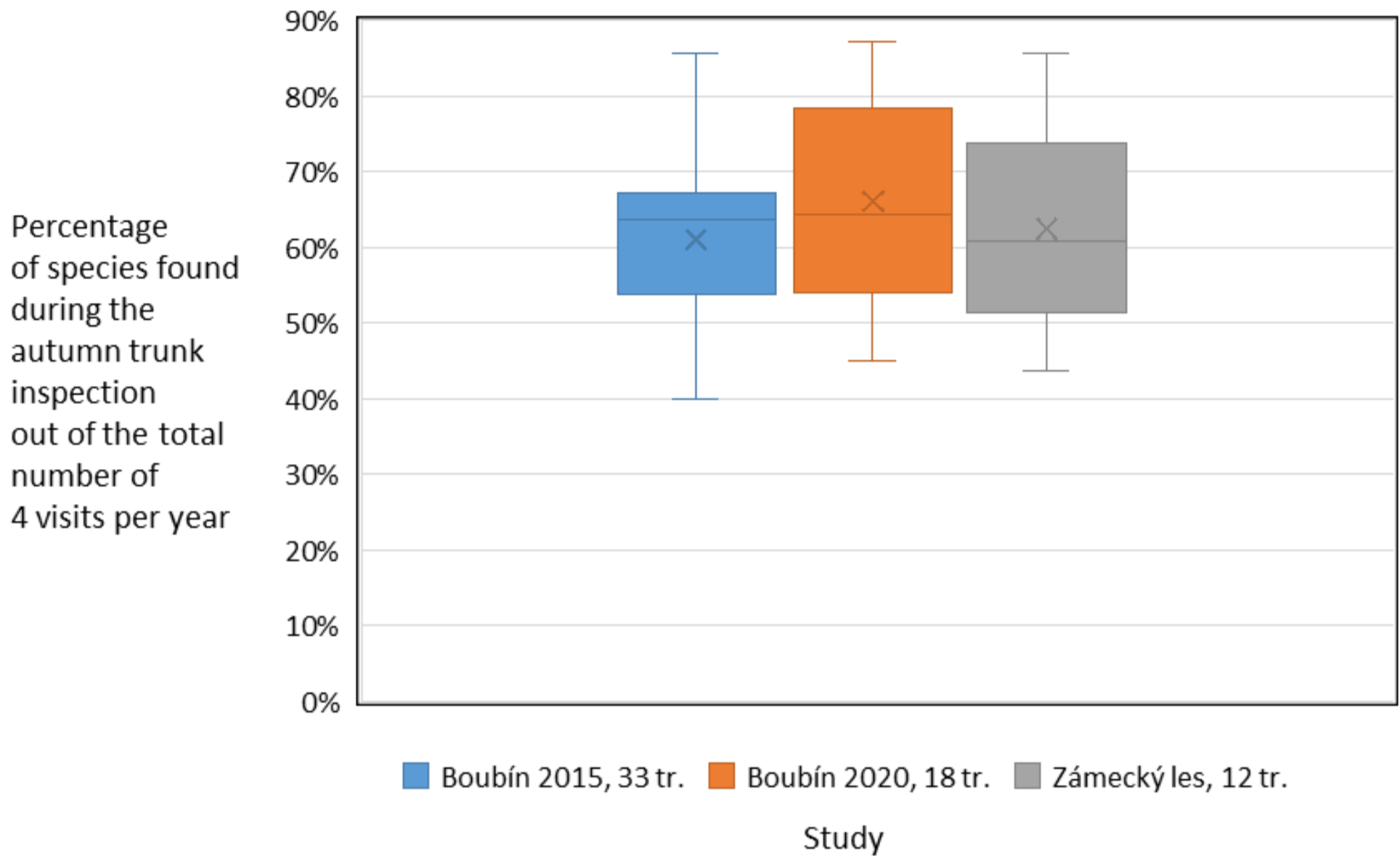
Explanations: **box** – interquartile range (3rd quartile – 1st quartile); **line inside the box** – median; **x** – mean value; **lines above and under box** – minimum, maximum (lowest and greatest values excluding outliers), **tr.** – trunk.

#### References

Holec J., Kučera T., Běťák J., Hort L. (2020): Macrofungi on large decaying spruce trunks in a Central European old-growth forest: what factors affect their species richness and composition? – *Mycological Progress* 19: 53–66.

Holec J., Holcová K., Žák M. (2022): Diversity and ecology of macrofungi on large decaying spruce trunks: what has changed after five years? – *Sydowia* 75: 23–35.

Holec J., Hubený P., Kučera T. (2024): Naturalness is key: high species richness of wood-inhabiting fungi does not automatically mean high species quality. – *Sydowia* 76: 279–295.



**J.** Most frequent species and their relationship to spruce (this study) and oak (Holec et al. 2019). For comparison of fungal species occurrence on oak and spruce trunks, we used two-proportional z-test which is appropriate to compare the occurrence in non-equal sample sets.

Explanations: **SUM**: number of trunks inhabited, **que**: *Quercus*, **pic**: *Picea*, **pooled**: proportion of occurrence on all trunks, **p-value**: significance, **z-value**: proportional z-test.

$$z = (P_q - P_p) / \sqrt{P_{qp} * (1 - P_{qp}) * (1/N_q + 1/N_p)}$$

where number of trunks **N<sub>q</sub> = N<sub>p</sub> = 32**, **P<sub>qp</sub>**: proportion of occurrence on *Quercus+Picea*, **P<sub>q</sub>**: proportion only on *Quercus*, **P<sub>p</sub>**: proportion only on *Picea*, **sqrt**: square root.

#### Reference

Holec J., Běťák J., Dvořák D., Kříž M., Kuchařková M., Krzyściak-Kosińska R., Kučera T. (2019a): Macrofungi on fallen oak trunks in the Białowieża Virgin Forest – ecological role of trunk parameters and surrounding vegetation. – Czech Mycology 71(1): 65–89.

species	SUM	SUMque	SUMpic	pooled	z-value	p-value
Galerina triscopa (Fr.) Kühner	29	4	25	0.453125	-5.273224493	<b>1.34047E-07</b>
Hymenochaete rubiginosa (Dicks.) Lév.	28	28	0	0.4375	7.05533683	<b>1.72173E-12</b>
Phaeohelotium monticola (Berk.) Dennis	26	26	0	0.40625	6.617361535	<b>3.65667E-11</b>
Xylobolus frustulatus (Pers.) Boidin	26	26	0	0.40625	6.617361535	<b>3.65667E-11</b>
Mycena inclinata (Fr.) Quéf.	24	24	0	0.375	6.196773354	<b>5.76324E-10</b>
Resinicium furfuraceum (Bres.) Parmasto	23	16	7	0.359375	2.344642592	<b>0.019045326</b>
Laccaria amethystina Cooke	23	8	15	0.359375	-1.823610905	0.068210917
Mycena galericulata (Scop.) Gray	22	22	0	0.34375	5.789974916	<b>7.03969E-09</b>
Laccaria laccata (Scop.) Cooke	22	5	17	0.34375	-3.158168136	<b>0.00158764</b>
Botryobasidium subcoronatum (Höhn. & Litsch.) Donk	21	8	13	0.328125	-1.331116651	0.183150631
Tomentella sublilacina (Ellis & Holw.) Wakef., agg.	21	7	14	0.328125	-1.863563312	0.062383054
Physisporinus sanguinolentus (Alb. & Schwein.) Pilát	21	6	15	0.328125	-2.396009972	<b>0.016574639</b>
Trechispora hymenocystis (Berk. & Broome) K.H. Larss.	19	12	7	0.296875	1.367971136	0.171321111
Humaria hemisphaerica (F.H. Wigg.) Fuckel	19	10	9	0.296875	0.273594227	0.784396471
Fomitopsis pinicola (Sw.) P. Karst.	18	0	18	0.28125	-5.004345937	<b>5.6052E-07</b>
Hyphodontia pallidula (Bres.) J. Erikss.	17	4	13	0.265625	-2.547176896	<b>0.010859837</b>
Rickenella fibula (Bull.) Raithelh.	17	3	14	0.265625	-3.113216206	<b>0.001850604</b>
Mycena stipata Maas Geest. & Schwöbel	17	0	17	0.265625	-4.811334136	<b>1.49926E-06</b>
Exidiopsis calcea (Pers.) K. Wells	16	0	16	0.25	-4.618802154	<b>3.85962E-06</b>
Hypholoma lateritium (Schaeff.) P. Kumm.	15	14	1	0.234375	3.836097791	<b>0.000125005</b>
Mycena sanguinolenta (Alb. & Schwein.) P. Kumm.	15	4	11	0.234375	-2.065591118	<b>0.038867104</b>
Dacrymyces stillatus Nees	14	0	14	0.21875	-4.233202098	<b>2.30387E-05</b>
Botryobasidium intertextum (Schwein.) Jülich & Stalpers	13	9	4	0.203125	1.553471275	0.120310587
Mycena speirea (Fr.) Gillet	13	7	6	0.203125	0.310694255	0.756033065
Galerina marginata (Batsch) Kühner	13	5	8	0.203125	-0.932082765	0.351293754
Lactarius tabidus Fr.	13	1	12	0.203125	-3.417636804	<b>0.000631673</b>
Lycoperdon perlatum Pers.	12	7	5	0.1875	0.640512615	0.52183939
Athelia decipiens (Höhn. & Litsch.) J. Erikss.	12	3	9	0.1875	-1.921537846	0.054663936
Russula ochroleuca Pers.	12	2	10	0.1875	-2.562050461	<b>0.01040562</b>
Fomitopsis rosea (Alb. & Schwein.) P. Karst.	12	0	12	0.1875	-3.843075691	<b>0.000121502</b>
Mycena epipterygia (Scop.) Gray	12	0	12	0.1875	-3.843075691	<b>0.000121502</b>
Coniophora olivacea (Fr.) P. Karst.	11	4	7	0.171875	-0.99397844	0.320233364
Coniophora arida (Fr.) P. Karst.	11	0	11	0.171875	-3.644587613	<b>0.000267821</b>
Gyrophanopsis polonensis (Bres.) Stalpers & P.K. Buchanan	10	10	0	0.15625	3.442651863	<b>0.00057604</b>
Laetiporus sulphureus (Bull.) Murrill	10	10	0	0.15625	3.442651863	<b>0.00057604</b>
Lycoperdon pyriforme Schaeff.	10	4	6	0.15625	-0.688530373	0.49111885
Trechispora farinacea (Pers.) Liberta	10	4	6	0.15625	-0.688530373	0.49111885
Crustoderma dryinum (Berk. & M.A. Curtis) Parmasto	10	1	9	0.15625	-2.754121491	<b>0.005884992</b>
Paxillus involutus (Batsch) Fr.	10	1	9	0.15625	-2.754121491	<b>0.005884992</b>
Postia caesia (Schrad.) P. Karst., agg.	10	0	10	0.15625	-3.442651863	<b>0.00057604</b>

***	<b>bold</b>	p < 0.001
**	normal	p < 0.01
*	<b>bold</b>	p < 0.05
not significant	normal	p > 0.05

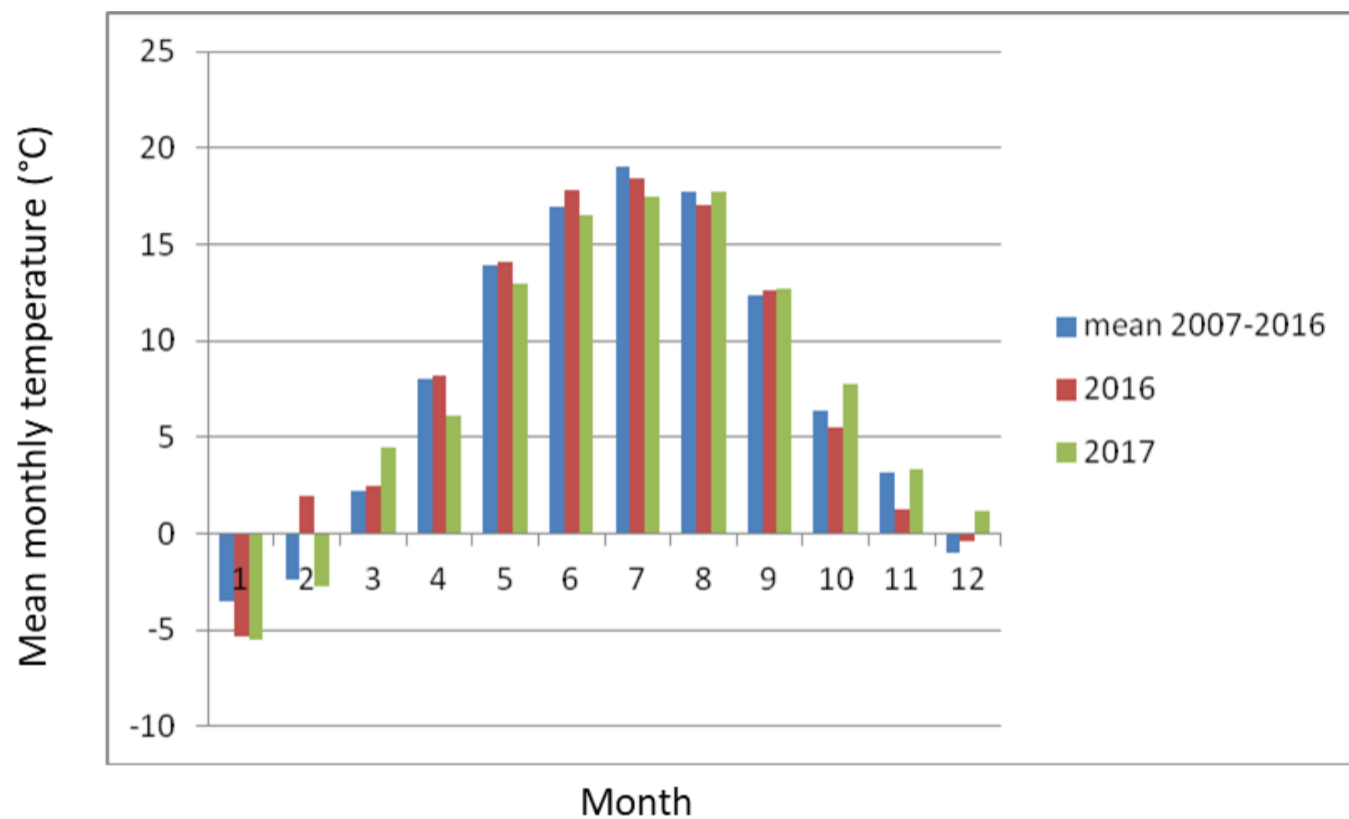
K. Basic meteorological data for the Białowieża Forest obtained by meteorological stations in the village of Białowieża (centre of the Palace Park of Białowieża National Park) measuring temperature and Narewka or Nowe Masiewo (north of the Białowieża National Park) measuring precipitation.

Data were collected by the Institute of Meteorology and Water Management (<http://www.imgw.pl>) and retrieved from web page [https://dane.imgw.pl/data/dane\\_pomiarowo\\_obserwacyjne/](https://dane.imgw.pl/data/dane_pomiarowo_obserwacyjne/).

Historical data.

Period →	1949–1983	1986–2007	2008–2016
Mean annual temperature (°C)	6.8	7.1	7.7
Mean annual precipitation (mm)	641	606	708

Monthly temperatures.



Monthly precipitation.

