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3 Morphological traits predict host-tree specialization in wood-inhabiting fungal communities  
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62 **Abstract**  
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65 Tree species is one of the most important determinants of wood-inhabiting fungal community  
66 composition, yet its relationship with fungal reproductive and dispersal traits remains poorly  
67 understood. We studied fungal communities (total of 657 species) inhabiting broadleaved and  
68 coniferous dead wood (total of 192 logs) in 12 semi-natural boreal forests. We utilized a trait-  
69 based hierarchical joint species distribution model to examine how the relationship between  
70 dead wood quality and species occurrence correlates with reproductive and dispersal  
71 morphological traits. Broadleaved trees had higher species richness than conifers, due to  
72 discomycetoids and pyrenomycetoids specializing in them. Resupinate and pileate species  
73 were generally specialized in coniferous dead wood. Fungi inhabiting broadleaved trees had  
74 larger and more elongated spores than fungi in conifers. Spore size was larger and spore shape  
75 more spherical in species occupying large dead wood units. These results indicate the selective  
76 effect of dead wood quality, visible not only in species diversity, but also in reproductive and  
77 dispersal traits.  
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95 Index descriptors: broadleaved, coniferous, dead wood, functional trait, fruitbody,  
96 morphology, specialization, spore, tree species  
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121 **INTRODUCTION**  
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126 Functional traits in fungi can be defined as any morphological, physiological or phenological  
127 feature affecting the fitness of an individual fungus (Dawson et al., 2018). Knowledge of the  
128 relationship between species traits and species responses to environmental conditions provides  
129 understanding of the mechanisms influencing community assembly in different environments  
130 (McGill et al., 2006; Weiher et al., 2011). Although trait-based assessments of community-  
131 level responses in the fungal kingdom have lagged behind that of animal and plant  
132 communities, currently fungal ecological research is undergoing a proliferation of empirical  
133 and conceptual studies addressing this issue (Aguilar-Trigueros et al., 2015; Crowther et al.,  
134 2014; Dawson et al., 2018; Peay et al., 2008).

145 Wood-inhabiting fungi constitute a highly species-rich and functionally important group  
146 regulating nutrient cycling in forest ecosystems (Boddy et al., 2008; Dowding, 1981; Kahl et  
147 al., 2017; Stokland et al., 2012). Wood-inhabiting fungal communities strongly respond to  
148 changes in environmental variables such as climatic conditions (Bässler et al., 2010; Boddy  
149 and Heilmann-Clausen, 2008; Heilmann-Clausen et al., 2014; Heilmann-Clausen and  
150 Christensen, 2005; Lindblad, 2001; Pouska et al., 2017), resource quality (Abrego and Salcedo,  
151 2013; Juutilainen et al., 2017; Küffer et al., 2008; Renvall, 1995) and habitat naturalness  
152 (Abrego and Salcedo, 2014; Bader et al., 1995; Löhmus, 2011; Sippola et al., 2001; Sippola  
153 and Renvall, 1999). Given the strong responses of wood-inhabiting fungal communities to the  
154 environment and their high taxonomical and morphological diversity, many recent studies have  
155 focused on understanding how fungal functional diversity is influenced by environmental  
156 conditions (e.g. Abrego et al., 2017; Bässler et al., 2014; Caiafa et al., 2017; Calhim et al.,  
157 2018; Kauserud et al., 2011; Nordén et al., 2013; Norros et al., 2015).  
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180 Traits related to spore and fruitbody morphology are among the very few traits that are  
181 comprehensively available for wood-inhabiting fungi (Dawson et al., 2018). In previous  
182 studies, these traits have been found to be important in determining the occurrences of fungal  
183 species on dead wood of different sizes and decay stages (Abrego et al., 2017; Nordén et al.,  
184 2013). In terms of fruitbody morphology, wood-inhabiting fungal species with robust pileate  
185 and resupinate fruitbodies have been found to require large dead wood (Abrego et al., 2017;  
186 Bässler et al., 2016), while fungi with ramarioid fruitbodies and resupinate polypores require  
187 strongly decayed wood (Abrego et al., 2017). In terms of spore morphology, dead wood in  
188 advanced decay stages harbours more wood-inhabiting fungal species with thick-walled and  
189 ornamented spores (Abrego et al., 2017). The links between spore size and dead wood  
190 characteristics, however, remain unresolved. Nordén et al. (2013) found that spore size slightly  
191 decreased as log size increased, while Abrego et al. (2017) discovered that larger logs hold  
192 species with somewhat larger spores. The discrepancy in the results between the cited studies  
193 most likely arises from the differences in the taxonomical coverage and host-tree species.  
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210 Host-tree identity is an important determinant of the species composition of wood-  
211 inhabiting fungal communities (Krah et al., 2018b; Lumley et al., 2001; Ordynets et al., 2018;  
212 Rajala et al., 2010). In some cases, host-tree identity can determine wood-inhabiting fungal  
213 diversity more than microclimatic conditions and local dead wood amount or heterogeneity  
214 (Krah et al., 2018b). In general, broadleaved and coniferous dead trees hold quite distinct  
215 fungal communities, broadleaved trees being more species rich (Abrego et al., 2016; Rajala et  
216 al., 2010; Stokland, 2012a). According to Rajala et al. (2010), the higher species richness in  
217 broadleaved trees results from a higher diversity of Ascomycota. In spite of the clear influence  
218 of host-tree species on wood-inhabiting fungal community composition, to our knowledge, the  
219 effect of host tree identity on the functional composition of wood-inhabiting fungal  
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239 communities has not been thoroughly investigated (but see Kauserud et al., 2008 for  
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241 polypores).

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243 Fennoscandian boreal forests represent a suitable ecosystem for studying the effect of  
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245 host-tree identity on wood-inhabiting fungal communities. These forests are composed of a  
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247 relatively small set of broadleaved and coniferous tree species, which all produce high amounts  
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249 of dead wood (Esseen et al., 1997; Siitonen, 2001). In the southern boreal zone in Finland,  
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251 (Ahti et al., 1968), the dominant tree species are Norway spruce (*Picea abies*, hereafter called  
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253 spruce), Scots pine (*Pinus sylvestris*, pine), birches (*Betula* spp.) and European aspen (*Populus*  
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255 *tremula*, aspen). While the fungal communities inhabiting dead spruce wood have been  
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257 extensively studied (Edman et al., 2004; Kruys et al., 1999; Kubartová et al., 2012; Ottosson  
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259 et al., 2015), the fungal communities inhabiting the other dominant tree species, especially  
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261 birch and aspen, have been less studied (but see Lumley et al. 2001; Rajala et al. 2010;  
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263 Ruokolainen et al. 2018).

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266 The main aim of the present study is to evaluate how host-tree characteristics relate to  
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268 the morphological composition of fruiting wood-inhabiting fungi. For this, we use an extensive  
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270 dataset consisting of 657 species of non-lichenized fungi producing sexual fruitbodies. We  
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272 surveyed large logs (base diameter > 15 cm) belonging to the four dominant tree species in  
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274 Fennoscandian boreal forests (spruce, pine, birch and aspen) in 12 seminatural forest sites.  
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276 More specifically, we determine how much of the variation in species occurrences is explained  
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278 by the host-tree species and volume, and how much of the variation in community composition  
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280 is explained by the morphological characteristics of the fruitbodies and spores.  
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284 We expected differences in trait composition to arise from the differences in the wood  
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286 composition and distributional patterns of coniferous versus broadleaved trees. Coniferous and  
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288 broadleaved wood differ in their chemical and physical characteristics, coniferous wood having  
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290 generally higher amounts of toxic compounds for saproxylic organisms (Stokland, 2012a). In  
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298 terms of distributional patterns, in Finnish boreal forests broadleaved trees are less abundant  
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300 and show more clumped distributions than coniferous trees. Thus, the fungal species growing  
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302 on each of the wood types should be well adapted to colonize and exploit the wood resources  
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304 accordingly.  
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307 We hypothesized that the manner by which species exploit the wood resources is  
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309 reflected in the morphological traits, as these may be linked to resource-use and dispersal  
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311 strategies. Our main working hypotheses related to fruitbody morphology are: 1) species  
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313 producing small-sized fruitbodies, such as some Ascomycota, are most prevalent on  
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315 broadleaved wood because unlike other fungi, they are able to decompose bark through soft  
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317 rot, and bark is more abundant in decomposing broadleaved logs than in coniferous logs; 2)  
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319 Agaricoids are most prevalent on broadleaved wood, because they have lignin-decomposing  
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321 enzymes (causing white rot) which are especially efficient in exploiting wood of broadleaved  
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323 trees (Krah et al., 2018a); 3) Species with pileate and resupinate fruitbodies are expected to be  
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325 equally prevalent in broadleaved and coniferous logs, because these include lineages which  
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327 equally well decompose cellulose and mostly occur on coniferous logs (i.e. brown-rot fungi),  
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329 or mainly decompose lignin and mostly occur on broadleaved logs (i.e. white-rot fungi) (Krah  
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331 et al., 2018a). Our working hypothesis about how spore morphology is linked to host tree is  
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333 that 4) coniferous trees host species with smaller spores because their wood is easier to  
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335 penetrate, compared to wood of broadleaved trees (Kauserud et al., 2008); and 5) broadleaved  
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337 trees with clumped distributions in the forest landscape (e.g. aspen) also have species with  
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339 small-sized spores, because they should be able to disperse longer distances (Norros et al.,  
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341 2014).  
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## 344 **MATERIALS AND METHODS**

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## Study sites and design

We carried out the study in central Finland, which belongs to the southern boreal vegetation zone (Ahti et al., 1968). All of the 12 study sites were spruce dominated forests characterized by *Myrtillus* or *Oxalis-Myrtillus* forest types (Cajander, 1949). All study sites were seminatural, and varied relatively little in their age and management history. To control for the quality variation among the study sites in the analyses, we used a forest naturalness index described in Supplementary material 1. From each forest, we chose four large (base diameter  $\geq 15$ cm), naturally died, fallen logs of birch, spruce, pine and aspen (these species produce the majority of the coarse dead wood (diameter at breast height  $>10$ cm) in the area), in total 16 logs at each site and 192 logs in the whole study. To minimize the variation in log quality, only logs that had their decay stage between 2-4 (Renvall, 1995), and moss cover  $< 50\%$  were selected. For each log, we measured the base and top diameter and the length of the logs, and calculated the volume by using the formula of a truncated cone.

## Fungal data collection and identification

We thoroughly surveyed the fungal sexual fruitbodies on each study log. All fruitbodies from the same taxon within a study log were considered as one occurrence of the taxon. To better account for the species-specific variation in the timing and duration of fruitbody production (see Purhonen et al., 2017), two subsequent inspections were conducted for each log. The first inspection was performed between 21<sup>st</sup> of May and 6<sup>th</sup> of June, and the second between 20<sup>th</sup> of August and 26<sup>th</sup> of September. To enable multiple surveys of the same logs, moss and bark cover was left intact and the logs were not turned over. The fruitbodies were identified to species in the field or collected for microscopic identification (about 7500 specimens collected). When the species-level identification was not possible, we identified the specimens to the highest possible taxonomical level and named them with unique labels according to their

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416 morphology (e.g. pyrenomycete sp1, sp2 etc.). Some of the classified taxa include multiple  
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418 species (i.e. species complexes), as their taxonomy is still unresolved. The nomenclature  
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420 follows Index fungorum (Royal Botanic Gardens Kew et al., 2016).  
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### 423 **Fungal trait data collection**

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427 The identified species were classified into seven groups according to their fruitbody  
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429 morphology; agaricoids were species having a soft pileus and stipe (also pleurotoid fungi were  
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431 grouped here). As discomycetoids, we classified species with disc- to cup-shaped fruitbodies.  
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433 Pileates were species that grow as crusts over the log surface when young but majority of the  
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435 fruitbody is a pileus or erected on the edges when adults. As pyrenomycetoids, we classified  
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437 those fungi of which fruitbodies were organized in individual round or flask shaped bags (i.e.  
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439 perithecia). Ramarioids had fruitbodies with branched structure. As resupinates, we classified  
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441 those species that mostly grow as a crust over the log surface, but some may be slightly pileate  
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443 as well. Stromatoids were fungi whose fruitbodies are organized round or flask shaped bags  
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445 embedded in a hard mass-like structure.  
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449 For the spore morphology, we gathered information about spore length, width and  
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451 presence of ornamentation (meaning that the surface of the spore is not smooth but has some  
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453 texture) from the literature. For those specimens that we could only identify to the genus level,  
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455 but still recognize as unique taxa, we measured the spore size and noted the shape during the  
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457 identification procedure (see detailed description of the trait variable in Table 2.). The literature  
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459 used for the spore morphology is listed in Supplementary Material 2.  
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462 To account for phylogenetic relationships between species, the phylogenetic  
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464 relationships were estimated based on the taxonomic levels. As the data include a large number  
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466 of poorly known species and species that are not yet described, it was not possible to use a  
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468 quantitative phylogenetic tree. For each species, we included the taxonomic levels of the genus,  
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475 family, order and class, using the Index Fungorum and Mycobank online databases  
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477 (International Mycological Association, 2017; Royal Botanic Gardens Kew et al., 2017).  
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## 481 **Statistical analyses**

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484 We analyzed the data with Hierarchical Modelling of Species Communities (HMSC;  
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486 Ovaskainen et al., 2017). HMSC is a joint species distribution modelling framework (Warton  
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488 et al., 2015) that enables the integration of data on species occurrences or abundances,  
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490 environmental covariates, species traits and phylogenetic relationships, as well as the spatio-  
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492 temporal nature of the study design (Ovaskainen et al., 2017).  
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495 In the HMSC analyses, the  $n_y \times n_s$  response matrix  $\mathbf{Y}$  consisted of presence-absences of  
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497 the  $n_s = 657$  species observed in the  $n_y = 192$  logs, called henceforth sampling units. We  
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499 modelled  $\mathbf{Y}$  with probit-regression, including in the predictor matrix  $\mathbf{X}$  the environmental  
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501 covariates of the tree species (categorical variable with four levels: aspen, birch, spruce and  
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503 pine), the size of the dead wood unit (log-transformed volume), decay class (categorical  
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505 variable with two levels: decay class 2; and decay classes 3 and 4 combined, as only four logs  
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507 had decay class four), and the forest naturalness index. We modelled the mapping from  $\mathbf{X}$  to  $\mathbf{Y}$   
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509 as a function of species traits and phylogenetic relationships following Abrego et al. (2017)  
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511 and Ovaskainen et al. (2017). We included in the matrix of species traits  $\mathbf{T}$  the fruitbody  
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513 morphology (categorical variable with seven levels: agaricoid, discomycetoid, pileate,  
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515 pyrenomycetoid, ramarioid, resupinate, stromatoid), the presence of ornamentation in the  
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517 spores (categorical variable with two levels: yes or no), spore shape (log-transformed ratio of  
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519 length to width), and spore size (log-transformed volume). In the absence of a quantitative  
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521 phylogeny, we followed Abrego et al. (2017) and used as a proxy for the phylogenetic  
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523 correlation matrix  $\mathbf{C}$  a taxonomical correlation matrix, constructed from the five levels of class,  
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525 order, family, genus and species, and assumed equal branch length for each level. As a  
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534 community-level random effect, implemented through a latent variable approach (Ovaskainen  
535 et al., 2017, 2016), we included the study site, with 12 levels.  
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538 We fitted the model to the data using the HMSC-R package (Tikhonov et al., 2019). We  
539 assumed the default prior distributions, and sampled the posterior distribution for 150\*thinning  
540 iterations, out of which the first 50\*thinning iterations were discarded as burn-in. We used  
541 thinning=100 and thus run the MCMC chain for a total of 15,000 iterations. We assessed the  
542 convergence of the MCMC chain visually, and examining the convergence of the results  
543 between thinning=1, thinning=10, and thinning=100.  
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551 To examine host-tree specialization at the levels of species and functional groups, we  
552 used the fitted model to predict species occurrences to new sampling units that were  
553 standardized to be of average size and decay stage and consisted of each of the four host-tree  
554 species. To examine host-tree specialization at the species level, we used these predictions to  
555 classify the host-tree use of each fungal species to one of the following seven classes:  
556 generalist, coniferous generalist, spruce specialist, pine specialist, broadleaved generalist, birch  
557 specialist, and aspen specialist. We first classified the species as generalists, broadleaved  
558 species or coniferous species by asking whether the predicted mean occurrence probability over  
559 broadleaved trees (birch and aspen) was smaller or greater than that for coniferous trees (pine  
560 and spruce) with at least 95% posterior probability. We further classified the broadleaved  
561 species as aspen specialists, birch specialists or broadleaved generalists by examining if the  
562 occurrence probability on aspen was smaller or greater than that for birch with at least 95%  
563 posterior probability. Similarly, we classified the coniferous species as spruce specialists, pine  
564 specialists and coniferous generalists.  
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581 To examine host-use specialization at the functional group level, we counted for each  
582 seven host-tree use classes the numbers of species belonging to each of the seven fruitbody  
583 types. We then asked if a particular fruitbody type was over- or underrepresented in a given  
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593 host-tree type by conducting a randomization test, in which we randomly permuted the  
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595 fruitbody types among the species, and examined if the observed value was greater or smaller  
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597 than the 95% quantile in 1000 randomizations. To examine the association among host-tree use  
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599 and spore-related traits (presence of ornamentation and the shape and size of spores), we  
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601 computed the posterior distributions of community-weighted mean traits for species predicted  
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603 to occur on each of the four tree species.  
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## 608 **RESULTS**

### 609 **Morphological traits and species richness**

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616 In total, we recorded 657 species in total, which occurred 5714 times (Appendix 1). A large  
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618 proportion of the species was resupinates (288 species, 44%), followed by discomycetes (148,  
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620 22.5%), agaricoids (73, 11%), pyrenomycetoids (71, 11%), pileates (49, 7%), stromatoids (18,  
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622 3%), and ramarioids (10, 1.5%).  
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625 Aspen dead wood had the highest fungal species richness (239 spp.), followed by birch  
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627 (221), spruce (209) and pine (186). All tree species shared 68 species, on top of which the two  
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629 broadleaved species shared 107 species, the two conifers shared 70, whereas all other  
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631 combinations of coniferous and broadleaved tree species shared less than 20 fungal species.  
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633 Discomycetoids, pyrenomycetoids, ramarioids and stromatoids had significantly higher species  
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635 richness on broadleaved host trees than on conifers (Supplementary Material 3).  
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638 Spore size (volume) and shape (length/width) showed a weak but statistically significant  
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640 negative association (in linear regression,  $p=0.02$ ,  $R^2=0.008$ ). While pyrenomycetoids had the  
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642 largest and most elongated spores, agaricoids had large and spherical spores, whereas pileates  
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644 and resupinates had the smallest spores (Fig. 1).  
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652 **Effects of environmental variables on community composition**  
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655 The fitted joint species distribution model explained 6% of the variation in the fungal  
656 community composition, as measured by the average Tjur (2009)  $R^2$  value over the species. Of  
657 the variables included in the model, host-tree species was by far the most important one, as  
658 71% of the explained variation in species occurrence was attributed to it. The percentages of  
659 explained variation attributed to other variables were 15% for log-characteristics (size and  
660 decay class), 5% for forest naturalness, and 9% for the random effect of the site. Considering  
661 only associations that had at least 95% posterior support, the occurrence probability of 86  
662 species increased and of 0 species decreased with the size of the log, 16 species preferred decay  
663 class 3 and 11 species decay class 2, and the occurrence probability of 10 species increased and  
664 of 1 species decreased with the increasing value of the naturalness index.  
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677 Among the 293 species that occurred at least four times in the data, 66 were generalists,  
678 95 broadleaved generalists, 30 birch specialists, 14 aspen specialists, 41 coniferous specialists,  
679 27 spruce specialists and 20 pine specialists (Fig. 2).  
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683 **Effects of morphological traits on the responses to the environment**  
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687 The traits explained 7% of the variation in the species responses to the environmental variables.  
688 The posterior mean of the phylogenetic signal parameter  $\rho$  was 0.20 and its 95% credibility  
689 interval was [0.11, 0.35]. As the prior for  $\rho$  has probability mass of 0.5 at  $\rho = 0$  (no  
690 phylogenetic signal) and the remaining probability is distributed evenly in [0, 1], the model  
691 revealed a moderate but statistically well supported phylogenetic signal in species responses to  
692 environmental covariates. In other words, phylogenetically (taxonomically) related species  
693 showed more similar responses to the environmental covariates than could be predicted solely  
694 based on their traits. We recorded a large number of non-random associations between host-  
695 tree use and fruitbody type (Fig. 3). In particular, species with resupinate fruitbodies were  
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711 typically conifer generalists, while species with pileate fruitbodies were often specialized to  
712 spruce. Species with discomycetoid fruitbody were typically broadleaved generalists, whereas  
713 species with pyrenomycetoid fruitbodies were often birch specialists.  
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718 The fungal species occurring on broadleaved dead wood had on the average larger spores  
719 than those occurring on coniferous dead wood (Fig. 4A). The fungal species occurring on aspen  
720 had the most elongated spores, whereas those occurring on spruce had the most spherical spores  
721 (Fig. 4B). The proportion of species with ornamented spores varied between 12% and 16% on  
722 all host trees, with birch having the largest and spruce the smallest proportion of species with  
723 ornamented spores (Fig. 4C). Larger logs had larger and more spherical spores, whereas  
724 smaller logs had smaller and more elongated spores (Fig. 4D-E). Spore ornamentation did not  
725 vary with log size (Fig. 4F).  
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## 737 **DISCUSSION**

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741 Our study shows that the occurrence of fungal species in dead wood of different characteristics  
742 relates to the morphological traits of the fungal fruitbodies and sexual spores. While it is well  
743 known that many wood-inhabiting fungal species are specialized to certain host-tree species  
744 (Berglund et al., 2011; Küffer et al., 2008; Stokland et al., 2004; Stokland, 2012a), to our  
745 knowledge, this is the first time that the importance of the fruitbody and spore morphology in  
746 determining host-tree specialization is revealed. We next discuss in turn, how and why  
747 fruitbody and spore morphology are linked to host-tree identity.  
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756 Specialization to host-tree species was related to fruitbody morphology. In line with our  
757 hypothesis that species developing small-sized fruitbodies from the Ascomycota lineages are  
758 more prevalent on broadleaved wood, we found discomycetes to be specialized to broadleaved  
759 trees in general, and pyrenomycetes to birch in particular. This association may relate to the  
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770 fact that broadleaved dead wood generally holds higher proportions of bark, which is possible  
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772 to decompose only through the so called soft-rot carried out by some Ascomycota species  
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774 (Stokland, 2012b). While we expected species with pileate and resupinate fruitbodies to be  
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776 equally prevalent in broadleaved and coniferous wood, we found resupinate species to be  
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778 specialized to conifer tree species in general and pileates to spruce in particular. Because of the  
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780 small-scale of our study (forests from central Finland), it remains to be tested by larger scale  
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782 studies whether this is a general pattern in wood-inhabiting fungal communities.  
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786 Our results also revealed an association between host tree species and spore size. Fungal  
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788 species on broadleaved trees had on average larger spores than those inhabiting conifers. This  
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790 result is in line with Kauserud et al. (2008) who found that polypore species inhabiting  
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792 broadleaved dead wood had significantly larger spores than species inhabiting coniferous dead  
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794 wood. They speculated that because coniferous trees are evolutionary older, their wood is easier  
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796 to penetrate and thus colonizing spores do not need as much energy and inoculum potential as  
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798 spores colonizing broadleaved trees. Our results show that this may also relate to the  
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800 relationship between fruitbody morphology and spore size, as pyrenomycetoids had on average  
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802 the largest and most elongated spores, and they were also as a group specialized on broadleaved  
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804 trees (birch in particular).  
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807 We expected aspen dead trees to hold species with smaller spores, because these trees  
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809 show clustered and isolated distributional patterns in the boreal forest landscape, and smaller  
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811 spores are able to disperse larger distances (Norros et al., 2014). Yet, our results showed the  
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813 contrary, the fungal species occurring on broadleaved dead wood having on average larger, and  
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815 more specifically more elongated, spores. Some studies have suggested that spore elongation  
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817 increases attachment to substrate (Calhim et al., 2018; Ingold, 1965). It remains to be tested  
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819 what is the primary reason pushing larger spore size on species inhabiting broadleaved trees.  
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Considering the relationship between log characteristics and spore morphology, previous studies have reported weak and/or contrasting results (e. g. Nordén et al. 2013; Abrego et al. 2017). Interestingly, we found a clear relationship between spore size and shape and the log size. Species with spherical and large spores preferred large logs, whereas species with elongated and small spores preferred smaller logs. Bässler et al. (2014) hypothesized that wood-inhabiting fungal species with smaller and more elongated spores, follow the *r* reproductive strategy (sensu Grime 1988), and thus cope better in managed environments where dead wood items are typically smaller. We cannot conclude how spore morphology relates to the *K/r* reproductive strategy since we did not collect data about spore production. Yet, our results are in line with Bässler et al.'s (2014) hypothesis that species with smaller and more elongated spores occur more often in smaller dead trees; thus, their proportion can be expected to be higher in forests where most dead wood is small due to management actions (Abrego and Salcedo, 2013; Eräjää et al., 2010).

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Spore ornamentation is not likely to influence airborne dispersal substantially (Hussein et al., 2013) but may be important for attaching to animal vectors for dispersal. Especially mycorrhizal species are characterized by ornamented spore walls (Halbwachs et al., 2015), which are suggested to aid in transportation to deeper soil layers via arthropod vectors (Calhim et al., 2018). As mycorrhizal species only utilize decaying logs for attaching their fruitbodies, it is logical that we did not find clear differences in spore ornamentation frequency between different tree species. However, the role of mycorrhizal fungi might be minor in the present study. The rationale is that the occurrence of mycorrhizal wood-inhabiting fungal species increases in the last decay stages (Mäkipää et al., 2017; Rajala et al., 2015), and our study included only intermediate decay stages. Moreover, the proportion of species with ornamented spores was equal in totally saprotrophic groups (ramarioids and stromatoids) and a group encompassing many mycorrhizal fungi (resupinates) (Kotiranta et al., 2009). However, we

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888 treated ornamentation as a bipartite yes/no variable although we acknowledge that there is a lot  
889 of variation within the different types of ornamentation and the role of different ornamentation  
890 types deserves more research attention.  
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894 We note that the vast majority of the variation in species occurrences at the level of logs  
895 was not explained by the fitted model. This result is in accordance with previous studies from  
896 temperate Europe (Abrego et al., 2017, 2014; Bässler et al., 2012), which concluded that  
897 random processes dominate in shaping wood-inhabiting fungal communities at small spatial  
898 scales. Most fungal species were rare (55% occurring three or fewer times), which is a common  
899 feature of ecological communities in which random processes are dominating (Vellend, 2016;  
900 White et al., 2006). However, there might be many other variables we did not include, but  
901 which could have improved the models predictive power, such as microclimatic factors or  
902 direct measurements on wood composition such as C/N ratio. This result was also partially  
903 influenced by the fact that we conducted only two surveys, one in each of the peak fruiting  
904 season in boreal forests (Abrego et al., 2016; Halme and Kotiaho, 2012; Purhonen et al., 2017).  
905 Since many wood-inhabiting fungi have ephemeral fruitbodies, repeating surveys over several  
906 years in the peak fruiting seasons would have decreased the proportion of rare species and thus  
907 increased the predictive power of our model. Also molecular surveys of mycelia would have  
908 possibly decreased the proportion of rare species and increased predictability of their  
909 occurrence (e.g. Kubartová *et al.* 2012; Mäkipää *et al.* 2017). However, in comparison to  
910 molecular surveys, fruitbody based surveys provide direct information about the “breeding”  
911 populations of fungi. As a large portion of the species groups in the present study is  
912 taxonomically poorly known, some of the results should be considered with caution. For  
913 example *Mollisia* sp., which were found to share several host-tree species, might indeed be  
914 specialized in different host trees (see also Runnel *et al.* 2014).  
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947 We found that broadleaved dead trees hold higher species richness than coniferous dead  
948 trees. In particular, aspen hosted the highest and pine the lowest species richness. Higher  
949 species richness in broadleaved trees may result from the lack of defensive chemicals that  
950 conifer tree species have, making them easier to colonize and decay (Hoppe et al., 2016;  
951 Stokland, 2012a). However, fungal fruiting patterns may differ between tree species, and thus  
952 to observe the true differences in species richness between tree species, fruitbody surveys  
953 should be accompanied with molecular data of mycelia within wood. Furthermore, different  
954 tree species have different residence times, and thus the total species richness may be higher  
955 for tree species with longer life-span as a log.  
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## 958 **Conclusions**

959  
960 Our study showed that the occurrence of fungal species in dead wood of different  
961 characteristics is related to the morphological traits of fungi. Our results also revealed that  
962 specialization to host-tree species occurs at the level of fruitbody morphological groups, and  
963 that the size and shape of the fungal spores relate to the preference for logs of different sizes.  
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## 1017 1018 1019 **REFERENCES** 1020

- 1021  
1022  
1023 Abrego, N., García-Baquero, G., Halme, P., Ovaskainen, O., Salcedo, I., 2014. Community  
1024  
1025 turnover of wood-inhabiting fungi across hierarchical spatial scales. *PLoS One* 9,  
1026  
1027 e103416. <https://doi.org/10.1371/journal.pone.0103416>  
1028  
1029  
1030 Abrego, N., Halme, P., Purhonen, J., Ovaskainen, O., 2016. Fruit body based inventories in  
1031  
1032 wood-inhabiting fungi: Should we replicate in space or time? *Fungal Ecol.* 20, 225–232.  
1033  
1034 <https://doi.org/10.1016/j.funeco.2016.01.007>  
1035  
1036 Abrego, N., Norberg, A., Ovaskainen, O., 2017. Measuring and predicting the influence of  
1037  
1038 traits on the assembly processes of wood-inhabiting fungi. *J. Ecol.*  
1039  
1040 <https://doi.org/10.1111/1365-2745.12722>  
1041  
1042  
1043 Abrego, N., Salcedo, I., 2014. Response of wood-inhabiting fungal community to  
1044  
1045 fragmentation in a beech forest landscape. *Fungal Ecol.* 8, 18–27.  
1046  
1047 <https://doi.org/10.1016/j.funeco.2013.12.007>  
1048  
1049 Abrego, N., Salcedo, I., 2013. Variety of woody debris as the factor influencing wood-  
1050  
1051 inhabiting fungal richness and assemblages: Is it a question of quantity or quality? *For.*  
1052  
1053 *Ecol. Manage.* 291, 377–385. <https://doi.org/10.1016/j.foreco.2012.11.025>  
1054  
1055 Aguilar-Trigueros, C.A., Hempel, S., Powell, J.R., Anderson, I.C., Antonovics, J., Bergmann,  
1056  
1057 J., Cavagnaro, T.R., Chen, B., Hart, M.M., Klironomos, J., Petermann, J.S., Verbruggen,  
1058  
1059  
1060  
1061  
1062

1063  
1064  
1065 E., Veresoglou, S.D., Rillig, M.C., 2015. Branching out: Towards a trait-based  
1066 understanding of fungal ecology. *Fungal Biol. Rev.* 29, 34–41.  
1067  
1068  
1069 <https://doi.org/10.1016/j.fbr.2015.03.001>  
1070

1071  
1072 Ahti, T., Hämet-Ahti, L., Jalas, J., 1968. Vegetation zones and their sections in northwestern  
1073 Europe. *Ann. Bot. Fenn.* 5, 169–211.  
1074

1075  
1076 Bader, P., Jansson, S., Jonsson, B.G., 1995. Wood-inhabiting fungi and substratum decline in  
1077 selectively logged boreal spruce forests. *Biol. Conserv.* 72, 355–362.  
1078  
1079 [https://doi.org/10.1016/0006-3207\(94\)00029-P](https://doi.org/10.1016/0006-3207(94)00029-P)  
1080

1081  
1082 Bässler, C., Ernst, R., Cadotte, M., Heibl, C., Müller, J., 2014. Near-to-nature logging  
1083 influences fungal community assembly processes in a temperate forest. *J. Appl. Ecol.* 51,  
1084 939–948. <https://doi.org/10.1111/1365-2664.12267>  
1085  
1086  
1087

1088  
1089 Bässler, C., Müller, J., Cadotte, M.W., Heibl, C., Bradtka, J.H., Thorn, S., Halbwachs, H.,  
1090 Forest, B., Park, N., Str, F., 2016. Functional response of lignicolous fungal guilds to bark  
1091 beetle deforestation. *Ecol. Indic.* 65, 149–160.  
1092  
1093 <https://doi.org/10.1016/j.ecolind.2015.07.008>  
1094  
1095

1096  
1097 Bässler, C., Müller, J., Dziock, F., Brandl, R., 2010. Effects of resource availability and climate  
1098 on the diversity of wood-decaying fungi. *J. Ecol.* 98, 822–832.  
1099  
1100 <https://doi.org/10.1111/j.1365-2745.2010.01669.x>  
1101

1102  
1103 Bässler, C., Müller, J., Svoboda, M., Lepšová, A., Hahn, C., Holzer, H., Pouska, V., 2012.  
1104 Diversity of wood-decaying fungi under different disturbance regimes-A case study from  
1105 spruce mountain forests. *Biodivers. Conserv.* 21, 33–49. <https://doi.org/10.1007/s10531-011-0159-0>  
1106  
1107  
1108  
1109

1110  
1111  
1112 Berglund, H., Hottola, J., Penttilä, R., Siitonen, J., 2011. Linking substrate and habitat  
1113 requirements of wood-inhabiting fungi to their regional extinction vulnerability.  
1114 *Ecography (Cop.)*. 34, 864–875. <https://doi.org/10.1111/j.1600-0587.2010.06141.x>  
1115  
1116  
1117  
1118  
1119  
1120  
1121

- 1122  
1123  
1124 Boddy, L., Frankland, J.C., van West, P. (Eds.), 2008. Ecology of saprotrophic basidiomycetes.  
1125  
1126 Elsevier Ltd, London.  
1127  
1128  
1129 Boddy, L., Heilmann-Clausen, J., 2008. Basidiomycete community development in temperate  
1130  
1131 angiosperm wood, in: Boddy, L., Frankland, J.C., van West, P. (Eds.), Ecology of  
1132  
1133 Saprotrophic Basidiomycetes. Elsevier, London, pp. 211–237.  
1134  
1135 Caiafa, M. V., Gómez-Hernández, M., Williams-Linera, G., Ramírez-Cruz, V., 2017.  
1136  
1137 Functional diversity of macromycete communities along an environmental gradient in a  
1138  
1139 Mexican seasonally dry tropical forest. *Fungal Ecol.* 28, 66–75.  
1140  
1141 <https://doi.org/10.1016/j.funeco.2017.04.005>  
1142  
1143 Cajander, A.K., 1949. Forest types and their significance. *Acta For. Fenn.* 56, 1–69.  
1144  
1145 Calhim, S., Halme, P., Petersen, J.H., Læssøe, T., Bässler, C., Heilmann-Clausen, J., 2018.  
1146  
1147 Fungal spore diversity reflects substrate-specific deposition challenges. *Sci. Rep.* 8, 1–9.  
1148  
1149 <https://doi.org/10.1038/s41598-018-23292-8>  
1150  
1151  
1152 Crowther, T.W., Maynard, D.S., Crowther, T.R., Peccia, J., Smith, J.R., Bradford, M. a, 2014.  
1153  
1154 Untangling the fungal niche: the trait-based approach. *Front. Microbiol.* 5, 579.  
1155  
1156 <https://doi.org/10.3389/fmicb.2014.00579>  
1157  
1158 Dawson, S.K., Boddy, L., Halbwachs, H., Bässler, C., Crowther, T.W., Heilmann-Clausen, J.,  
1159  
1160 Nordén, J., Ovaskainen, O., Jönsson, M., 2018. Handbook for standardised measurement  
1161  
1162 of macrofungal functional traits; a start with basidiomycete wood fungi. *Funct. Ecol.* doi:  
1163  
1164 10.1111/1365-2435.13239. <https://doi.org/10.1111/1365-2435.13239>  
1165  
1166  
1167 Dowding, P., 1981. Nutrient uptake and allocation during substrate exploitation by fungi, in:  
1168  
1169 Wicklow, D.T., Carroll, G.C. (Eds.), *The Fungal Community. Its Organization and Role*  
1170  
1171 *in the Ecosystems.* Marcel Dekker Inc, New York, pp. 612–636.  
1172  
1173 Edman, M., Kruys, N., Jonsson, B.G., 2004. Local Dispersal Sources Strongly Affect  
1174  
1175 Colonization Patterns of Wood-Decaying Fungi on Spruce Logs. *Ecol. Appl.* 14, 893–  
1176  
1177  
1178  
1179  
1180

1181  
1182  
1183 901.  
1184

1185 Eräjää, S., Halme, P., Kotiaho, J.S., Markkanen, A., Toivanen, T., 2010. The volume and  
1186 composition of dead wood on traditional and forest fuel harvested clear-cuts. *Silva Fenn.*  
1187  
1188 44, 203–211. <https://doi.org/10.14214/sf.150>  
1189

1190  
1191  
1192 Esseen, P.A., Ehnström, B., Ericson, L., Sjöberg, K., 1997. Boreal forests. *Ecol. Bull.* 46, 16–  
1193  
1194 47.

1195  
1196 Grime, J.P., 1988. The C-S-R model of primary plant strategies – origins, implications and  
1197 tests, in: Gottlieb, L.D., Jain, S. (Eds.), *Plant Evolutionary Biology*. Chapman and Hall,  
1198 London, pp. 371–393.  
1199

1200  
1201  
1202 Halbwachs, H., Brandl, R., Bässler, C., 2015. Spore wall traits of ectomycorrhizal and  
1203 saprotrophic agarics may mirror their distinct lifestyles. *Fungal Ecol.* 17, 197–204.  
1204  
1205 <https://doi.org/10.1016/j.funeco.2014.10.003>  
1206

1207  
1208  
1209 Halme, P., Kotiaho, J.S., 2012. The importance of timing and number of surveys in fungal  
1210 biodiversity research. *Biodivers. Conserv.* 21, 205–219. [https://doi.org/10.1007/s10531-](https://doi.org/10.1007/s10531-011-0176-z)  
1211  
1212 011-0176-z  
1213

1214  
1215 Heilmann-Clausen, J., Aude, E., van Dort, K., Christensen, M., Piltaver, A., Veerkamp, M.,  
1216  
1217 Walley, R., Siller, I., Standovár, T., Ódor, P., 2014. Communities of wood-inhabiting  
1218 bryophytes and fungi on dead beech logs in Europe - reflecting substrate quality or shaped  
1219 by climate and forest conditions? *J. Biogeogr.* 41, 2269–2282.  
1220  
1221 <https://doi.org/10.1111/jbi.12388>  
1222

1223  
1224  
1225 Heilmann-Clausen, J., Christensen, M., 2005. Wood-inhabiting macrofungi in Danish beech-  
1226 forests ? conflicting diversity patterns and their implications in a conservation perspective.  
1227  
1228 *Biol. Conserv.* 122, 633–642. <https://doi.org/10.1016/j.biocon.2004.10.001>  
1229

1230  
1231  
1232 Hoppe, B., Purahong, W., Wubet, T., Kahl, T., Bauhus, J., Arnstadt, T., Hofrichter, M., Buscot,  
1233  
1234 F., Krüger, D., 2016. Linking molecular deadwood-inhabiting fungal diversity and  
1235  
1236

1237  
1238  
1239

community dynamics to ecosystem functions and processes in Central European forests.

Fungal Divers. 77, 367–379. <https://doi.org/10.1007/s13225-015-0341-x>

Hussein, T., Norros, V., Hakala, J., Petäjä, T., Aalto, P.P., Rannik, Ü., Vesala, T., Ovaskainen, O., 2013. Species traits and inertial deposition of fungal spores. J. Aerosol Sci. 61, 81–98. <https://doi.org/10.1016/j.jaerosci.2013.03.004>

Ingold, C.T., 1965. Spore liberation. Oxford University Press, Oxford.

International Mycological Association, 2017. Mycobank [WWW Document]. <http://www.mycobank.org/>.

Juutilainen, K., Mönkkönen, M., Kotiranta, H., Halme, P., 2017. Resource use of wood-inhabiting fungi in different boreal forest types. Fungal Ecol. 27, 96–106. <https://doi.org/10.1016/j.funeco.2017.03.003>

Kahl, T., Arnstadt, T., Baber, K., Bässler, C., Bauhus, J., Borcken, W., Buscot, F., Floren, A., Heibl, C., Hessenmöller, D., Hofrichter, M., Hoppe, B., Kellner, H., Krüger, D., Linsenmair, K.E., Matzner, E., Otto, P., Purahong, W., Seilwinder, C., Schulze, E.D., Wende, B., Weisser, W.W., Gossner, M.M., 2017. Wood decay rates of 13 temperate tree species in relation to wood properties, enzyme activities and organismic diversities. For. Ecol. Manage. 391, 86–95. <https://doi.org/10.1016/j.foreco.2017.02.012>

Kauserud, H., Colman, J.E., Ryvarden, L., 2008. Relationship between basidiospore size, shape and life history characteristics: a comparison of polypores. Fungal Ecol. 1, 19–23. <https://doi.org/10.1016/j.funeco.2007.12.001>

Kauserud, H., Heegaard, E., Halvorsen, R., Boddy, L., Høiland, K., Chr. Stenseth, N., 2011. Mushroom's spore size and time of fruiting are strongly related: Is moisture important? Biol. Lett. 7, 273–276. <https://doi.org/10.1098/rsbl.2010.0820>

Kotiranta, H., Saarenoksa, R., Kytövuori, I., 2009. Aphylloroid fungi of Finland. A checklist with ecology, distribution, and threat categories. Norrlinna 19, 1–223.

- 1299  
1300  
1301 Krah, F.S., Bässler, C., Heibl, C., Soghigian, J., Schaefer, H., Hibbett, D.S., 2018a.  
1302  
1303 Evolutionary dynamics of host specialization in wood-decay fungi. *BMC Evol. Biol.* 18,  
1304 1–13. <https://doi.org/10.1186/s12862-018-1229-7>  
1305  
1306  
1307 Krah, F.S., Seibold, S., Brandl, R., Baldrian, P., Müller, J., Bässler, C., 2018b. Independent  
1308 effects of host and environment on the diversity of wood-inhabiting fungi. *J. Ecol.* 1–15.  
1309  
1310 <https://doi.org/10.1111/1365-2745.12939>  
1311  
1312  
1313 Kruys, N., Fries, C., Jonsson, B.G., Lämås, T., Ståhl, G., 1999. Wood-inhabiting cryptogams  
1314 on dead Norway spruce (*Picea abies*) trees in managed Swedish boreal forests. *Can. J.*  
1315  
1316  
1317  
1318  
1319 *For. Res.* 29, 178–186. <https://doi.org/10.1139/x98-191>  
1320  
1321 Kubartová, A., Ottosson, E., Dahlberg, A., Stenlid, J., 2012. Patterns of fungal communities  
1322 among and within decaying logs, revealed by 454 sequencing. *Mol. Ecol.* 21, 4514–4532.  
1323  
1324  
1325 <https://doi.org/10.1111/j.1365-294X.2012.05723.x>  
1326  
1327 Küffer, N., Gillet, F., Senn-Irlet, B., Aragno, M., Job, D., 2008. Ecological determinants of  
1328  
1329  
1330 fungal diversity on dead wood in European forests. *Fungal Divers.* 30, 83–95.  
1331  
1332 Lindblad, I., 2001. Diversity of poroid and some corticoid wood-inhabiting fungi along the  
1333  
1334 rainfall gradient in tropical forests, Costa Rica. *J. Trop. Ecol.* 17, 353–369.  
1335  
1336 Lõhmus, A., 2011. Silviculture as a disturbance regime: The effects of clear-cutting, planting  
1337  
1338 and thinning on polypore communities in mixed forests. *J. For. Res.* 16, 194–202.  
1339  
1340  
1341 <https://doi.org/10.1007/s10310-011-0256-7>  
1342  
1343 Lumley, T.C., Gignac, L.D., Currah, R.S., 2001. Microfungus communities of white spruce  
1344  
1345 and trembling aspen logs at different stages of decay in disturbed and undisturbed sites in  
1346  
1347 the boreal mixedwood region of Alberta. *Can. J. Bot.* 79, 76–92.  
1348  
1349  
1350 <https://doi.org/10.1139/cjb-79-1-76>  
1351  
1352 Mäkipää, R., Rajala, T., Schigel, D., Rinne, K.T., Pennanen, T., Abrego, N., Ovaskainen, O.,  
1353  
1354  
1355  
1356  
1357 2017. Interactions between soil- and dead wood-inhabiting fungal communities during the

- 1358  
1359  
1360 decay of Norway spruce logs. *ISME J.* 11, 1964–1974.  
1361  
1362 <https://doi.org/10.1038/ismej.2017.57>  
1363  
1364 McGill, B.J., Enquist, B.J., Weiher, E., Westoby, M., 2006. Rebuilding community ecology  
1365 from functional traits. *Trends Ecol. Evol.* 21, 178–185.  
1366  
1367 <https://doi.org/10.1016/j.tree.2006.02.002>  
1368  
1369 Nordén, J., Penttilä, R., Siitonen, J., Tomppo, E., Ovaskainen, O., 2013. Specialist species of  
1370 wood-inhabiting fungi struggle while generalists thrive in fragmented boreal forests. *J.*  
1371 *Ecol.* 101, 701–712. <https://doi.org/10.1111/1365-2745.12085>  
1372  
1373  
1374  
1375  
1376  
1377 Norros, V., Karhu, E., Nordén, J., Vähätalo, A. V., Ovaskainen, O., 2015. Spore sensitivity to  
1378 sunlight and freezing can restrict dispersal in wood-decay fungi. *Ecol. Evol.* 5, 3312–  
1379 3326. <https://doi.org/10.1002/ece3.1589>  
1380  
1381  
1382  
1383  
1384 Norros, V., Rannik, Ü., Hussein, T., Petäjä, T., Vesala, T., Ovaskainen, O., 2014. Do small  
1385 spores disperse further than large spores? *Ecology* 95, 1612–1621.  
1386  
1387 <https://doi.org/10.1890/13-0877.1>  
1388  
1389  
1390 Ordynets, A., Heilmann-Clausen, J., Savchenko, A., Bässler, C., Volobuev, S., Akulov, O.,  
1391 Karadelev, M., Kotiranta, H., Saitta, A., Langer, E., Abrego, N., 2018. Do plant-based  
1392 biogeographical regions shape aphylloroid fungal communities in Europe? *J.*  
1393 *Biogeogr.* 45, 1182–1195. <https://doi.org/10.1111/jbi.13203>  
1394  
1395  
1396  
1397  
1398  
1399 Ottosson, E., Kubartova, A., Edman, M., Jönsson, M., Lindhe, A., Stenlid, J., Dahlberg, A.,  
1400 2015. Diverse ecological roles within fungal communities in decomposing logs of *Picea*  
1401 *abies*. *FEMS Microbiol. Ecol.* 91, 1–13. <https://doi.org/10.1093/femsec/fiv012>  
1402  
1403  
1404  
1405 Ovaskainen, O., Abrego, N., Halme, P., Dunson, D., 2016. Using latent variable models to  
1406 identify large networks of species-to-species associations at different spatial scales.  
1407 *Methods Ecol. Evol.* 7, 549–555. <https://doi.org/10.1111/2041-210X.12501>  
1408  
1409  
1410  
1411 Ovaskainen, O., Tikhonov, G., Norberg, A., Guillaume Blanchet, F., Duan, L., Dunson, D.,  
1412  
1413  
1414  
1415  
1416



- 1417  
1418  
1419 Roslin, T., Abrego, N., 2017. How to make more out of community data? A conceptual  
1420 framework and its implementation as models and software. *Ecol. Lett.* 20, 561–576.  
1421  
1422 <https://doi.org/10.1111/ele.12757>  
1423  
1424  
1425 Peay, K.G., Kennedy, P.G., Bruns, T.D., 2008. Fungal community ecology: A hybrid beast  
1426 with a molecular master. *Bioscience* 58, 799–810.  
1427  
1428  
1429 Pouska, V., Macek, P., Zibarová, L., Ostrow, H., 2017. How does the richness of wood-  
1430 decaying fungi relate to wood microclimate? *Fungal Ecol.* 27, 178–181.  
1431  
1432 <https://doi.org/10.1016/j.funeco.2016.06.006>  
1433  
1434  
1435 Purhonen, J., Huhtinen, S., Kotiranta, H., Kotiaho, J.S., 2017. Detailed information on fruiting  
1436 phenology provides new insights on wood-inhabiting fungal detection. *Fungal Ecol.* 27,  
1437 175–177. <https://doi.org/10.1016/j.funeco.2016.06.007>  
1438  
1439  
1440  
1441  
1442 Rajala, T., Peltoniemi, M., Pennanen, T., Mäkipää, R., 2010. Relationship between wood-  
1443 inhabiting fungi determined by molecular analysis (denaturing gradient gel  
1444 electrophoresis) and quality of decaying logs. *Can. J. For. Res.* 40, 2384–2397.  
1445  
1446 <https://doi.org/10.1139/X10-176>  
1447  
1448  
1449  
1450 Rajala, T., Tuomivirta, T., Pennanen, T., Mäkipää, R., 2015. Habitat models of wood-  
1451 inhabiting fungi along a decay gradient of Norway spruce logs. *Fungal Ecol.* 18, 48–55.  
1452  
1453 <https://doi.org/10.1016/j.funeco.2015.08.007>  
1454  
1455  
1456 Renvall, P., 1995. Community structure and dynamics of wood-rotting Basidiomycetes on  
1457 decomposing conifer trunks in northern Finland. *Karstenia* 35, 1–51.  
1458  
1459  
1460  
1461 Royal Botanic Gardens Kew, Landcare Research-NZ, Chinese Academy of Science, 2017.  
1462  
1463 [Index fungorum \[WWW Document\]. www.indexfungorum.org.](http://www.indexfungorum.org)  
1464  
1465  
1466 Royal Botanic Gardens Kew, Landcare Research-NZ, Chinese Academy of Science, 2015.  
1467  
1468 [Index Fungorum \[WWW Document\]. www.indexfungorum.org.](http://www.indexfungorum.org)  
1469  
1470  
1471 Runnel, K., Põldmaa, K., Lõhmus, A., 2014. “Old-forest fungi” are not always what they seem:  
1472  
1473  
1474  
1475

1476  
1477  
1478 The case of *Antrodia crassa*. *Fungal Ecol.* 9, 27–33.  
1479  
1480 <https://doi.org/10.1016/j.funeco.2014.02.006>  
1481

1482 Ruokolainen, A., Shorohova, E., Penttilä, R., Kotkova, V., Kushnevskaia, H., 2018. A  
1483 continuum of dead wood with various habitat elements maintains the diversity of wood-  
1484 inhabiting fungi in an old-growth boreal forest. *Eur. J. For. Res.*  
1485 <https://doi.org/10.1007/s10342-018-1135-y>. <https://doi.org/10.1007/s10342-018-1135-y>  
1486  
1487  
1488

1489 Siitonen, J., 2001. Forest management, coarse woody debris and saproxylic organisms:  
1490 Fennoscandian boreal forests as an example. *Ecol. Bull.* 49, 11–41.  
1491  
1492

1493 Sippola, A.-L., Lehesvirta, T., Renvall, P., 2001. Effect of selective logging on coarse woody  
1494 debris and diversity of wood-decaying polypores in eastern Finland. *Ecol. Bull.* 49, 243–  
1495 254.  
1496  
1497  
1498  
1499

1500 Sippola, A.L., Renvall, P., 1999. Wood-decomposing fungi and seed-tree cutting: A 40-year  
1501 perspective. *For. Ecol. Manage.* 115, 183–201. [https://doi.org/10.1016/S0378-  
1502 1127\(98\)00398-3](https://doi.org/10.1016/S0378-1127(98)00398-3)  
1503  
1504  
1505  
1506

1507 Stokland, J.N., 2012a. Host-tree associations, in: Stokland, J.N., Siitonen, J., Jonsson, B.G.  
1508 (Eds.), *Biodiversity in Dead Wood*. Cambridge University Press, Cambridge, pp. 82–109.  
1509  
1510

1511 Stokland, J.N., 2012b. Wood decomposition, in: Stokland, J.N., Siitonen, J., Jonsson, B.G.  
1512 (Eds.), *Biodiversity in Dead Wood*. Cambridge University Press, Cambridge, pp. 10–28.  
1513  
1514  
1515

1516 Stokland, J.N., Siitonen, J., Jonsson, B.G., 2012. *Biodiversity on dead wood*. Cambridge  
1517 University Press, Cambridge.  
1518  
1519

1520 Stokland, J.N., Tomter, S.M., Söderberg, U., 2004. Development of dead wood indicators for  
1521 biodiversity monitoring: experiences from Scandinavia, in: Marchetti, M. (Ed.),  
1522 *Monitoring and Indicators of Forest Biodiversity in Europe, from Ideas to Operationality*.  
1523 EFI-Proceedings No. 51, pp. 207–226.  
1524  
1525  
1526  
1527  
1528

1529 Tikhonov, G., Opedal, Ø., Lehtikoinen, A., Ovaskainen, O., 2019. Joint species distribution  
1530  
1531  
1532  
1533  
1534

1535  
1536  
1537 modelling with HMSC-R. bioRxiv.  
1538

1539 Tjur, T., 2009. Coefficients of determination in logistic regression models - A new proposal:

1540 The coefficient of discrimination. *Am. Stat.* 63, 366–372.

1541  
1542  
1543 <https://doi.org/10.1198/tast.2009.08210>  
1544  
1545

1546 Vellend, M., 2016. The theory of ecological communities. Princeton University Press, New  
1547 Jersey.

1550 Warton, D.I., Blanchet, F.G., O’Hara, R.B., Ovaskainen, O., Taskinen, S., Walker, S.C., Hui,

1551 F.K.C., 2015. So Many Variables: Joint Modeling in Community Ecology. *Trends Ecol.*

1552 *Evol.* 30, 766–779. <https://doi.org/10.1016/j.tree.2015.09.007>  
1553  
1554  
1555

1556 Weiher, E., Freund, D., Bunton, T., Stefanski, A., Lee, T., Bentivenga, S., 2011. Advances,  
1557 challenges and a developing synthesis of ecological community assembly theory. *Philos.*

1558 *Trans. R. Soc. B Biol. Sci.* 366, 2403–2413. <https://doi.org/10.1098/rstb.2011.0056>  
1559  
1560

1561 White, E.P., Adler, P.B., Lauenroth, W.K., Gill, R.A., Greenberg, D., Kaufman, D.M.,

1562 Rassweiler, A., Rusak, J.A., Smith, M.D., Steinbeck, J.R., Waide, R.B., Yao, J., 2006. A  
1563  
1564 comparison of the species time relationship across ecosystems and taxonomic groups.

1565  
1566  
1567  
1568

1569 *Oikos* 112, 185–195. <https://doi.org/10.1111/j.0030-1299.2006.14223.x>  
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1571 **Figure captions:**  
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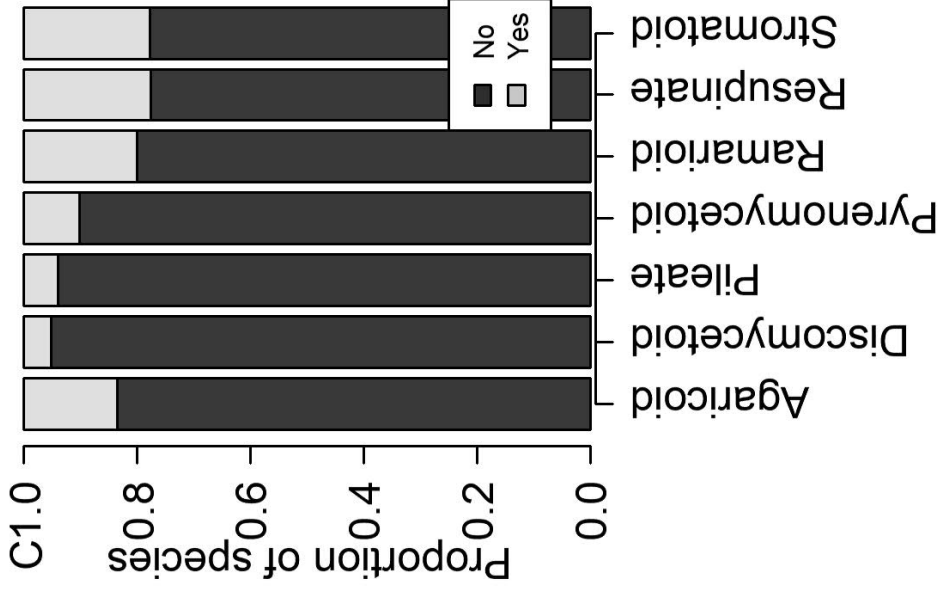
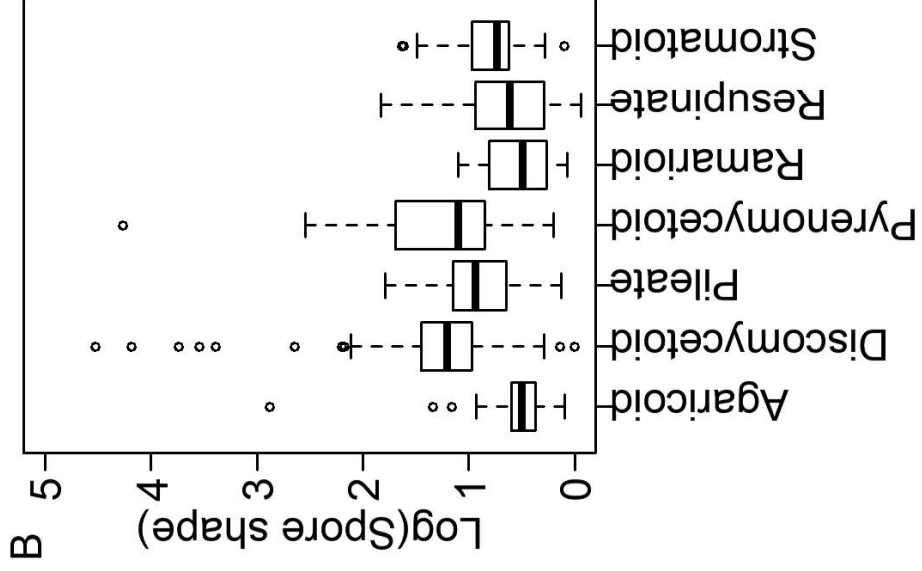
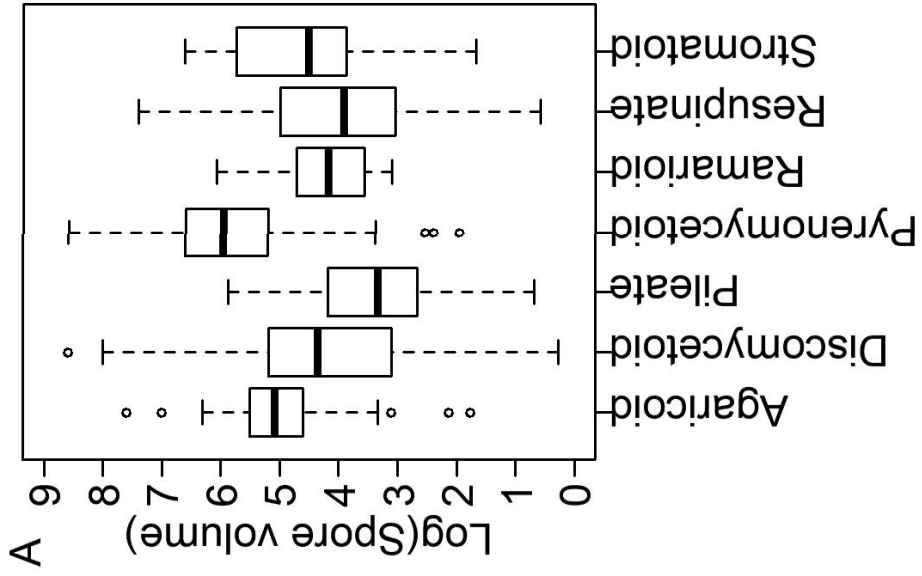
1573  
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1575 **Fig. 1** Relationship between spore morphological traits and fruitbody types. The relationship  
1576 between (A) the fruitbody type and spore volume, (B) spore shape, (C) and spore  
1577 ornamentation.  
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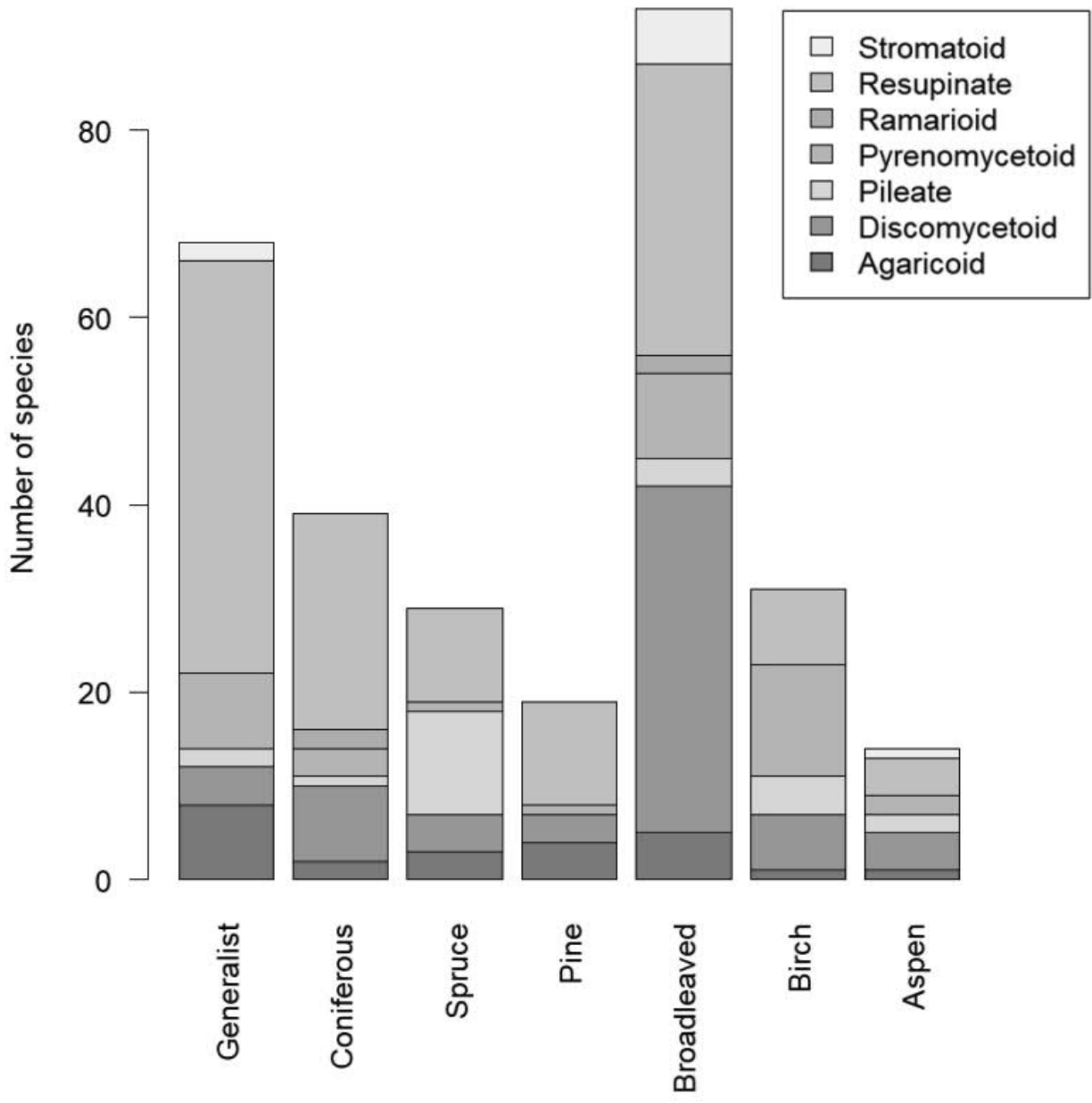
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1583 **Fig. 2** Numbers of host-tree generalist and specialist fungal species. The bars show the numbers  
1584 of fungal species classified to the seven host-tree specialization classes, with colours  
1585 representing different fruitbody types. Note that the figure includes only those species that  
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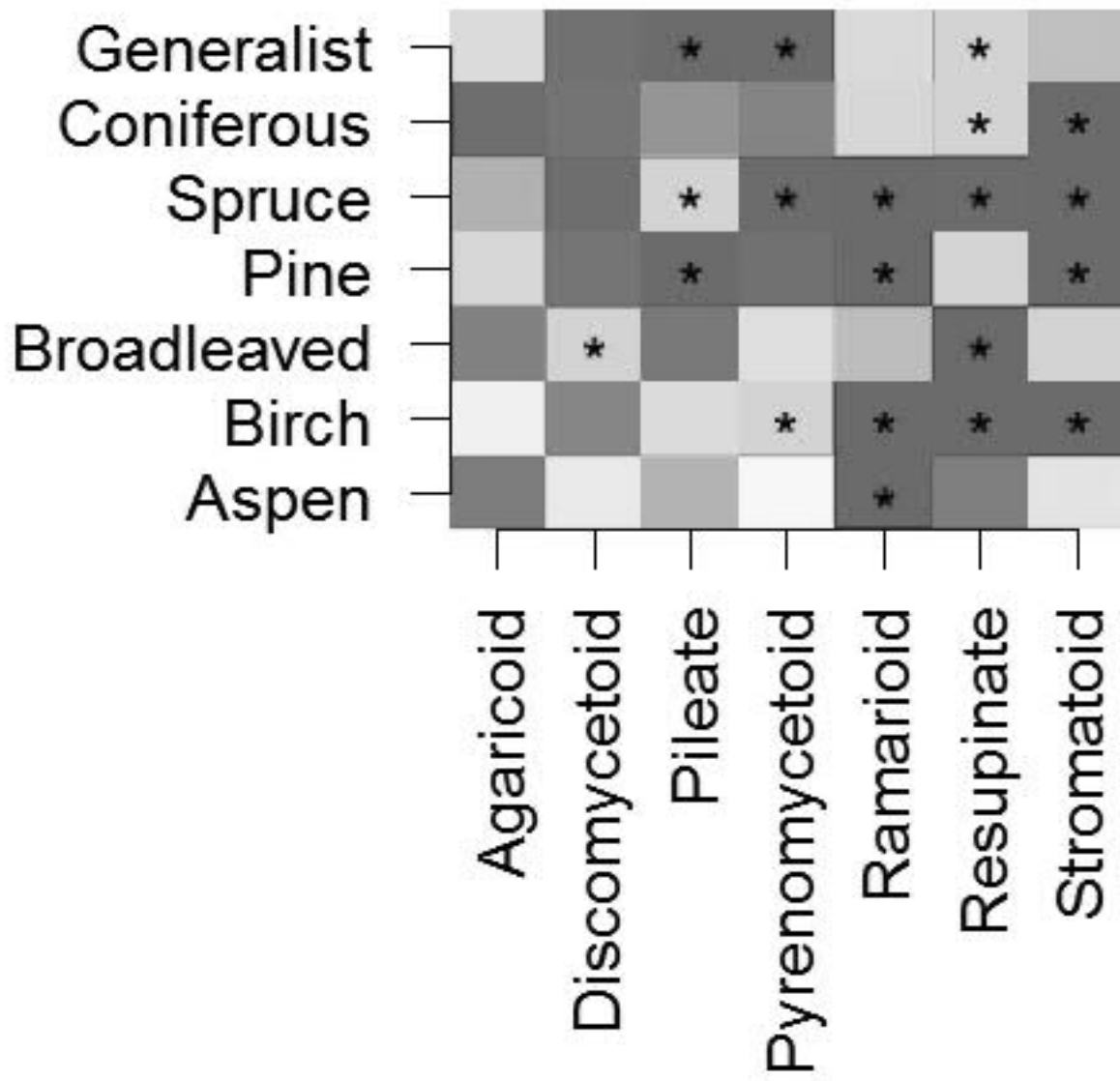
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1596 occur at least four times in the data, as reliable classification for host-tree specialization is not  
1597 possible for rare species.  
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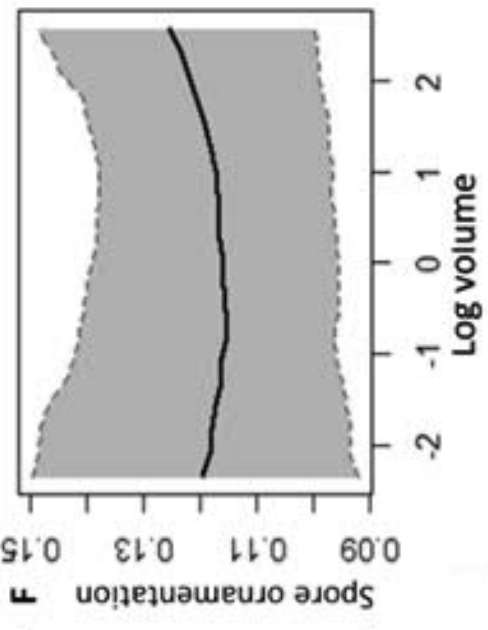
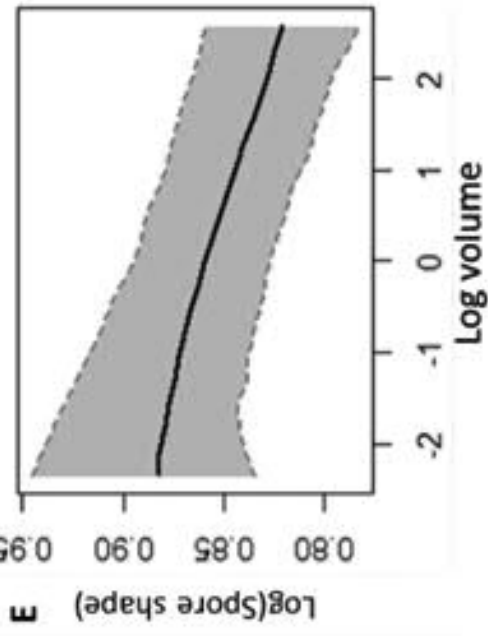
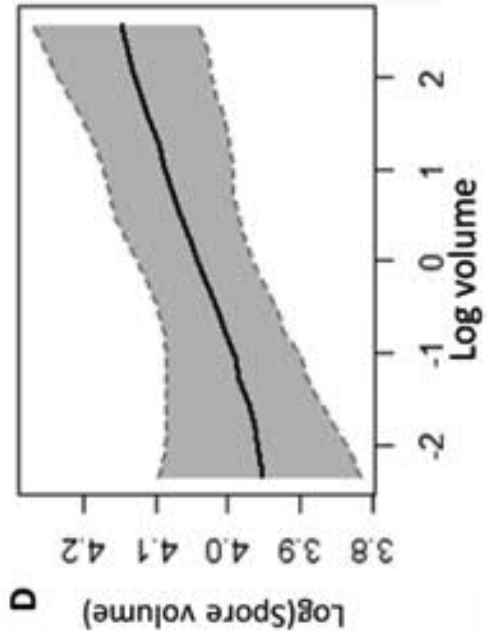
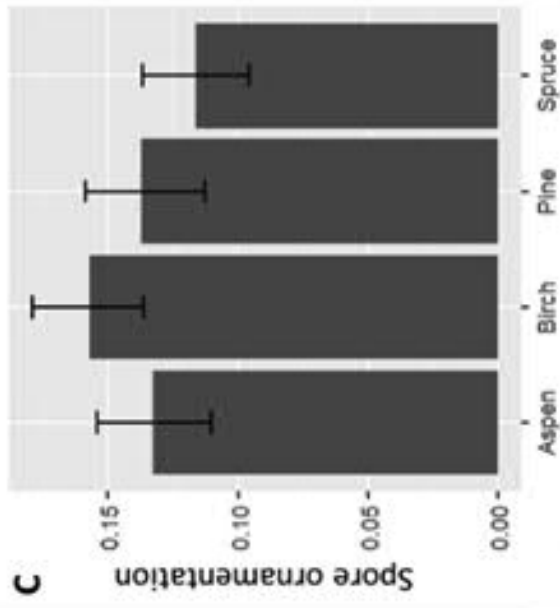
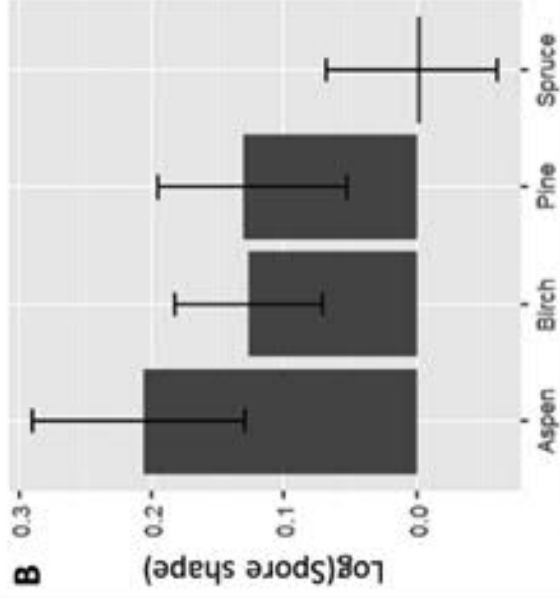
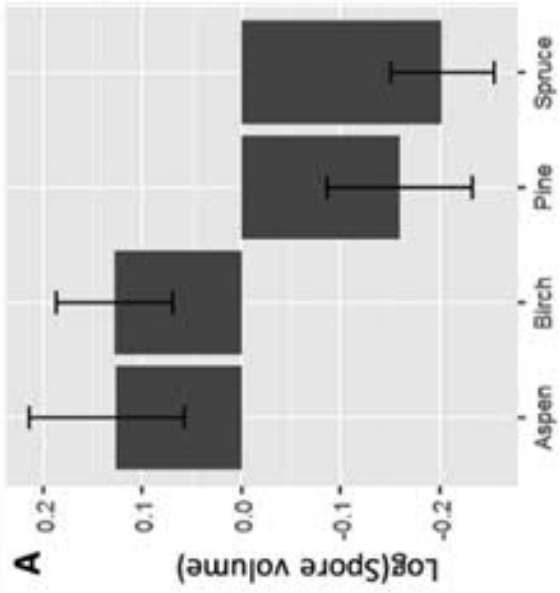
**Fig. 3** Host-tree specialization-level of fungi with different fruitbody types. Green colours  
1603 (respectively, red colours) indicate that the fungal species groups have a given host-tree  
1604 classification more often (respectively, less often) than expected by random, the asterisks  
1605 indicating those results that are supported by at least 95% posterior probability. Note that this  
1606 analysis is restricted to those species that occur at least 4 times in the data.  
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**Fig. 4** Community-weighted mean spore trait values for different host-tree species (panels A-  
1615 C) and for logs of different sizes (panels D-F). The first column shows the mean spore volume,  
1616 the second column shows the mean spore shape, and the third column shows the mean  
1617 proportions of species with ornamented spores. The error bars (panels A-C) and shaded areas  
1618 (panels D-F) show the 95% credibility interval.  
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# Morphological traits predict host-tree specialization in wood-inhabiting fungal communities

Purhonen Jenna, Ovaskainen Otso, Halme Panu, Komonen Atte, Huhtinen Seppo, Kotiranta Heikki, Læssøe Thomas, & Abrego Nerea

## Supplementary Material 1

### Detailed description of the forest naturalness index

The study site naturalness was calculated based on the average age of the dominating forest cover (data received from the State Forest Enterprise of Finland), the average amount of dead wood per hectare, and the average number of stumps per hectare. The dead wood and stump data were collected from four to eight, 50 meter in length and 10 meter wide, randomly placed transects. The transects were situated in the same forest stands in which the logs were surveyed for fungi. The number of transects varied depending on the characteristics of the study site. If there was clear within-site variation in the forest types surrounding the study logs, we established 2-4 additional transects. The transects were inspected for all dead wood units larger than 15 cm at the base. We measured the length, base diameter and top diameter (this information was later used for calculating the volume of the dead wood with the formula of a truncated cone) for standing and grounded dead wood. We also recorded the number of stumps. Transect data was then used to count average values for each of the variables at the transect level. We divided these values by 0.05 for estimating the average values per hectare. The sites were then sorted according to each of the above variable separately and a score from 1 to 12 was given depending on the site position. Sites with higher average age, more dead wood and fewer stumps were given more points and considered being more natural. The points of each forest were summed up to form the “forest naturalness index” (Table 1).

Table 1 The age of dominating forest cover in years and amount of deadwood (m<sup>3</sup>/ha) and number of stumps per hectare for each study site. Corresponding naturalness index-value for each site is the sum of the points. The sites are sorted according to their Index-values from most natural to least.

Site	Age / Deadwood / Stumps	Points	Index
Latokuusikko	173 / 334 / 0	11 / 12 / 12	35
Pyhä-Häkki	272 / 98 / 39	12 / 9 / 11	32
Kalajanvuori	140 / 100 / 64	9 / 10 / 10	29
Kuusimäki	140 / 171 / 110	8 / 11 / 6	25
Kivetty	132 / 86 / 103	6 / 8 / 8	22
Lortikka	150 / 32 / 96	10 / 1 / 9	20
Leivonmäki	135 / 67 / 135	7 / 6 / 4	17
Ilmakkamäki	124 / 65 / 117	5 / 5 / 5	15
Vuorilampi	116 / 81 / 199	3 / 7 / 3	13
Vaarunvuori	104 / 37 / 106	2 / 2 / 7	11
Hallinmäki	119 / 59 / 259	4 / 3 / 2	9
Tikkamäki	84 / 60 / 303	1 / 4 / 1	6

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## Supplementary material 2

**TABLE 1** List of detected species or taxonomic groups in alphabetical order. The trait data are shown for fruitbody type (7 categories, see Methods), spore volume ( $\mu\text{m}^3$ , calculated with the formula of using species-specific mean spore length and width), shape (species-specific mean length of the spore divided by its width) and ornamentation (Yes, No). The information was extracted from literature (below) or by measuring/ observing by the authors.

Species or taxa name	Fruit body type	Volume	Shape	Orn	Birch	Spruce	Pine	Aspen	Total
<i>Acanthostigma</i> sp1.	Pyrenomycetoid	96.40	2.24	No	-	1	-	1	2
<i>Acrogenospora</i> <i>carmichaeliana</i>	Pyrenomycetoid	1948.28	2.14	No	-	-	-	1	1
<i>Actidium</i> <i>hysterioides</i>	Pyrenomycetoid	57.65	6.44	No	-	12	1	-	13
<i>Alutaceodontia</i> <i>alutacea</i>	Resupinate	14.97	4.24	No	-	8	3	2	13
<i>Amphinema</i> <i>byssoides</i>	Resupinate	22.09	1.80	No	37	19	2	34	92
<i>Amphisphaerella</i> <i>dispersella</i>	Pyrenomycetoid	1526.81	2.67	No	-	-	-	1	1
<i>Amphisphaeria</i> <i>bertiana</i>	Pyrenomycetoid	174.95	2.44	No	1	-	-	-	1
<i>Amylocorticiellum</i> <i>cremeoisabellinum</i>	Resupinate	57.73	1.71	No	-	-	-	1	1
<i>Amylocorticiellum</i> <i>subillaqueatum</i>	Resupinate	15.90	1.78	No	-	-	-	1	1
<i>Amylocorticium</i> <i>cebennence</i>	Resupinate	26.84	3.00	No	-	1	1	-	2
<i>Amylocorticium</i> <i>pedunculatum</i>	Resupinate	37.33	1.38	No	-	-	1	-	1
<i>Amylocystis</i> <i>lapponica</i>	Pileate	53.31	2.64	No	-	3	-	-	3
<i>Amyloporia</i> <i>sinuosa</i>	Resupinate	10.96	3.41	No	-	9	13	-	22
<i>Amylostereum</i> <i>chailletii</i>	Pileate	41.58	2.55	No	-	7	-	1	8
<i>Amyloxenasma</i> <i>grisellum</i>	Resupinate	32.67	2.00	No	-	2	1	2	5
<i>Annulohypoxyton</i> <i>multiforme</i>	Stromatoid	177.21	2.11	No	12	-	-	8	20
<i>Antrodia</i> <i>albobrunnea</i>	Resupinate	11.23	3.18	No	-	-	1	-	1
<i>Antrodia</i> <i>macra</i>	Resupinate	96.26	2.52	No	-	-	-	3	3
<i>Antrodia</i> <i>pulvinascens</i>	Resupinate	52.60	2.14	No	-	-	-	1	1
<i>Antrodia</i> <i>serialis</i>	Pileate	40.09	2.45	No	-	39	1	-	40
<i>Antrodia</i> <i>xantha</i>	Resupinate	7.27	3.03	No	-	1	9	-	10
<i>Antrodiella</i> <i>pallescens</i>	Resupinate	10.21	1.89	No	1	-	-	-	1
<i>Antrodiella</i> <i>romellii</i>	Resupinate	14.91	1.67	No	2	-	-	-	2
<i>Aphanobasidium</i> <i>pseudotsugae</i>	Resupinate	71.79	1.73	No	-	11	25	-	36
<i>Arachnopeziza</i> <i>aurata</i>	Discomycetoid	199.69	29.51	No	17	-	-	11	28
<i>Arachnopeziza</i> cf <i>aranea</i>	Discomycetoid	58.90	4.80	No	1	-	-	1	2
<i>Arachnopeziza</i> <i>cornuta</i>	Discomycetoid	50.31	4.94	No	15	-	-	18	33

<i>Arachnopeziza joannea</i>	Discomycetoid	71.57	4.63	No	-	-	-	1	1
<i>Arachnopeziza</i> sp nov	Discomycetoid	105.85	4.84	No	-	-	-	1	1
<i>Arachnopeziza</i> sp1.	Discomycetoid	226.19	4.50	No	-	1	1	-	2
<i>Arachnopeziza</i> sp3.	Discomycetoid	88.36	4.17	No	-	-	1	-	1
<i>Armillaria borealis</i>	Agaricoid	152.17	1.55	No	1	-	1	-	2
<i>Arrhenia epichysium</i>	Agaricoid	106.40	1.76	No	-	-	-	1	1
<i>Artomyces cristatus</i>	Ramarioid	288.63	1.07	No	-	-	1	-	1
<i>Artomyces pyxidatus</i>	Ramarioid	22.30	1.62	Yes	-	-	-	6	6
<i>Ascocorticium anomalum</i>	Resupinate	10.22	2.43	No	-	-	2	-	2
<i>Ascocoryne cylichnium</i>	Discomycetoid	571.28	3.83	No	34	11	5	25	75
<i>Ascocoryne sarcoides</i>	Discomycetoid	238.56	3.33	No	1	3	12	1	17
<i>Asterodon ferruginosus</i>	Resupinate	75.40	1.50	No	3	-	1	1	5
<i>Asterostroma laxum</i>	Resupinate	269.39	1.00	Yes	-	-	1	-	1
<i>Athelia acrospora</i>	Resupinate	37.12	2.27	No	-	2	-	-	2
<i>Athelia decipiens</i>	Resupinate	39.40	1.46	No	8	27	10	6	51
<i>Athelia epiphylla</i> coll	Resupinate	292.13	1.96	No	3	-	-	3	6
<i>Athelia neuhoffii</i>	Resupinate	124.04	1.47	No	4	12	4	5	25
<i>Athelopsis glaucina</i>	Resupinate	37.77	4.22	No	-	-	-	1	1
<i>Athelopsis subinconspicua</i>	Resupinate	99.30	1.65	No	1	11	-	2	14
<i>Auricularia auricula-judae</i>	Discomycetoid	221.51	2.63	No	-	2	-	-	2
<i>Basidioidendron caesiocinereum</i>	Resupinate	453.96	0.94	Yes	2	6	1	-	9
<i>Basidioidendron cinereum</i>	Resupinate	365.60	1.36	No	1	-	1	2	4
<i>Basidioradulum crustosum</i>	Resupinate	32.67	2.00	No	5	1	-	3	9
<i>Bertia moriformis</i>	Pyrenomycetoid	1038.69	6.96	No	7	23	7	16	53
<i>Bisporella citrina</i>	Discomycetoid	85.53	3.03	No	23	-	-	26	49
<i>Bjerkandera adusta</i>	Pileate	28.21	1.73	No	-	-	-	3	3
<i>Boidinia furfuracea</i>	Resupinate	98.17	1.00	Yes	-	1	1	-	2
<i>Bolbitius reticulatus</i>	Agaricoid	168.35	2.00	No	1	-	-	-	1
<i>Boliniaceae</i> sp1.	Pyrenomycetoid	72.55	2.50	No	-	-	3	-	3
<i>Botryobasidium botryosum</i>	Resupinate	99.40	2.40	No	14	26	24	14	78
<i>Botryobasidium conspersum</i>	Resupinate	47.52	2.91	No	2	-	-	1	3
<i>Botryobasidium intertextum</i>	Resupinate	25.92	4.13	No	-	1	4	2	7
<i>Botryobasidium laeve</i>	Resupinate	53.92	2.00	Yes	3	-	-	-	3
<i>Botryobasidium medium</i>	Resupinate	249.46	1.91	No	1	1	3	-	5
<i>Botryobasidium obtusisporum</i>	Resupinate	177.21	2.11	No	-	1	-	-	1
<i>Botryobasidium subcoronatum</i>	Resupinate	40.09	2.45	No	26	32	27	20	105

<i>Botryohypochnus isabellinus</i>	Resupinate	482.33	1.00	Yes	12	3	4	12	31
<i>Butyrea luteoalbum</i>	Resupinate	11.71	2.56	No	-	7	6	-	13
<i>Byssomerulius corium</i>	Pileate	42.41	2.00	No	-	-	-	1	1
<i>Byssoporia terrestris</i>	Resupinate	43.30	1.29	No	-	1	-	2	3
<i>Cabalodontia bresadolae</i>	Resupinate	56.00	2.08	No	-	-	-	1	1
<i>Cabalodontia cretacea</i>	Resupinate	18.04	4.29	No	-	-	17	-	17
<i>Cabalodontia subcretacea</i>	Resupinate	11.49	4.33	No	-	-	2	-	2
<i>Calocera cornea</i>	Ramarioid	70.51	2.62	No	4	-	-	7	11
<i>Calocera furcata</i>	Ramarioid	101.02	3.00	No	-	8	4	-	12
<i>Calocera viscosa</i>	Ramarioid	113.10	2.25	No	-	1	-	-	1
<i>Calycellina guttulifera</i>	Discomycetoid	11.35	2.94	No	1	1	-	-	2
<i>Calycellina ochracea</i>	Discomycetoid	120.29	4.46	No	4	-	-	1	5
<i>Calycellina</i> sp1.	Discomycetoid	5.54	4.08	No	-	1	-	-	1
<i>Calyptella</i> sp1.	Discomycetoid	134.77	2.24	No	1	-	-	3	4
<i>Camarops lutea/pugillus</i> complex	Stromatoid	62.54	1.86	No	-	-	1	1	2
<i>Camarops tubulina</i>	Stromatoid	62.54	1.86	No	-	2	-	-	2
<i>Capitotricha bicolor</i>	Discomycetoid	14.14	5.33	No	7	-	-	5	12
<i>Capronia</i> cf <i>mansonii</i>	Pyrenomycetoid	1256.64	1.60	No	-	-	1	-	1
<i>Capronia</i> cf <i>pilosella</i>	Pyrenomycetoid	337.57	2.26	No	4	5	3	8	20
<i>Capronia</i> cf <i>semi-immersa</i>	Pyrenomycetoid	795.22	2.40	No	-	1	-	-	1
<i>Capronia</i> sp4.	Pyrenomycetoid	795.22	2.40	No	2	3	4	1	10
<i>Capronia</i> sp5.	Pyrenomycetoid	452.39	2.67	No	-	-	-	4	4
<i>Ceraceomyces eludens</i>	Resupinate	28.30	1.21	No	2	9	13	-	24
<i>Ceraceomyces microsporus</i>	Resupinate	19.30	1.18	No	1	5	9	3	18
<i>Ceraceomyces serpens</i>	Resupinate	18.89	2.11	No	2	1	4	2	9
<i>Ceraceomyces tessulatus</i>	Resupinate	87.96	1.75	No	5	4	2	-	11
<i>Ceratosebacina longispora</i>	Resupinate	314.16	6.25	No	1	-	-	-	1
<i>Ceratosphaeria</i> cf <i>subferruginea</i>	Pyrenomycetoid	551.35	3.25	No	-	-	-	1	1
<i>Ceratosphaeria lampadophora</i>	Pyrenomycetoid	692.72	11.90	No	1	-	-	2	3
<i>Ceratosphaeria rhenana</i>	Pyrenomycetoid	463.29	3.55	No	6	2	9	13	30
<i>Ceratostomella rostrata</i>	Pyrenomycetoid	12.63	3.00	No	5	-	-	-	5
<i>Cerinomyces crustulinus</i>	Resupinate	82.96	3.08	No	-	6	4	-	10
<i>Ceriporus leptocephalus</i>	Pileate	74.32	2.30	No	-	-	-	2	2
<i>Ceriporus mollis</i>	Pileate	105.83	3.14	No	-	-	-	7	7
<i>Ceriporia excelsa</i>	Resupinate	16.90	1.89	No	2	-	-	1	3
<i>Ceriporia reticulata</i>	Resupinate	53.01	2.50	No	-	-	-	1	1

<i>Ceriporia viridans</i>	Resupinate	12.57	2.00	No	2	-	-	1	3
<i>Ceriporiopsis resinascens</i>	Resupinate	31.32	2.27	No	-	-	-	5	5
<i>Cerrena unicolor</i>	Pileate	30.62	1.68	No	1	-	-	-	1
<i>Chaetoderma luna</i>	Resupinate	198.80	2.78	No	-	-	6	-	6
<i>Chaetosphaeria cf cupulifera</i>	Pyrenomycetoid	389.66	5.44	No	8	-	1	2	11
<i>Chaetosphaeria myriocarpa</i>	Pyrenomycetoid	29.45	2.40	No	-	-	-	1	1
<i>Chaetosphaeria sp1.</i>	Pyrenomycetoid	268.61	12.67	No	8	-	-	2	10
<i>Chaetosphaeria sp2.</i>	Pyrenomycetoid	191.69	3.07	No	-	-	-	1	1
<i>Chaetosphaeria vermicularioides</i>	Pyrenomycetoid	41.72	3.40	No	1	1	-	-	2
<i>Cheimonophyllum candidissimum</i>	Agaricoid	107.99	1.10	No	2	-	-	13	15
<i>Chlorencoelia versiformis</i>	Discomycetoid	91.89	4.33	No	-	-	-	3	3
<i>Chlorociboria aeruginascens</i>	Discomycetoid	13.83	3.29	No	8	-	-	9	17
<i>Chlorociboria aeruginosa</i>	Discomycetoid	81.29	3.83	No	-	-	-	1	1
<i>Chrysomphalina chrysophylla</i>	Agaricoid	249.46	1.91	No	-	-	1	-	1
<i>Ciliolarina aff pinicola</i>	Discomycetoid	125.66	2.50	No	-	1	1	-	2
<i>Ciliolarina cf laetifica</i>	Discomycetoid	23.06	2.58	No	-	5	1	-	6
<i>Ciliolarina concortica</i>	Discomycetoid	14.89	2.76	No	-	1	1	-	2
<i>Ciliolarina neglecta</i>	Discomycetoid	9.45	2.94	No	-	9	12	-	21
<i>Ciliolarina sp1.</i>	Discomycetoid	53.82	3.48	No	1	-	-	-	1
<i>Cinereomyces lindbladii</i>	Resupinate	16.96	2.70	No	-	1	-	-	1
<i>Cistella cf geelmyedenii</i>	Discomycetoid	17.01	3.16	No	-	1	-	-	1
<i>Cistella cf improvisa</i>	Discomycetoid	11.78	3.22	No	2	-	-	3	5
<i>Cistella cf microspora</i>	Discomycetoid	8.42	2.00	No	-	1	-	-	1
<i>Cistella sp1.</i>	Discomycetoid	25.98	3.57	No	1	-	-	1	2
<i>Cistella sp2.</i>	Discomycetoid	11.35	2.94	No	1	-	-	-	1
<i>Cistella sp3.</i>	Discomycetoid	15.71	2.50	No	-	-	-	1	1
<i>Cistella sp4.</i>	Discomycetoid	11.35	2.94	No	-	1	-	-	1
<i>Cistella sp5.</i>	Discomycetoid	5.97	3.46	No	-	-	-	1	1
<i>Cistella sp6.</i>	Discomycetoid	26.70	4.25	No	-	-	-	1	1
<i>Cistella sp8.</i>	Discomycetoid	57.92	4.72	No	1	-	-	-	1
<i>Claussenomyces atrovirens</i>	Discomycetoid	283.73	4.71	No	1	18	11	1	31
<i>Clavulicium delectabile</i>	Resupinate	307.88	1.14	Yes	-	-	1	-	1
<i>Colacogloea peniophorae</i>	Resupinate	94.25	1.88	No	-	-	1	-	1
<i>Conferticium ochraceum</i>	Resupinate	37.11	1.75	No	-	3	-	-	3
<i>Conferticium ravum</i>	Resupinate	92.21	1.53	Yes	-	-	-	1	1
<i>Coniochaeta subcorticalis</i>	Pyrenomycetoid	358.97	1.39	No	1	-	-	-	1

<i>Coniophora arida</i>	Resupinate	461.81	1.71	No	-	5	3	5	13
<i>Coniophora olivacea</i>	Resupinate	196.35	2.00	No	8	15	11	9	43
<i>Coniophora puteana</i>	Resupinate	348.42	1.62	No	-	4	2	4	10
<i>Coronicium alboglaucum</i>	Resupinate	41.58	2.55	No	-	-	-	1	1
<i>Coronophora sp nov</i>	Pyrenomycetoid	31.10	4.95	No	-	-	-	2	2
<i>Corticium boreoroseum</i>	Resupinate	181.62	1.85	No	-	1	-	-	1
<i>Corticium polygonioides</i>	Resupinate	142.35	1.45	No	-	1	-	5	6
<i>Corticium roseum</i>	Resupinate	1649.34	2.10	No	1	-	-	6	7
<i>Crepidotus calolepis</i>	Agaricoid	220.72	1.48	No	-	-	-	5	5
<i>Crepidotus cesatii</i>	Agaricoid	248.87	1.15	Yes	-	5	-	-	5
<i>Crepidotus pallidus</i>	Discomycetoid	123.26	1.72	Yes	8	-	-	8	16
<i>Crepidotus subverrucisporus</i>	Agaricoid	227.21	1.52	Yes	-	1	-	-	1
<i>Crocicreas sp1.</i>	Discomycetoid	5.77	4.25	No	-	-	-	1	1
<i>Crustoderma corneum</i>	Resupinate	177.21	2.11	No	-	-	1	-	1
<i>Crustoderma dryinum</i>	Resupinate	56.55	2.67	No	-	1	-	-	1
<i>Crustoderma efibulatum</i>	Resupinate	21.83	4.05	No	-	-	1	-	1
<i>Cryptodiscus foveolaris</i>	Discomycetoid	44.55	2.73	No	1	-	-	-	1
<i>Cryptodiscus pallidus</i>	Discomycetoid	198.61	3.29	No	-	-	-	1	1
<i>Cryptodiscus pini</i>	Discomycetoid	26.46	6.29	No	-	-	10	-	10
<i>Cudonia confusa</i>	Agaricoid	159.04	17.78	No	-	1	-	-	1
<i>Cyathicula sp1.</i>	Discomycetoid	381.70	5.33	No	-	-	1	1	2
<i>Cyathicula sp2.</i>	Discomycetoid	125.29	5.35	No	-	-	-	1	1
<i>Cylindrobasidium evolvens</i>	Resupinate	181.62	1.85	No	4	-	-	4	8
<i>Cystoderma jasonis</i>	Agaricoid	74.55	1.80	No	-	-	2	-	2
<i>Dacrymyces adpressus</i>	Discomycetoid	383.02	2.57	No	-	-	1	-	1
<i>Dacrymyces lacrymalis</i>	Discomycetoid	230.37	2.74	No	1	2	-	5	8
<i>Dacrymyces macnabbii</i>	Discomycetoid	89.00	2.64	No	-	7	8	1	16
<i>Dacrymyces microsporus</i>	Discomycetoid	89.00	2.64	No	-	10	3	3	16
<i>Dacrymyces minor</i>	Discomycetoid	166.69	2.76	No	4	6	-	6	16
<i>Dacrymyces minutus</i>	Discomycetoid	121.49	2.93	No	-	7	2	-	9
<i>Dacrymyces ovisporus</i>	Discomycetoid	1491.03	1.33	No	-	1	1	-	2
<i>Dacrymyces sp1.</i>	Discomycetoid	954.26	1.67	No	-	-	1	-	1
<i>Dacrymyces sp2.</i>	Discomycetoid	110.84	1.90	No	-	1	-	-	1
<i>Dacrymyces stillatus</i>	Discomycetoid	368.25	2.82	No	-	17	17	-	34
<i>Dacrymyces tortus</i>	Discomycetoid	138.06	3.33	No	-	8	16	-	24
<i>Dacryobolus karstenii</i>	Resupinate	7.51	3.89	No	-	2	3	-	5

<i>Dacryobolus sudans</i>	Resupinate	9.72	3.67	No	-	3	1	1	5
<i>Daldinia concentrica</i>	Stromatoid	753.98	1.88	No	1	-	-	-	1
<i>Dialonectria cf episphaeria</i>	Pyrenomycetoid	270.59	2.38	Yes	5	-	-	1	6
<i>Diatrype stigma</i>	Stromatoid	31.42	5.00	No	1	-	-	-	1
<i>Diatrypella sp1.</i>	Stromatoid	5.32	5.09	No	1	-	-	-	1
<i>Dichostereum boreale</i>	Resupinate	57.98	1.40	Yes	-	1	-	-	1
<i>Ditiola peziziformis</i>	Discomycetoid	1813.09	3.17	No	-	-	1	-	1
<i>Durella melanochlora</i>	Discomycetoid	239.23	2.84	No	6	-	-	7	13
<i>Echinosphaeria canescens</i>	Pyrenomycetoid	556.65	7.78	No	2	-	-	1	3
<i>Echinosphaeria cincinnata</i>	Pyrenomycetoid	261.34	2.00	No	2	1	1	-	4
<i>Elmerina caryae</i>	Resupinate	27.24	2.22	No	4	-	-	-	4
<i>Endoxyla macrostoma</i>	Pyrenomycetoid	67.73	3.93	No	-	1	-	-	1
<i>Endoxyla parallela</i>	Stromatoid	84.55	4.41	No	1	2	3	5	11
<i>Endoxyla rostrata</i>	Pyrenomycetoid	12.63	3.00	No	4	-	-	-	4
<i>Entoloma depluens</i>	Agaricoid	402.50	1.34	No	2	-	-	1	3
<i>Eutypa flavovirens</i>	Stromatoid	27.83	3.11	No	5	-	-	2	7
<i>Exidia glandulosa</i>	Discomycetoid	163.36	3.25	No	3	-	-	3	6
<i>Exidia repansa</i>	Discomycetoid	91.89	4.33	No	3	-	-	-	3
<i>Exidia saccharina</i>	Discomycetoid	135.30	3.27	No	-	-	1	-	1
<i>Exidiopsis calcea</i>	Resupinate	376.52	2.52	No	-	1	-	-	1
<i>Exidiopsis effusa</i>	Resupinate	218.68	3.06	No	-	-	-	1	1
<i>Flagelloscypha sp1.</i>	Discomycetoid	137.44	1.40	No	-	-	-	1	1
<i>Flammulaster limulatus</i>	Agaricoid	113.49	1.88	No	4	-	-	8	12
<i>Flaviporus citrinellus</i>	Resupinate	13.09	1.37	No	-	1	1	1	3
<i>Fomes fomentarius</i>	Pileate	356.37	2.73	No	40	-	-	5	45
<i>Fomitopsis betulina</i>	Pileate	9.72	3.67	No	2	-	-	-	2
<i>Fomitopsis pinicola</i>	Pileate	94.25	1.88	No	22	33	9	9	73
<i>Fomitopsis rosea</i>	Pileate	27.34	2.37	No	-	3	-	-	3
<i>Galerina hypnorum</i>	Agaricoid	194.83	1.71	Yes	-	2	-	-	2
<i>Galerina marginata</i>	Agaricoid	246.69	1.65	Yes	-	1	1	5	7
<i>Galerina mniophila</i>	Agaricoid	285.64	1.91	Yes	-	1	2	-	3
<i>Galerina pumila</i>	Agaricoid	332.22	1.96	No	-	-	1	-	1
<i>Galerina styliifera</i>	Agaricoid	111.33	1.56	No	-	1	2	2	5
<i>Galzinia incrustans coll</i>	Resupinate	15.71	2.50	No	2	1	2	5	10
<i>Ganoderma applanatum</i>	Pileate	209.35	1.48	Yes	-	-	-	1	1
<i>Gelatoporia dichrous</i>	Pileate	4.67	3.91	No	1	-	-	-	1

<i>Globulicium hiemale</i>	Resupinate	1194.49	1.00	No	-	21	16	-	37
<i>Gloeocystidiellum convolvens</i>	Resupinate	33.58	1.58	Yes	4	-	-	2	6
<i>Gloeocystidiellum leucoxanthum</i>	Resupinate	356.37	2.73	No	-	-	-	5	5
<i>Gloeocystidiellum luridum</i>	Resupinate	168.35	2.00	No	-	1	-	1	2
<i>Gloeocystidiellum porosum</i>	Resupinate	35.34	1.67	Yes	-	-	-	3	3
<i>Gloeodontia subasperispora</i>	Resupinate	15.90	1.78	Yes	-	1	1	-	2
<i>Gloeophyllum sepiarium</i>	Pileate	71.58	2.78	No	-	1	-	-	1
<i>Gloeoporus pannocinctus</i>	Resupinate	1.86	4.63	No	4	-	-	4	8
<i>Gloeoporus taxicola</i>	Resupinate	6.61	2.76	No	-	1	2	-	3
<i>Gloiothele citrina</i>	Resupinate	71.57	1.00	No	3	7	2	2	14
<i>Glonium nitidum</i>	Pyrenomycetoid	68.72	5.60	No	-	1	1	-	2
<i>Godronia urceolus</i>	Discomycetoid	110.45	41.67	No	1	-	-	-	1
<i>Gorgoniceps aridula</i>	Discomycetoid	308.15	34.44	No	-	-	1	-	1
<i>Gorgoniceps hypothallosa</i>	Discomycetoid	190.85	9.00	No	-	-	6	-	6
<i>Gymnopilus penetrans</i>	Agaricoid	141.76	1.68	Yes	8	6	18	3	35
<i>Gymnopilus picreus</i>	Agaricoid	268.61	1.58	Yes	-	1	6	-	7
<i>Gymnopus androsaceus</i>	Agaricoid	109.94	1.82	No	1	4	-	1	6
<i>Gymnopus confluens</i>	Agaricoid	69.75	2.07	No	1	-	-	-	1
<i>Gymnopus dryophilus</i>	Agaricoid	45.63	1.69	No	1	1	-	-	2
<i>Gyromitra infula</i>	Agaricoid	1095.85	2.48	No	-	1	-	4	5
<i>Hamatocanthoscypha laricionis</i>	Discomycetoid	13.15	3.73	No	-	1	-	-	1
<i>Hamatocanthoscypha sp nov</i>	Discomycetoid	38.78	3.16	No	-	-	-	1	1
<i>Hamatocanthoscypha sp1.</i>	Discomycetoid	15.27	3.33	No	1	-	-	-	1
<i>Hamatocanthoscypha sp2.</i>	Discomycetoid	26.23	3.14	No	2	-	-	3	5
<i>Hamatocanthoscypha sp3.</i>	Discomycetoid	10.43	3.93	No	-	-	1	-	1
<i>Hamatocanthoscypha straminella</i>	Discomycetoid	37.32	3.44	No	2	-	-	4	6
<i>Helicobasidium sp1.</i>	Resupinate	500.30	1.86	No	-	-	-	1	1
<i>Helminthosphaeria aff carpathica</i>	Pyrenomycetoid	285.10	2.18	No	-	1	1	-	2
<i>Helminthosphaeria aff odontiae</i>	Pyrenomycetoid	176.71	1.80	No	-	2	-	-	2
<i>Helminthosphaeria aff pilifera</i>	Pyrenomycetoid	238.12	2.10	No	-	-	1	-	1
<i>Helminthosphaeria cf gibberosa</i>	Pyrenomycetoid	464.56	2.15	No	2	-	2	-	4
<i>Helminthosphaeria ludens</i>	Pyrenomycetoid	1105.84	2.75	No	1	6	1	-	8
<i>Helminthosphaeria sp1.</i>	Pyrenomycetoid	320.74	2.45	No	-	-	-	1	1
<i>Helminthosphaeriaceae sp nov.</i>	Pyrenomycetoid	1269.11	2.29	Yes	-	3	5	-	8
<i>Helvella macropus</i>	Agaricoid	1991.57	2.19	Yes	-	-	-	1	1
<i>Hemimycena sp1.</i>	Agaricoid	268.61	1.58	No	1	-	-	-	1



<i>Henningsomyces candidus</i>	Discomycetoid	81.91	1.14	No	14	-	-	1	15
<i>Henningsomyces pienikarva</i>	Discomycetoid	81.91	1.14	No	-	1	1	-	2
<i>Hericium cirrhatum</i>	Pileate	28.27	1.33	No	-	-	-	1	1
<i>Hericium coralloides</i>	Ramarioid	35.26	1.31	Yes	-	-	-	1	1
<i>Hilberina aff moseri</i>	Pyrenomycetoid	692.72	11.90	No	-	1	-	-	1
<i>Hilberina aff munkii</i>	Pyrenomycetoid	326.73	6.50	No	1	-	-	1	2
<i>Hilberina cf caudata</i>	Pyrenomycetoid	596.90	11.88	No	1	2	-	-	3
<i>Humaria hemisphaerica</i>	Discomycetoid	2596.72	2.17	Yes	3	-	-	8	11
<i>Hyalopeziza millepunctata</i>	Discomycetoid	19.14	3.55	No	1	-	-	4	5
<i>Hyaloscypha albohyalina</i>	Discomycetoid	113.05	3.36	No	4	1	1	6	12
<i>Hyaloscypha aureliella</i>	Discomycetoid	40.50	3.30	No	-	46	46	-	92
<i>Hyaloscypha diabolica</i>	Discomycetoid	19.16	3.05	No	-	1	-	-	1
<i>Hyaloscypha epiporia</i>	Discomycetoid	28.04	2.93	No	-	3	-	-	3
<i>Hyaloscypha fuckelii</i>	Discomycetoid	38.04	3.10	No	19	1	1	17	38
<i>Hyaloscypha intacta</i>	Discomycetoid	105.83	3.14	No	6	-	-	18	24
<i>Hyaloscypha latispora</i>	Discomycetoid	83.71	2.19	No	1	-	-	-	1
<i>Hyaloscypha leuconica</i>	Discomycetoid	41.39	3.81	No	5	4	3	10	22
<i>Hyaloscypha quercicola</i>	Discomycetoid	41.72	3.40	No	1	-	-	-	1
<i>Hyaloscypha sp1. nov.</i>	Discomycetoid	14.77	2.35	No	1	-	-	-	1
<i>Hyaloscypha spiralis</i>	Discomycetoid	113.05	3.36	No	5	1	1	3	10
<i>Hyaloscypha vitreola</i>	Discomycetoid	113.05	3.36	No	21	-	-	7	28
<i>Hymenochaete fuliginosa</i>	Resupinate	18.06	2.88	No	-	3	-	-	3
<i>Hymenochaetopsis tabacina</i>	Pileate	28.23	2.30	No	-	-	-	2	2
<i>Hymenoscyphus sp2.</i>	Discomycetoid	139.51	4.14	No	-	-	-	1	1
<i>Hymenoscyphus sp3.</i>	Discomycetoid	427.65	3.27	No	-	-	1	-	1
<i>Hymenoscyphus vikingultorum</i>	Discomycetoid	123.70	5.83	No	1	-	-	-	1
<i>Hyphoderma cremeoalbum</i>	Resupinate	311.61	2.09	No	1	1	-	-	2
<i>Hyphoderma definitum</i>	Resupinate	103.70	3.85	No	-	4	5	-	9
<i>Hyphoderma incrustatum</i>	Resupinate	198.80	2.78	No	2	1	-	3	6
<i>Hyphoderma obtusifforme</i>	Resupinate	261.34	2.00	No	1	-	-	-	1
<i>Hyphoderma occidentale</i>	Resupinate	230.37	2.74	No	-	2	1	1	4
<i>Hyphoderma roseocremeum</i>	Resupinate	101.02	3.00	No	-	-	1	-	1
<i>Hyphoderma setigerum</i>	Resupinate	93.88	2.27	No	13	-	1	15	29
<i>Hyphoderma sibiricum</i>	Resupinate	127.23	1.78	No	-	1	-	-	1
<i>Hyphodiscus hemiamyloideus</i>	Discomycetoid	25.22	1.83	No	8	-	1	9	18
<i>Hyphodiscus hymeniophilus</i>	Discomycetoid	8.84	3.33	No	-	2	-	-	2

<i>Hyphodontia abieticola</i>	Resupinate	55.32	1.64	No	2	1	5	1	9
<i>Hyphodontia alutaria</i>	Resupinate	39.40	1.46	No	-	2	-	-	2
<i>Hyphodontia barba-jovis</i>	Resupinate	62.83	1.25	No	4	-	-	1	5
<i>Hyphodontia curvispora</i>	Resupinate	5.52	3.60	No	1	-	-	-	1
<i>Hyphodontia efibulata</i>	Resupinate	99.30	1.65	No	-	-	-	2	2
<i>Hyphodontia pallidula</i>	Resupinate	15.90	1.78	No	1	14	1	2	18
<i>Hyphodontia subalutacea</i>	Resupinate	16.84	4.00	No	12	2	9	12	35
<i>Hypholoma fasciculare</i>	Agaricoid	99.30	1.65	No	-	-	-	1	1
<i>Hypholoma polytrichi</i>	Agaricoid	127.23	1.78	No	1	-	-	-	1
<i>Hypochnicium albostramineum</i>	Resupinate	322.06	1.33	Yes	-	-	2	2	4
<i>Hypochnicium bombycinum</i>	Resupinate	404.09	1.50	No	-	-	-	3	3
<i>Hypochnicium polonese</i>	Resupinate	119.28	1.67	No	1	-	-	-	1
<i>Hypochnicium punctulatum</i>	Resupinate	106.32	1.26	Yes	2	3	5	1	11
<i>Hypochnicium subrigescens</i>	Resupinate	149.31	1.00	Yes	-	2	1	-	3
<i>Hypochnicium wakefieldiae</i>	Resupinate	188.26	1.26	Yes	-	2	4	-	6
<i>Hypomyces rosellus</i>	Resupinate	437.37	6.11	Yes	1	-	-	-	1
<i>Hypomyces semitranslucens</i>	Resupinate	372.13	4.42	Yes	-	3	-	1	4
<i>Hypoxyylon fuscum</i>	Stromatoid	447.97	2.08	No	1	-	-	-	1
<i>Hypoxyylon rubiginosum</i>	Stromatoid	215.98	2.20	No	1	-	-	8	9
<i>Hysterium pulicare</i>	Pyrenomycetoid	1256.64	3.13	No	32	-	-	3	35
<i>Hysterographium fraxini</i>	Pyrenomycetoid	5367.71	2.78	No	-	-	-	8	8
<i>Immersiella caudata</i>	Pyrenomycetoid	874.74	12.22	No	12	-	-	2	14
<i>Inonotus obliquus</i>	Resupinate	261.54	1.54	No	5	-	-	-	5
<i>Irpex litschaueri</i>	Resupinate	17.32	2.38	No	1	-	-	-	1
<i>Ischnoderma benzoinum</i>	Pileate	14.43	3.43	No	-	3	1	-	4
<i>Jaapia ochroleuca</i>	Resupinate	265.07	2.70	Yes	-	-	6	-	6
<i>Junghuhnia collabens</i>	Resupinate	6.42	2.19	No	-	1	-	-	1
<i>Junghuhnia luteoalba</i>	Resupinate	11.71	2.56	No	-	5	15	-	20
<i>Kirschsteiniothelia cf atra</i>	Pyrenomycetoid	2126.47	3.16	No	-	-	2	-	2
<i>Kuehneromyces lignicola</i>	Agaricoid	84.82	1.69	No	1	-	1	1	3
<i>Kuehneromyces mutabilis</i>	Agaricoid	84.82	1.69	No	-	-	-	1	1
<i>Kurtia argillacea</i>	Resupinate	119.28	1.67	No	9	5	6	11	31
<i>Lachnella</i> sp1.	Discomycetoid	63.54	2.47	No	-	-	-	1	1
<i>Lachnum corticale</i>	Discomycetoid	231.94	5.60	No	-	-	-	30	30
<i>Lachnum pudibundum</i>	Discomycetoid	25.13	4.00	No	-	-	-	1	1
<i>Lachnum</i> sp1.	Discomycetoid	25.24	4.33	No	12	3	-	12	27

Lachnum sp2.	Discomycetoid	23.81	3.79	No	-	-	-	3	3
Lachnum virgineum	Discomycetoid	24.19	4.86	No	16	-	-	13	29
Laetinaeria aff uvidula	Discomycetoid	434.92	1.94	No	-	-	-	1	1
Lasiosphaeria hirsuta/tuberculosa complex	Pyrenomycetoid	2156.90	10.00	Yes	13	-	-	17	30
Lasiosphaeria ovina	Pyrenomycetoid	565.49	11.25	No	4	-	-	9	13
Lasiosphaeria pyramidata	Pyrenomycetoid	628.32	12.50	No	1	-	-	-	1
Laxitextum bicolor	Pileate	23.32	1.90	Yes	4	-	-	2	6
Lentaria afflata	Ramarioid	60.13	1.79	No	-	-	-	1	1
Lentinellus castoreus	Agaricoid	28.27	1.33	Yes	1	-	-	-	1
Lentinellus flabelliformis	Agaricoid	60.75	1.47	Yes	1	-	-	-	1
Lentinellus micheneri	Agaricoid	60.75	1.47	Yes	1	-	-	1	2
Lentinellus ursinus	Agaricoid	28.27	1.33	Yes	3	-	-	-	3
Lentinus substrictus	Pileate	17.91	2.85	No	-	-	-	1	1
Lentomitella cirrhosa	Pyrenomycetoid	82.83	2.00	Yes	13	2	5	12	32
Lentomitella crinigera	Pyrenomycetoid	285.10	2.18	Yes	5	6	8	3	22
Lentomitella tomentosa	Pyrenomycetoid	481.15	2.23	No	2	-	-	1	3
Lenzites betulina	Pileate	27.00	2.20	No	1	-	-	1	2
Leptodontidium trabinellum	Discomycetoid	115.68	2.68	No	32	-	-	8	40
Leptoporus mollis	Pileate	20.72	2.48	No	-	2	-	-	2
Leptosporomyces galzinii	Resupinate	8.42	2.00	No	1	1	1	-	3
Leptosporomyces septentrionalis	Resupinate	15.03	3.57	No	-	1	-	1	2
Leucogyrophana romellii	Resupinate	41.48	1.54	No	-	2	1	-	3
Leucogyrophana sororia	Resupinate	25.24	1.55	No	-	5	2	-	7
Leucoscypha leucotricha	Discomycetoid	5366.72	2.24	Yes	-	1	1	-	2
Lophiostoma cf quadrinucleatum	Pyrenomycetoid	1325.60	2.95	No	-	-	-	3	3
Lophiostoma compressum	Pyrenomycetoid	1615.37	2.64	No	2	-	-	1	3
Lophiostoma curtum	Pyrenomycetoid	608.97	2.70	No	9	-	-	-	9
Lophiostoma sp1.	Pyrenomycetoid	345.25	4.92	No	-	-	-	6	6
Lophiotrema boreale	Pyrenomycetoid	169.63	3.64	No	6	-	-	6	12
Lophium mytilinum	Pyrenomycetoid	636.17	71.11	No	-	15	30	-	45
Megacollybia platyphylla	Agaricoid	350.90	1.17	No	2	-	-	-	2
Melanomma cf fuscidulum	Pyrenomycetoid	226.19	4.50	No	8	3	6	8	25
Melanomma pulvis-pyrius	Pyrenomycetoid	254.47	3.56	No	22	-	-	11	33
Melanomma subdispersum	Pyrenomycetoid	994.02	3.00	No	11	-	-	2	13
Melanopsamma pomiformis	Pyrenomycetoid	497.75	2.31	No	2	-	1	1	4

<i>Melanospora caprina</i>	Pyrenomycetoid	2393.01	1.56	No	-	1	-	1	2
<i>Menispora cf glauca/caesia</i>	Pyrenomycetoid	413.51	5.78	No	17	-	-	3	20
<i>Merismodes anomala</i>	Discomycetoid	1005.31	2.50	No	5	1	-	17	23
<i>Merulius tremellosus</i>	Pileate	5.22	3.40	No	1	-	-	2	3
<i>Metulodontia nivea</i>	Resupinate	37.33	1.38	No	1	1	-	1	3
<i>Mollisia sp1.</i>	Discomycetoid	33.80	3.78	No	47	34	43	45	169
<i>Mollisia sp2.</i>	Discomycetoid	316.42	2.18	No	16	-	-	1	17
<i>Mollisia sp3.</i>	Discomycetoid	129.27	3.53	No	2	-	-	-	2
<i>Mollisia sp4.</i>	Discomycetoid	18.85	3.00	No	2	-	-	4	6
<i>Mucronella calva</i>	Ramarioid	35.34	1.67	No	3	13	9	-	25
<i>Mycena algeriensis</i>	Agaricoid	220.72	1.48	No	-	1	-	-	1
<i>Mycena amicta</i>	Agaricoid	150.62	1.79	No	-	2	-	-	2
<i>Mycena epipterygia</i>	Agaricoid	298.65	1.38	No	1	20	2	-	23
<i>Mycena galericulata</i>	Agaricoid	451.59	1.42	No	2	-	-	3	5
<i>Mycena galopus</i>	Agaricoid	311.02	1.83	No	1	3	2	-	6
<i>Mycena haematopus</i>	Agaricoid	220.72	1.48	No	3	-	-	-	3
<i>Mycena laevigata</i>	Agaricoid	84.82	1.69	No	-	1	1	-	2
<i>Mycena leptcephala</i>	Agaricoid	186.53	1.90	No	-	1	-	1	2
<i>Mycena metata/filopes</i>	Agaricoid	186.53	1.90	No	2	3	3	-	8
<i>Mycena rubromarginata</i>	Agaricoid	331.83	1.54	No	-	14	8	1	23
<i>Mycena sanguinolenta</i>	Agaricoid	184.00	1.62	No	2	1	1	-	4
<i>Mycena silvae-nigrae</i>	Agaricoid	552.92	1.38	No	-	1	1	-	2
<i>Mycena stipata</i>	Agaricoid	306.80	1.60	No	-	4	22	-	26
<i>Mycena tintinnabulum</i>	Agaricoid	22.09	1.80	No	1	-	-	-	1
<i>Mycena viridimarginata</i>	Agaricoid	346.36	1.29	No	-	8	1	-	9
<i>Mycoacia aurea</i>	Resupinate	10.82	2.57	No	-	-	2	-	2
<i>Mycoacia fuscoatra</i>	Resupinate	21.87	2.44	No	3	-	-	1	4
<i>Mytilinidion mytilinellum</i>	Pyrenomycetoid	182.80	5.43	No	-	3	8	-	11
<i>Myxarium sp1.</i>	Discomycetoid	166.90	1.70	No	-	-	-	2	2
<i>Natantiella lignea</i>	Pyrenomycetoid	124.25	3.00	No	5	-	-	5	10
<i>Nectria peziza</i>	Pyrenomycetoid	296.98	2.27	Yes	2	-	-	-	2
<i>Nemania atropurpurea</i>	Stromatoid	190.00	2.19	No	-	-	-	5	5
<i>Nemania dark sp.</i>	Stromatoid	313.87	2.16	No	1	-	-	4	5
<i>Nemania genea</i>	Stromatoid	423.77	2.63	No	-	1	-	-	1
<i>Nemania serpens</i>	Stromatoid	383.50	2.00	No	10	-	-	18	28
<i>Neobulgaria lilacina</i>	Discomycetoid	141.86	2.35	Yes	11	2	2	4	19

<i>Neodasyscypha cerina</i>	Discomycetoid	29.45	2.40	No	3	-	-	5	8
<i>Niesslia</i> sp.	Pyrenomycetoid	7.03	5.89	No	1	-	-	-	1
<i>Oligoporus alni</i>	Pileate	5.88	4.33	No	2	-	-	8	10
<i>Orbilia auricolor</i>	Discomycetoid	4.64	14.00	No	-	-	-	2	2
<i>Orbilia delicatula</i>	Discomycetoid	1.78	2.27	Yes	30	40	29	23	122
<i>Orbilia</i> sp1.	Discomycetoid	2.54	7.67	No	16	1	1	12	30
<i>Orbilia</i> sp2.	Discomycetoid	6.28	8.00	No	3	-	-	1	4
<i>Orbilia</i> sp3.	Discomycetoid	17.49	2.09	No	4	2	-	9	15
<i>Orbilia</i> sp4.	Discomycetoid	3.80	3.64	No	7	5	2	10	24
<i>Orbilia</i> sp5.	Discomycetoid	8.03	5.92	No	1	-	-	1	2
<i>Orbilia</i> sp6.	Discomycetoid	1.31	4.86	No	5	-	-	3	8
<i>Orbilia</i> sp7.	Discomycetoid	38.84	7.21	No	1	1	-	2	4
<i>Orbilia</i> sp8.	Discomycetoid	3.50	6.11	No	-	-	-	1	1
<i>Otidea tuomikoskii</i>	Agaricoid	303.95	1.79	No	1	-	-	-	1
<i>Oxyporus corticola</i>	Resupinate	56.45	1.42	No	1	-	-	9	10
<i>Panellus mitis</i>	Agaricoid	5.83	3.80	No	-	1	-	-	1
<i>Panellus serotinus</i>	Agaricoid	8.39	3.17	No	2	-	-	-	2
<i>Panus conchatus</i>	Agaricoid	44.18	2.08	No	1	-	-	-	1
<i>Patinellaria sanguinea</i>	Discomycetoid	70.51	2.62	No	25	-	-	24	49
<i>Paullicorticium pearsonii</i>	Resupinate	34.36	2.80	No	-	2	-	-	2
<i>Paullicorticium seorsum</i>	Resupinate	55.22	1.33	No	-	2	1	-	3
<i>Peniophora incarnata</i>	Resupinate	113.10	2.25	No	9	-	-	9	18
<i>Peniophora laurentii</i>	Resupinate	174.95	2.44	No	1	-	-	1	2
<i>Peniophora nuda</i>	Resupinate	53.46	3.27	No	3	-	-	-	3
<i>Peniophora pithya</i>	Resupinate	30.68	2.50	No	-	11	-	-	11
<i>Peniophora polygonia</i>	Resupinate	91.25	3.38	No	-	-	-	1	1
<i>Peniophora violaceolivida</i>	Resupinate	50.49	3.09	No	7	-	-	3	10
<i>Peniophorella guttuliferum</i>	Resupinate	68.44	2.54	No	3	-	-	1	4
<i>Peniophorella pallida</i>	Resupinate	56.55	2.67	No	-	2	7	-	9
<i>Peniophorella praetermissa</i>	Resupinate	177.21	2.11	No	19	31	21	24	95
<i>Peniophorella pubera</i>	Resupinate	120.58	2.00	No	10	2	1	4	17
<i>Perenniporia subacida</i>	Resupinate	54.44	1.26	No	-	-	-	1	1
<i>Peziza</i> cf <i>arvernensis</i>	Discomycetoid	1287.92	1.77	Yes	1	-	-	6	7
<i>Pezizella</i> sp1.	Discomycetoid	75.63	3.57	No	-	1	-	-	1
<i>Pezizella</i> sp2.	Discomycetoid	24.82	3.95	No	1	-	-	-	1
<i>Phaeohelotium</i> sp1.	Discomycetoid	44.18	3.60	No	1	-	-	-	1

<i>Phaeohelotium</i> sp2.	Discomycetoid	15.59	2.89	No	3	-	-	2	5
<i>Phaeohelotium</i> sp3.	Discomycetoid	14.46	2.68	No	-	-	2	-	2
<i>Phanerochaete calotricha</i>	Resupinate	15.90	1.78	No	-	-	-	1	1
<i>Phanerochaete laevis</i>	Resupinate	34.15	2.09	No	5	-	-	4	9
<i>Phanerochaete sordida</i>	Resupinate	35.64	2.18	No	9	4	1	5	19
<i>Phanerochaete velutina</i>	Resupinate	35.64	2.18	No	6	3	1	10	20
<i>Phellinus ferrugineofuscus</i>	Resupinate	6.94	2.90	No	-	22	-	-	22
<i>Phellinus igniarius</i> coll	Pileate	127.42	1.15	No	9	-	-	1	10
<i>Phellinus laevigatus</i>	Resupinate	46.03	1.31	No	9	-	-	-	9
<i>Phellinus lundellii</i>	Pileate	82.87	1.24	No	2	-	-	-	2
<i>Phellinus nigrolimitatus</i>	Pileate	21.87	2.44	No	-	7	1	-	8
<i>Phellinus tremulae</i>	Pileate	65.56	1.35	No	-	-	-	15	15
<i>Phellinus viticola</i>	Pileate	17.30	3.78	No	-	27	3	-	30
<i>Phialocephala piceae</i>	Discomycetoid	37.77	4.22	No	1	-	-	-	1
<i>Phlebia centrifuga</i>	Resupinate	44.55	2.73	No	-	2	-	-	2
<i>Phlebia femsjoensis</i>	Resupinate	17.89	2.00	No	-	1	1	-	2
<i>Phlebia lilascens</i> coll	Resupinate	16.90	1.89	No	-	2	1	-	3
<i>Phlebia livida</i>	Resupinate	21.87	2.44	No	-	4	3	-	7
<i>Phlebia radiata</i>	Resupinate	10.82	2.57	No	1	1	1	-	3
<i>Phlebia rufa</i>	Resupinate	21.87	2.44	No	1	-	-	1	2
<i>Phlebia segregata</i>	Resupinate	25.84	2.89	No	1	4	-	4	9
<i>Phlebia serialis</i>	Resupinate	11.76	3.33	No	-	-	2	-	2
<i>Phlebia subserialis</i>	Resupinate	25.84	2.89	No	1	-	1	-	2
<i>Phlebia subulata</i>	Resupinate	28.21	1.73	No	-	7	-	-	7
<i>Phlebia tuberculata</i>	Resupinate	47.71	2.25	No	-	-	-	1	1
<i>Phlebiella christiansenii</i>	Pileate	92.21	1.53	Yes	2	5	4	-	11
<i>Phlebiopsis gigantea</i>	Resupinate	60.14	2.23	No	-	1	-	-	1
<i>Phloeomana clavata</i>	Agaricoid	212.06	1.25	No	-	2	-	-	2
<i>Phloeomana hiemalis</i>	Agaricoid	161.05	1.38	No	-	-	-	1	1
<i>Phloeomana speirea</i>	Agaricoid	161.99	1.65	No	1	-	-	-	1
<i>Pholiota flammans</i>	Agaricoid	22.09	1.80	No	-	-	1	-	1
<i>Pholiota scamba</i>	Agaricoid	184.00	1.62	No	-	3	1	-	4
<i>Pholiota squarrosa</i>	Agaricoid	99.30	1.65	No	-	-	-	1	1
<i>Pholiota tuberculosa</i>	Agaricoid	141.76	1.68	No	2	-	-	1	3
<i>Piloderma bicolor</i>	Resupinate	15.95	1.30	No	18	11	12	12	53
<i>Piloderma byssinum</i>	Resupinate	52.46	1.27	No	13	15	17	17	62

<i>Piloderma olivaceum</i>	Resupinate	15.95	1.30	No	1	2	4	1	8
<i>Piloderma</i> sp1.	Resupinate	29.81	1.27	No	1	-	-	1	2
<i>Piloderma sphaerosporum</i>	Resupinate	23.12	1.21	No	1	1	3	4	9
<i>Pisorisporium</i> sp.	Pyrenomycetoid	561.24	11.59	No	4	-	-	10	14
<i>Platystomum obtectum</i>	Pyrenomycetoid	1842.94	2.74	No	-	-	3	-	3
<i>Pleurotus pulmonarius</i>	Agaricoid	104.92	2.53	No	-	-	-	1	1
<i>Pluteus cervinus</i>	Agaricoid	158.03	1.39	No	15	-	-	3	18
<i>Pluteus podospileus</i>	Agaricoid	140.71	1.24	No	2	-	-	-	2
<i>Pluteus semibulbosus</i>	Agaricoid	160.37	1.23	No	1	-	-	1	2
<i>Polydesmia pruinosa</i>	Discomycetoid	278.33	3.89	No	3	-	-	8	11
<i>Postia caesia</i> coll.	Pileate	9.01	3.40	No	-	7	-	-	7
<i>Postia fragilis</i>	Pileate	10.28	3.52	No	1	1	3	-	5
<i>Postia guttulata</i>	Pileate	19.00	1.75	No	-	1	1	-	2
<i>Postia leucomallella</i>	Pileate	10.28	3.52	No	-	3	6	-	9
<i>Postia ptychogaster</i>	Resupinate	19.52	1.91	No	-	1	1	-	2
<i>Postia rennyi</i>	Resupinate	26.47	1.81	No	-	-	1	-	1
<i>Postia sericeomollis</i>	Resupinate	14.37	1.98	No	-	1	3	-	4
<i>Postia tephroleuca</i>	Pileate	8.39	3.17	No	1	6	3	-	10
<i>Postia undosa</i>	Pileate	9.62	3.29	No	-	-	-	1	1
<i>Propolis farinosa</i>	Discomycetoid	607.90	3.58	No	13	-	-	21	34
<i>Propolis</i> sp1.	Discomycetoid	2120.58	2.70	No	-	6	1	-	7
<i>Protodontia piceicola</i>	Resupinate	56.55	1.13	No	-	1	-	-	1
<i>Protodontia subgelatinosa</i>	Resupinate	115.18	1.37	No	5	-	-	-	5
<i>Protounguicularia transiens</i>	Discomycetoid	31.81	3.56	No	3	-	-	4	7
<i>Pseudocosmospora vilior</i>	Pyrenomycetoid	270.59	2.38	Yes	5	1	-	-	6
<i>Pseudographis pinicola</i>	Discomycetoid	2990.01	5.22	No	-	1	1	-	2
<i>Pseudohydnum gelatinosum</i>	Pileate	148.49	1.14	No	-	2	-	-	2
<i>Pseudoplectania nigrella</i>	Discomycetoid	1045.36	1.00	No	6	7	13	4	30
<i>Pseudotomentella flavovirens</i>	Resupinate	215.69	1.00	Yes	-	1	-	-	1
<i>Pseudotomentella griseopergamacea</i>	Resupinate	526.16	1.00	Yes	3	1	-	1	5
<i>Pseudotomentella humicola</i>	Resupinate	269.39	1.00	Yes	-	-	-	1	1
<i>Pseudotomentella mucidula</i>	Resupinate	331.34	1.00	Yes	1	-	2	-	3
<i>Pseudotomentella nigra</i>	Resupinate	572.56	1.00	Yes	-	-	-	2	2
<i>Pseudotomentella tristis</i>	Resupinate	307.88	1.14	Yes	1	-	2	3	6
<i>Psilocistella</i> cf <i>conincola</i>	Discomycetoid	38.61	2.36	No	-	-	1	-	1

<i>Psilocistella obsoleta</i>	Discomycetoid	3.99	2.60	No	1	-	-	-	1
<i>Psilocistella</i> sp tummakarva	Discomycetoid	22.51	3.10	No	-	-	-	1	1
<i>Psilocistella</i> sp2.	Discomycetoid	197.29	3.93	No	1	-	-	-	1
<i>Psilocistella</i> sp3.	Discomycetoid	7.85	3.64	No	-	-	-	3	3
<i>Psilocistella</i> sp4.	Discomycetoid	11.31	4.27	No	-	-	1	-	1
<i>Psilocistella</i> sp5.	Discomycetoid	85.53	3.03	No	-	-	-	3	3
<i>Psilocistella</i> sp6.	Discomycetoid	21.99	3.50	No	-	-	-	1	1
<i>Pycnoporellus fulgens</i>	Pileate	38.17	1.80	No	-	3	-	-	3
<i>Radulomyces confluens</i>	Resupinate	299.30	1.00	Yes	-	1	-	-	1
<i>Rectipilus fasciculatus</i>	Discomycetoid	40.64	1.92	No	-	-	1	-	1
<i>Repetobasidium vile</i>	Resupinate	34.36	2.80	No	1	-	-	-	1
<i>Resinicium bicolor</i>	Resupinate	44.18	2.08	No	6	18	12	12	48
<i>Resinicium furfuraceum</i>	Resupinate	31.18	1.91	No	-	13	27	4	44
<i>Resupinatus poriaeformis</i>	Resupinate	113.65	1.00	No	2	-	-	1	3
<i>Rhizochaete sulphurina</i>	Resupinate	29.70	1.82	No	-	-	3	1	4
<i>Rhizochaete violascens</i>	Resupinate	45.63	1.69	No	2	3	1	2	8
<i>Rhizoctonia fusisporus</i>	Resupinate	39.27	6.25	No	2	-	2	2	6
<i>Rhizoctonia ochracea</i>	Resupinate	307.88	1.14	No	-	-	-	1	1
<i>Rhizoctonia pseudocornigerum</i>	Resupinate	96.21	2.86	No	-	-	-	1	1
<i>Rhodonina placenta</i>	Resupinate	26.51	2.16	No	-	2	1	-	3
<i>Roridomyces roridus</i>	Agaricoid	186.07	2.21	No	-	-	1	-	1
<i>Schizopora paradoxa</i>	Resupinate	66.36	1.48	No	1	-	-	-	1
<i>Scopuloides rimosa</i>	Resupinate	9.62	2.29	No	5	1	-	-	6
<i>Scutellinia scutellata</i>	Discomycetoid	1758.11	1.68	Yes	3	-	-	5	8
<i>Scytinostroma galactinum</i>	Resupinate	23.32	1.90	No	-	-	-	2	2
<i>Scytinostromella heterogenea</i>	Resupinate	30.04	1.42	Yes	1	-	-	-	1
<i>Sebacina grisea</i>	Resupinate	178.92	2.50	No	1	-	-	-	1
<i>Serpula himantoides</i>	Resupinate	249.46	1.91	Yes	1	5	5	-	11
<i>Sidera lunata</i>	Resupinate	4.31	2.50	No	-	-	2	-	2
<i>Simocybe centunculus</i>	Agaricoid	142.35	1.45	No	3	-	-	5	8
<i>Simocybe haustellaris</i>	Agaricoid	201.95	1.55	No	2	-	-	1	3
<i>Sistotrema aff binucleosporum</i>	Resupinate	7.59	2.15	No	-	-	2	-	2
<i>Sistotrema aff farinaceum</i>	Resupinate	15.38	1.42	No	-	-	1	-	1
<i>Sistotrema brinkmannii</i>	Resupinate	14.72	2.02	No	17	3	3	17	40
<i>Sistotrema coroniferum</i>	Resupinate	23.86	2.67	No	-	-	-	1	1
<i>Sistotrema coronilla</i>	Resupinate	18.62	2.47	No	1	-	-	-	1



<i>Sistotrema octosporum</i> coll	Resupinate	29.70	1.82	No	4	-	1	3	8
<i>Sistotrema porulosum</i>	Resupinate	20.86	1.70	No	-	-	-	3	3
<i>Sistotrema raduloides</i>	Resupinate	53.01	2.50	No	4	-	-	2	6
<i>Sistotrema resinicystidium</i>	Resupinate	22.09	1.80	No	3	1	1	2	7
<i>Sistotrema sernanderi</i>	Resupinate	35.64	2.18	No	4	-	-	1	5
<i>Sistotrema</i> sp nov.	Resupinate	3.85	1.79	No	1	-	-	-	1
<i>Sistotremastrum suecicum</i>	Resupinate	12.63	3.00	No	-	-	6	-	6
<i>Sistotremella perpusilla</i>	Resupinate	15.90	1.78	No	-	-	1	-	1
<i>Skeletocutis amorphia</i>	Pileate	4.78	2.77	No	-	4	1	-	5
<i>Skeletocutis biguttulata</i>	Resupinate	8.24	3.82	No	-	-	20	-	20
<i>Skeletocutis brevispora</i>	Resupinate	5.15	2.67	No	-	5	-	-	5
<i>Skeletocutis carneogrisea</i>	Pileate	2.86	3.14	No	-	4	-	-	4
<i>Skeletocutis kuehneri</i>	Resupinate	1.78	4.44	No	-	6	-	-	6
<i>Skeletocutis nivea</i>	Pileate	1.99	6.00	No	1	-	-	1	2
<i>Skeletocutis papyracea/subincarnata</i>	Resupinate	7.43	3.10	No	-	9	9	-	18
<i>Skeletocutis stellae</i>	Resupinate	3.34	4.25	No	-	-	1	-	1
<i>Sphaerobasidium minutum</i>	Resupinate	37.33	1.38	No	-	1	1	-	2
<i>Sphaerostilbella berkeleyana</i>	Resupinate	105.83	3.14	Yes	1	-	-	-	1
<i>Steccherinum lacerum</i>	Resupinate	34.58	1.34	No	1	-	-	-	1
<i>Steccherinum ochraceum</i>	Resupinate	14.53	1.43	No	1	-	-	-	1
<i>Stereum hirsutum</i>	Pileate	45.95	2.17	No	13	-	-	1	14
<i>Stereum rugosum</i>	Pileate	186.53	1.90	No	6	-	-	-	6
<i>Stereum sanguinolentum</i>	Pileate	63.62	3.00	No	-	1	-	-	1
<i>Stereum subtomentosum</i>	Pileate	26.84	3.00	No	1	-	-	-	1
<i>Stictis</i> cf <i>mollis</i>	Discomycetoid	649.01	91.83	No	-	-	-	4	4
<i>Stictis</i> sp1.	Discomycetoid	77.90	65.22	No	1	-	-	1	2
<i>Strossmayeria basitricha</i>	Discomycetoid	414.69	8.25	No	1	-	-	-	1
<i>Strossmayeria nigra</i>	Discomycetoid	349.44	8.78	No	-	-	-	2	2
<i>Stypella dubia</i>	Resupinate	75.40	1.50	No	1	-	-	-	1
<i>Stypella vermiformis</i>	Resupinate	55.22	1.33	No	-	-	1	-	1
<i>Subulicystidium longisporum</i>	Resupinate	80.18	4.91	No	13	-	-	12	25
<i>Suillosporium cystidiatum</i>	Resupinate	163.36	3.25	No	-	-	1	-	1
<i>Tapinella panuoides</i>	Agaricoid	48.11	1.43	No	-	1	-	-	1
<i>Tomentella badia</i>	Resupinate	785.40	1.00	Yes	-	-	-	1	1
<i>Tomentella botryoides</i>	Resupinate	232.28	1.08	Yes	-	-	-	1	1

<i>Tomentella brevispina</i>	Resupinate	331.34	1.00	Yes	1	1	-	1	3
<i>Tomentella bryophila</i>	Resupinate	402.12	1.00	Yes	8	2	-	7	17
<i>Tomentella cinerascens</i>	Resupinate	113.65	1.00	Yes	2	1	-	2	5
<i>Tomentella coerulea</i>	Resupinate	259.44	1.07	Yes	-	-	-	1	1
<i>Tomentella ellisii</i>	Resupinate	304.17	1.26	Yes	1	-	2	-	3
<i>Tomentella lapida</i>	Resupinate	572.56	1.00	Yes	12	6	2	5	25
<i>Tomentella lateritia</i>	Resupinate	331.34	1.00	Yes	1	1	-	1	3
<i>Tomentella lilacinogrisea</i>	Resupinate	307.88	1.14	Yes	4	-	1	2	7
<i>Tomentella</i> sp1.	Resupinate	111.33	1.56	Yes	1	-	-	-	1
<i>Tomentella</i> sp2.	Resupinate	307.88	1.14	Yes	-	-	-	1	1
<i>Tomentella stiposa</i>	Resupinate	673.38	1.00	Yes	2	-	-	2	4
<i>Tomentella sublilacina</i>	Resupinate	364.47	1.10	Yes	6	8	2	3	19
<i>Tomentella terrestris</i>	Resupinate	346.43	1.23	Yes	2	2	2	1	7
<i>Tomentella umbrinospora</i>	Resupinate	288.63	1.07	Yes	1	-	-	-	1
<i>Tomentella viridescens</i>	Resupinate	331.34	1.00	Yes	-	1	1	-	2
<i>Tomentella viridula</i>	Resupinate	350.90	1.17	Yes	1	-	-	-	1
<i>Tomentellopsis bresadolana</i>	Resupinate	169.65	1.00	Yes	-	-	1	-	1
<i>Tomentellopsis</i> cf <i>submollis</i>	Resupinate	101.89	1.21	Yes	-	-	-	1	1
<i>Tomentellopsis echinospora</i>	Resupinate	98.17	1.00	Yes	1	-	-	-	1
<i>Tomentellopsis nigra</i>	Resupinate	572.56	1.00	Yes	1	-	1	1	3
<i>Tomentellopsis</i> sp1.	Resupinate	130.67	1.00	Yes	2	-	-	-	2
<i>Trametes hirsuta</i>	Pileate	22.24	2.66	No	1	-	-	2	3
<i>Trametes ochracea</i>	Pileate	39.51	2.56	No	3	-	-	8	11
<i>Trametes pubescens</i>	Pileate	28.19	2.77	No	-	-	-	2	2
<i>Trechispora alnicola</i>	Resupinate	24.44	1.28	Yes	-	-	1	-	1
<i>Trechispora byssinella</i>	Resupinate	14.91	1.67	No	1	2	-	1	4
<i>Trechispora cohaerens</i>	Resupinate	11.00	1.75	No	1	-	1	-	2
<i>Trechispora farinacea</i>	Resupinate	49.70	1.20	Yes	5	4	3	4	16
<i>Trechispora hymenocystis</i>	Resupinate	59.69	1.19	Yes	6	-	3	3	12
<i>Trechispora kavinioides</i>	Resupinate	13.92	1.56	No	1	1	-	-	2
<i>Trechispora laevis</i>	Resupinate	26.15	1.23	Yes	-	1	3	-	4
<i>Trechispora microspora</i>	Resupinate	35.26	1.31	Yes	2	2	2	1	7
<i>Trechispora minima</i>	Resupinate	35.60	1.06	Yes	-	-	1	1	2
<i>Trechispora stellulata</i>	Resupinate	22.97	1.08	Yes	-	3	-	-	3
<i>Tremella foliacea</i>	Ramarioid	436.35	1.19	No	1	-	-	-	1
<i>Tretomyces</i> cf <i>microsporus</i>	Resupinate	9.12	1.09	No	-	1	-	-	1

<i>Trichaptum abietinum</i>	Pileate	34.64	2.24	No	1	22	12	2	37
<i>Trichoderma minutisporum/pachybasioides</i>	Stromatoid	48.35	1.32	Yes	1	1	-	1	3
<i>Trichoderma pulvinatum</i>	Stromatoid	31.81	1.50	Yes	3	9	1	1	14
<i>Trichoderma strictipile</i>	Stromatoid	98.84	1.10	Yes	1	-	-	-	1
<i>Trichoderma viride</i>	Stromatoid	60.75	1.47	Yes	3	-	-	1	4
<i>Tricholomopsis decora</i>	Agaricoid	184.13	1.41	No	-	-	4	-	4
<i>Trichophaeopsis bicuspis</i>	Discomycetoid	1527.07	1.38	No	-	-	-	1	1
<i>Trichosphaeria notabilis</i>	Pyrenomycetoid	547.52	2.54	No	1	-	-	-	1
<i>Tubaria conspersa</i>	Agaricoid	214.23	1.43	No	1	-	-	5	6
<i>Tubaria furfuracea</i>	Agaricoid	178.59	1.57	No	3	1	1	2	7
<i>Tubulicrinis accedens</i>	Resupinate	30.76	1.53	No	1	2	5	-	8
<i>Tubulicrinis angustus</i>	Resupinate	26.94	5.00	No	-	1	-	-	1
<i>Tubulicrinis borealis</i>	Resupinate	18.85	3.00	No	-	28	15	-	43
<i>Tubulicrinis calothrix</i>	Resupinate	16.84	4.00	No	1	17	13	3	34
<i>Tubulicrinis chaetophorus</i>	Resupinate	49.77	1.85	No	-	-	1	-	1
<i>Tubulicrinis glebulosus</i>	Resupinate	20.71	4.00	No	4	1	2	5	12
<i>Tubulicrinis medius</i>	Resupinate	16.84	4.00	No	-	1	14	-	15
<i>Tubulicrinis propinquus</i>	Resupinate	14.97	4.24	No	-	-	1	-	1
<i>Tubulicrinis sororius</i>	Resupinate	14.43	3.43	No	-	2	1	-	3
<i>Tubulicrinis strangulatus</i>	Resupinate	14.62	1.00	No	-	11	4	-	15
<i>Tubulicrinis subulatus</i>	Resupinate	16.84	4.00	No	1	12	38	8	59
<i>Tulasnella albida</i>	Resupinate	87.47	1.22	No	-	-	-	2	2
<i>Tulasnella allantospora</i>	Resupinate	49.00	3.00	No	-	-	-	1	1
<i>Tulasnella brinkmannii</i>	Resupinate	265.81	3.16	No	1	-	-	-	1
<i>Tulasnella cf conidiata</i>	Resupinate	384.85	1.43	No	-	-	-	2	2
<i>Tulasnella cystidiophora</i>	Resupinate	98.17	1.00	No	3	-	-	1	4
<i>Tulasnella eichleriana</i>	Resupinate	22.27	1.36	No	4	3	1	3	11
<i>Tulasnella fuscoviolacea</i>	Resupinate	170.24	2.82	No	-	-	-	1	1
<i>Tulasnella pallida</i>	Resupinate	259.67	1.74	No	-	1	-	-	1
<i>Tulasnella subglobospora</i>	Resupinate	248.87	1.15	No	-	-	1	-	1
<i>Tulasnella tomaculum</i>	Resupinate	32.67	2.00	No	-	-	-	1	1
<i>Tulasnella violea</i>	Resupinate	127.63	1.30	No	11	2	4	-	17
<i>Tylospora asterophora</i>	Resupinate	70.93	1.18	No	1	1	1	1	4
<i>Tylospora fibrillosa</i>	Resupinate	110.75	1.32	Yes	11	10	11	9	41
<i>Tympanis sp1.</i>	Discomycetoid	238.76	4.75	No	-	2	4	-	6

<i>Urceolella</i> sp nov.	Discomycetoid	61.14	2.61	No	-	-	-	1	1
<i>Vaginatispora</i> cf <i>fuckelii</i>	Pyrenomycetoid	182.21	3.63	No	4	-	-	10	14
<i>Wallrothiella</i> <i>congregata</i>	Pyrenomycetoid	10.93	1.22	No	-	1	-	-	1
<i>Vararia</i> <i>investiens</i>	Resupinate	82.96	3.08	No	1	-	-	-	1
<i>Veluticeps</i> <i>abietina</i>	Pileate	174.95	2.44	No	-	3	-	-	3
<i>Xenasma</i> <i>pulverulentum</i>	Resupinate	282.74	1.67	Yes	-	-	-	1	1
<i>Xenasma</i> <i>rimicola</i>	Resupinate	306.80	1.60	Yes	-	-	-	1	1
<i>Xenasma</i> <i>tulasnelloideum</i>	Resupinate	87.47	1.22	Yes	-	-	-	2	2
<i>Xenasmatella</i> <i>borealis</i>	Resupinate	45.63	1.69	Yes	-	-	1	-	1
<i>Xenasmatella</i> <i>subflavidocrisea</i>	Resupinate	15.90	1.78	Yes	-	-	1	-	1
<i>Xenasmatella</i> <i>vaga</i>	Resupinate	74.48	1.24	Yes	14	12	18	11	55
<i>Xenolachne</i> <i>longicornis</i>	Discomycetoid	87.11	3.23	No	-	-	1	1	2
<i>Xeromphalina</i> <i>campanella</i>	Agaricoid	67.35	2.00	No	-	1	1	-	2
<i>Xeromphalina</i> <i>picta</i>	Agaricoid	119.28	1.67	No	1	-	-	-	1
<i>Xylodon</i> <i>asperus</i>	Resupinate	60.75	1.47	No	3	6	6	6	21
<i>Xylodon</i> <i>borealis</i>	Resupinate	55.22	1.33	No	-	-	-	1	1
<i>Xylodon</i> <i>brevisetus</i>	Resupinate	37.33	1.38	No	5	32	26	3	66
<i>Xylodon</i> <i>detriticus</i>	Resupinate	74.48	1.24	No	2	-	-	7	9
<i>Xylodon</i> <i>nespori</i>	Resupinate	20.87	2.33	No	-	-	1	-	1
<i>Xylodon</i> <i>radula</i>	Resupinate	74.66	2.77	No	2	1	-	-	3
<i>Xylodon</i> <i>rimosissimus</i>	Resupinate	60.75	1.47	No	-	1	-	2	3
<i>Xylodon</i> <i>sambuci</i>	Resupinate	57.98	1.40	No	-	-	-	3	3
Total occurrence of species					1566	1422	1222	1504	5714

### Consulted literature for fungal traits:

- Baloch, E., Gilenstam, G., Wedin, M., 2009. Phylogeny and classification of *Cryptodiscus*, with taxonomic synopsis of the Swedish species. *Fungal Divers.* 38, 51–68.
- Bernicchia, A., Gorjon, S.P., 2010. *Fungi Europaei* n° 12: Corticiaceae s.l., *Fungi Europaei*. Candusso Edizioni, Alassio.
- Boehm, E., Mugambi, G.K., Miller, A.N., Huhndorf, S.M., Marinowitz, S., Spatafora, J.W., Schoch, C.L., 2009. A molecular phylogenetic reappraisal of the Hysteriaceae, Mytiliniaceae and Gloniaceae (Pleosporomycetidae, Dothideomycetes) with keys to world species. *Stud. Mycol.* 64, 49–83. <https://doi.org/10.3114/sim.2009.64.03>
- Breitenbach, J., Kränzlin, F., 1984. *Fungi of Switzerland: Ascomycetes*, Vol. 1. Verlag Mykologia, Luzern.
- Dennis, R.W.G., 1960. *British cup fungi and their allies*. The Ray Society, London.
- Ellis, M., Ellis, J.P., 1997. *Microfungi on land plants: An identification handbook*. The Richmond Publishing Co. Ltd., Slough.
- Eriksson, J., Hjortstam, K., Ryvarde, L., 1984. *The Corticiaceae of North Europe*, Vol. 7. *Fungiflora*, Oslo.
- Eriksson, J., Hjortstam, K., Ryvarde, L., 1981. *The Corticiaceae of North Europe*, Vol. 6. *Fungiflora*, Oslo.

- Eriksson, J., Hjortstam, K., Ryvarde, L., 1978. The Corticiaceae of North Europe, Vol 5. Fungiflora, Oslo.
- Eriksson, J., Ryvarde, L., 1976. The Corticiaceae of North Europe, Vol 4. Fungiflora, Oslo.
- Eriksson, J., Ryvarde, L., 1975. The Corticiaceae of North Europe, Vol 3. Fungiflora, Oslo.
- Eriksson, J., Ryvarde, L., 1973. The Corticiaceae of North Europe, Vol. 2. Fungiflora, Oslo.
- Hansen, L., Knudsen, H., 2000. Nordic Macromycetes: Ascomycetes, Vol. 1. Nordsvamp, Copenhagen.
- Hansen, L., Knudsen, H., 1997. Nordic Macromycetes: Heterobasidioid, Aphyllorphoroid and Gastromycetoid Basidiomycetes, Vol.3. Nordsvamp, Copenhagen.
- Hjortstam, K., Larsson, K.-H., Ryvarde, L., 1988. The Corticiaceae of North Europe, Vol. 8. Fungiflora, Oslo.
- Huhtinen, S., 1989. A monograph of Hyaloscypha and allied genera. Karstenia 29, 45–252.
- International Mycological Association, 2017. Mycobank [WWW Document]. <http://www.mycobank.org/>.
- Knudsen, H., Vesterholt, J., 2008. Funga Nordica. Nordsvamp, Copenhagen.
- Miller, A.N., Huhndorf, S.M., Fournier, J., 2014. Phylogenetic relationships of five uncommon species of *Lasiosphaeria* and three new species in the Helminthosphaeriaceae (Sordariomycetes). Mycologia 106, 505–524. <https://doi.org/10.3852/13-223>
- Munk, A., 1957. Danish pyrenomycetes -A preliminary flora. Dansk Bot. Ark. 17, 1–491.
- Niemelä, T., 2005. Käävät, puiden sienet. Norrlinia 13, 1–320.
- Raitviir, A., 2004. Revised synopsis of the Hyaloscyphaceae. Scr. Mycol. 20, 1–132.
- Raitviir, A., Huhtinen, S., 2002. A few out of many -interesting inoperculate, lignicolous discomycetes from Norway. Folia Cryptogam. Est. 39, 13–26.
- Re, M., 2006. Molecular systematics of *Ceratostomella* sensu lato and morphologically similar fungi 98, 68–93.
- Royal Botanic Gardens Kew, Landcare Research-NZ, Chinese Academy of Science, 2017. Index fungorum [WWW Document]. [www.indexfungorum.org](http://www.indexfungorum.org).
- Sherwood, M.A., 1977. The Ostropalean fungi. Mycotaxon 5, 1–277.

# Morphological traits predict host-tree specialization in wood-inhabiting fungal communities

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## Supplementary Material 3

**TABLE 1** Kruskal-Wallis ANOVA chi-square test coefficients and P-values (df for all groups is 3) as well as P-values for Nemenyi pairwise comparisons of average species richness per log among the tree species for the total species richness and also separately for the fruitbody groups.

	Birch	Spruce	Pine	Birch	Spruce	Pine	Birch	Spruce	Pine
	All			Agaricoid			Discomycetoid		
	$\chi^2 = 17.602$ P < 0.001			$\chi^2 = 2.150$ P = 0.543			$\chi^2 = 94.978$ P < 0.001		
Spruce	0.390	-	-	0.890	-	-	<0.001	-	-
Pine	0.001	0.155	-	1.000	0.940	-	<0.001	0.990	-
Aspen	0.809	0.904	0.026	0.930	0.550	0.87	0.930	<0.001	<0.001
	Pileate			Pyrenomycetoid			Ramarioid		
	$\chi^2 = 69.800$ P < 0.001			$\chi^2 = 64.233$ P < 0.001			$\chi^2 = 7.7601$ P = 0.051		
Spruce	0.010	-	-	<0.001	-	-	0.056	-	-
Pine	0.000	<0.001	-	<0.001	0.984	-	0.720	0.468	-
Aspen	0.048	<0.001	0.461	0.268	<0.001	0.000	0.468	0.720	0.979
	Resupinate			Stromatoid					
	$\chi^2 = 19.879$ P < 0.001			$\chi^2 = 40.840$ P < 0.001					
Picea	0.012	-	-	0.0306	-	-			
Pinus	0.074	0.926	-	<0.001	0.448	-			
Populus	0.995	0.005	0.038	0.7908	0.001	<0.001			