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

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Abstract

Tree species is one of the most important determinants of wood-inhabiting fungal community composition, yet its relationship with fungal reproductive and dispersal traits remains poorly understood. We studied fungal communities (total of 657 species) inhabiting broadleaved and coniferous dead wood (total of 192 logs) in 12 semi-natural boreal forests. We utilized a trait-based hierarchical joint species distribution model to examine how the relationship between dead wood quality and species occurrence correlates with reproductive and dispersal morphological traits. Broadleaved trees had higher species richness than conifers, due to discomycetoids and pyrenomycetoids specializing in them. Resupinate and pileate species were generally specialized in coniferous dead wood. Fungi inhabiting broadleaved trees had larger and more elongated spores than fungi in conifers. Spore size was larger and spore shape more spherical in species occupying large dead wood units. These results indicate the selective effect of dead wood quality, visible not only in species diversity, but also in reproductive and dispersal traits.

Index descriptors: broadleaved, coniferous, dead wood, functional trait, fruit body, morphology, specialization, spore, tree species

INTRODUCTION

Functional traits in fungi can be defined as any morphological, physiological or phenological feature affecting the fitness of an individual fungus (Dawson et al., 2018). Knowledge of the relationship between species traits and species responses to environmental conditions provides understanding of the mechanisms influencing community assembly in different environments (McGill et al., 2006; Weiher et al., 2011). Although trait-based assessments of community-level responses in the fungal kingdom have lagged behind that of animal and plant communities, currently fungal ecological research is undergoing a proliferation of empirical and conceptual studies addressing this issue (Peay et al., 2008; Crowther et al., 2014; Aguilar-Trigueros et al., 2015; Dawson et al., 2018).

Wood-inhabiting fungi constitute a highly species-rich and functionally important group regulating nutrient cycling in forest ecosystems (Dowding, 1981; Boddy et al., 2008; Stokland et al., 2012; Kahl et al., 2017). Wood-inhabiting fungal communities strongly respond to changes in environmental variables such as climatic conditions (Lindblad, 2001; Heilmann-Clausen and Christensen, 2005; Boddy and Heilmann-Clausen, 2008; Bässler et al., 2010; Heilmann-Clausen et al., 2014; Pouska et al., 2017), resource quality (Renvall, 1995; Küffer et al., 2008; Abrego and Salcedo, 2013; Juutilainen et al., 2017) and habitat naturalness (Bader et al., 1995; Sippola and Renvall, 1999; Sippola et al., 2001; Lõhmus, 2011; Abrego and Salcedo, 2014). Given the strong responses of wood-inhabiting fungal communities to the environment and their high taxonomical and morphological diversity, many recent studies have focused on understanding how fungal functional diversity is influenced by environmental conditions (e.g. Abrego et al., 2017; Bässler et al., 2014; Caiafa et al., 2017; Calhim et al., 2018; Kausrud et al., 2011; Nordén et al., 2013; Norros et al., 2015).

Traits related to spore and fruit body morphology are among the very few traits that are comprehensively available for wood-inhabiting fungi (Dawson et al., 2018). In previous studies, these traits have been found to be important in determining the occurrences of fungal species on dead wood of different sizes and decay stages (Nordén et al., 2013; Abrego et al., 2017). In terms of fruit body morphology, wood-inhabiting fungal species with robust pileate and resupinate fruit bodies require large dead wood (Bässler et al., 2016; Abrego et al., 2017), while fungi with ramarioid fruit bodies and resupinate polypores are correlated with strongly decayed wood (Abrego et al., 2017). In terms of spore morphology, dead wood in advanced decay stages harbours more wood-inhabiting fungal species with thick-walled and ornamented spores (Abrego et al., 2017). The links between spore size and dead wood characteristics, however, remain unresolved. Nordén et al. (2013) found that spore size slightly decreased as log size increased, while Abrego et al. (2017) discovered that larger logs hold species with somewhat larger spores. The discrepancy in the results between the cited studies most likely arises from the differences in the taxonomical coverage and host-tree species.

Host-tree identity is an important determinant of the species composition of wood-inhabiting fungal communities (Lumley et al., 2001; Rajala et al., 2010; Krah et al., 2018b; Ordynets et al., 2018). In some cases, host-tree identity can determine wood-inhabiting fungal diversity more than microclimatic conditions and local dead wood amount or heterogeneity (Krah et al., 2018b). In general, broadleaved and coniferous dead trees hold quite distinct fungal communities, broadleaved trees being more species rich (Rajala et al., 2010; Stokland, 2012a; Abrego et al., 2016). According to Rajala et al. (2010), the higher species richness in broadleaved trees results from a higher diversity of Ascomycota. Despite the clear influence of host-tree species on wood-inhabiting fungal community composition, to our knowledge, the effect of host tree identity on the functional composition of wood-inhabiting fungal

communities has not been thoroughly investigated (but see Kauserud et al., 2008 for polypores).

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

The main aim of the present study is to evaluate how host-tree characteristics relate to the morphological composition of fruiting wood-inhabiting fungi. For this, we used an extensive dataset consisting of 657 species of non-lichenized fungi producing sexual fruit bodies. We surveyed large logs (base diameter > 15 cm) belonging to the four dominant tree species in Fennoscandian boreal forests (spruce, pine, birch and aspen) in 12 seminatural forest sites. More specifically, we determined how much of the variation in species occurrences is explained by the host-tree species and volume, and how much of the variation in community composition is explained by the morphological characteristics of the fruit bodies and spores.

We expected differences in trait composition to arise from the differences in the wood composition and distributional patterns of coniferous versus broadleaved trees. Coniferous and broadleaved wood differ in their chemical and physical characteristics, coniferous wood having generally higher amounts of toxic compounds for saproxylic organisms (Stokland, 2012a). In terms of distributional patterns, in Finnish boreal forests broadleaved trees are less abundant and show more clumped distributions than coniferous trees. Thus, the fungal species growing on each of the wood types should be well adapted to colonize and exploit the wood resources accordingly.

We hypothesized that the manner by which species exploit the wood resources is reflected in the morphological traits, as these may be linked to resource-use and dispersal strategies. Our main working hypotheses related to fruit body morphology are: (1) species producing small-sized fruit bodies, such as some Ascomycota, are most prevalent on broadleaved wood because unlike other fungi, they are able to decompose bark through soft rot, and bark is more abundant in decomposing broadleaved logs than in coniferous logs; (2) Agaricoids are most prevalent on broadleaved wood, because they have lignin-decomposing enzymes (causing white rot) which are especially efficient in exploiting wood of broadleaved trees (Krah et al., 2018a); (3) Species with pileate and resupinate fruit bodies are expected to be equally prevalent in broadleaved and coniferous logs, because these include lineages which equally well decompose cellulose and mostly occur on coniferous logs (i.e. brown-rot fungi), or mainly decompose lignin and mostly occur on broadleaved logs (i.e. white-rot fungi) (Krah et al., 2018a). Our working hypothesis about how spore morphology is linked to host tree is that (4) coniferous trees host species with smaller spores because their wood is easier to penetrate, compared to wood of broadleaved trees (Kauserud et al., 2008); and (5) broadleaved trees with clumped distributions in the forest landscape (e.g. aspen) also have species with small-sized spores, because they should be able to disperse longer distances (Norros et al., 2014).

MATERIALS AND METHODS

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 ≥ 15 cm), 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), that had died naturally, 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 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 fruit bodies on each study log. All fruit bodies 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 fruit body production (see Purhonen et al., 2017), two subsequent inspections were conducted for each log. The first inspection was performed between 21st of May and 6th of June, and the second between 20th of August and 26th 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 fruit bodies were identified to species in the field or collected for microscopic identification (about 7500 specimens collected). When 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 morphology (e.g. pyrenomycete sp1, sp2 etc.). Some of the classified taxa include multiple species (i.e. species complexes), as their taxonomy is still unresolved. The nomenclature follows Index Fungorum (Royal Botanic Gardens Kew et al., 2016).

Fungal trait data collection

The identified species were classified into seven groups according to their fruit body morphology; agaricoids were species having a soft pileus and stipe (also pleurotoid fungi were grouped here). We classified species with disc- to cup-shaped fruit bodies as discomycetoids. Pileates were species that grow as crusts over the log surface when young but the majority of the fruit body is a pileus or erected on the edges when adults. As pyrenomycetoids, we classified those fungi whose fruit bodies were individual round or flask shaped bags (i.e. perithecia). Ramarioids had fruit bodies with branched structure. As resupinates, we classified those species that mostly grow as a crust over the log surface, but some may be slightly pileate as well. Stromatoids were fungi whose fruit bodies were round or flask shaped bags embedded in a mass-like structure.

For the spore morphology, we gathered information about spore length, width and presence of ornamentation (meaning that the surface of the spore is not smooth but has some texture) from the literature. For those specimens that we could only identify to the genus level, but still recognize as unique taxa, we measured the spore size and noted the shape during the

identification procedure (see detailed trait variable data and literature used for the spore morphology in Supplementary Material 2).

To account for phylogenetic relationships between species, the phylogenetic relationships were estimated based on the taxonomic levels. As the data include a large number of poorly known species and species that are not yet described, it was not possible to use a quantitative phylogenetic tree. For each species, we included the taxonomic levels of the genus, family, order and class, using the Index Fungorum and Mycobank online databases (International Mycological Association, 2017; Royal Botanic Gardens Kew et al., 2017).

Statistical analyses

We analyzed the data with Hierarchical Modelling of Species Communities (HMSC; Ovaskainen et al., 2017). HMSC is a joint species distribution modelling framework (Warton et al., 2015) that enables the integration of data on species occurrences or abundances, environmental covariates, species traits and phylogenetic relationships, as well as the spatio-temporal nature of the study design (Ovaskainen et al., 2017).

In the HMSC analyses, the $n_y \times n_s$ response matrix \mathbf{Y} consisted of presence-absences of the $n_s = 657$ species observed in the $n_y = 192$ logs, called henceforth sampling units. We modelled \mathbf{Y} with probit-regression, including in the predictor matrix \mathbf{X} the environmental covariates of the tree species (categorical variable with four levels: aspen, birch, spruce and pine), the size of the dead wood unit (log-transformed volume), decay class (categorical variable with two levels: decay class 2; and decay classes 3 and 4 combined, as only four logs had decay class four), and the forest naturalness index. We modelled the mapping from \mathbf{X} to \mathbf{Y} as a function of species traits and phylogenetic relationships following Abrego et al. (2017) and Ovaskainen et al. (2017). We included in the matrix of species traits \mathbf{T} the fruit body morphology (categorical variable with seven levels: agaricoid, discomycetoid, pileate, pyrenomycetoid, ramarioid, resupinate, stromatoid), the presence of ornamentation on the spores (categorical variable with two levels: yes or no), spore shape (log-transformed ratio of length to width), and spore size (log-transformed volume). In the absence of a quantitative phylogeny, we followed Abrego et al. (2017) and used as a proxy for the phylogenetic correlation matrix \mathbf{C} a taxonomical correlation matrix, constructed from the five levels of class, order, family, genus and species, and assumed equal branch length for each level. As a community-level random effect, implemented through a latent variable approach (Ovaskainen et al., 2016, 2017), we included the study site, with 12 levels.

We fitted the model to the data using the HMSC-R package (Tikhonov et al., 2019). We assumed the default prior distributions, and sampled the posterior distribution for 150*thinning iterations, out of which the first 50*thinning iterations were discarded as burn-in. We used thinning=100 and thus run the MCMC chain for a total of 15,000 iterations. We assessed the convergence of the MCMC chain visually, and examining the convergence of the results between thinning=1, thinning=10, and thinning=100.

To examine host-tree specialization at the levels of species and functional groups, we used the fitted model to predict species occurrences to new sampling units that were standardized to be of average size and decay stage and consisted of each of the four host-tree species. To examine host-tree specialization at the species level, we used these predictions to classify the host-tree use of each fungal species to one of the following seven classes: generalist, coniferous generalist, spruce specialist, pine specialist, broadleaved generalist, birch specialist, and aspen specialist. We first classified the species as generalists, broadleaved species or coniferous species by asking whether the predicted mean occurrence probability over broadleaved trees (birch and aspen) was smaller or greater than that for coniferous trees (pine and spruce) with at least 95% posterior probability. We further classified the broadleaved

species as aspen specialists, birch specialists or broadleaved generalists by examining if the occurrence probability on aspen was smaller or greater than that for birch with at least 95% posterior probability. Similarly, we classified the coniferous species as spruce specialists, pine specialists and coniferous generalists.

To examine host-use specialization at the functional group level, we counted for each seven host-tree use classes the numbers of species belonging to each of the seven fruit body types. We then asked if a particular fruit body type was over- or underrepresented in a given host-tree type by conducting a randomization test, in which we randomly permuted the fruit body types among the species, and examined if the observed value was greater or smaller than the 95% quantile in 1000 randomizations. To examine the association among host-tree use and spore-related traits (presence of ornamentation and the shape and size of spores), we computed the posterior distributions of community-weighted mean traits for species predicted to occur on each of the four tree species.

RESULTS

Morphological traits and species richness

In total, we recorded 657 species, which occurred 5714 times (Supplementary Material 2). A large proportion of the species was resupinates (288 species, 44%), followed by discomycetes (148, 22.5%), agaricoids (73, 11%), pyrenomycetoids (71, 11%), pileates (49, 7%), stromatoids (18, 3%), and ramarioids (10, 1.5%).

Aspen dead wood had the highest fungal species richness (239 spp.), followed by birch (221), spruce (209) and pine (186). All tree species shared 68 species, on top of which the two broadleaved species shared 107 species, the two conifers shared 70, whereas all other combinations of coniferous and broadleaved tree species shared less than 20 fungal species. Discomycetoids, pyrenomycetoids, ramarioids and stromatoids had significantly higher species richness on broadleaved host trees than on conifers (Supplementary Material 3).

Spore size (volume) and shape (length/width) showed a weak but statistically significant negative association (in linear regression, $p=0.02$, $R^2=0.008$). While pyrenomycetoids had the largest and most elongated spores, agaricoids had large and spherical spores, whereas pileates and resupinates had the smallest spores (Fig. 1).

Effects of environmental variables on community composition

The fitted joint species distribution model explained 6% of the variation in the fungal community composition, as measured by the average Tjur (2009) R^2 value over the species. Of the variables included in the model, host-tree species was by far the most important one, as 71% of the explained variation in species occurrence was attributed to it. The percentages of explained variation attributed to other variables were 15% for log-characteristics (size and decay class), 5% for forest naturalness, and 9% for the random effect of the site. Considering only associations that had at least 95% posterior support, the occurrence probability of 86 species increased and of 0 species decreased with the size of the log, 16 species were most prevalent in decay class 3 and 11 species decay class 2, and the occurrence probability of 10 species increased and of 1 species decreased with the increasing value of the naturalness index.

Among the 293 species that occurred at least four times in the data, 66 were generalists, 95 broadleaved generalists, 30 birch specialists, 14 aspen specialists, 41 coniferous specialists, 27 spruce specialists and 20 pine specialists (Fig. 2).

Effects of morphological traits on the responses to the environment

The traits explained 7% of the variation in the species responses to the environmental variables. The posterior mean of the phylogenetic signal parameter ρ was 0.20 and its 95% credibility interval was [0.11, 0.35]. As the prior for ρ has probability mass of 0.5 at $\rho = 0$ (no phylogenetic signal) and the remaining probability is distributed evenly in [0, 1], the model revealed a moderate but statistically well supported phylogenetic signal in species responses to environmental covariates. In other words, phylogenetically (taxonomically) related species showed more similar responses to the environmental covariates than could be predicted solely based on their traits. We recorded a large number of non-random associations between host-tree use and fruit body type (Fig. 3). In particular, species with resupinate fruit bodies were typically conifer generalists, while species with pileate fruit bodies were often specific to spruce. Species with discomycetoid fruit bodies were typically broadleaved generalists, whereas species with pyrenomycetoid fruit bodies were often birch specialists.

The fungal species occurring on broadleaved dead wood had on the average larger spores than those occurring on coniferous dead wood (Fig. 4A). The fungal species occurring on aspen had the most elongated spores, whereas those occurring on spruce had the most spherical spores (Fig. 4B). The proportion of species with ornamented spores varied between 12% and 16% on all host trees, with birch having the largest and spruce the smallest proportion of species with ornamented spores (Fig. 4C). Larger logs had larger and more spherical spores, whereas smaller logs had smaller and more elongated spores (Fig. 4D-E). Spore ornamentation did not vary with log size (Fig. 4F).

DISCUSSION

Our study shows that the occurrence of fungal species in dead wood with different characteristics relates to the morphological traits of the fungal fruit bodies and sexual spores. While it is well known that many wood-inhabiting fungal species are specific to certain host-tree species (Stokland et al., 2004; Küffer et al., 2008; Berglund et al., 2011; Stokland, 2012a), to our knowledge, this is the first time that the importance of the fruit body and spore morphology in determining host-tree specialization is revealed. We next discuss in turn, how and why fruit body and spore morphology are linked to host-tree identity.

Specialization to host-tree species was related to fruit body morphology. In line with our hypothesis that species developing small-sized fruit bodies from the Ascomycota lineages are more prevalent on broadleaved wood, we found discomycetes to be specialized to broadleaved trees in general, and pyrenomycetes to birch in particular. This association may relate to the fact that broadleaved dead wood generally has a higher proportion of bark, which is decomposed most efficiently through the so called soft-rot carried out by some Ascomycota species (Stokland, 2012b). While we expected species with pileate and resupinate fruit bodies to be equally prevalent in broadleaved and coniferous wood, we found resupinate species to be specific to conifer tree species in general and pileates to spruce in particular. Because of the small-scale of our study (forests from central Finland), it remains to be tested by larger scale studies whether this is a general pattern in wood-inhabiting fungal communities.

Our results also revealed an association between host tree species and spore size. Fungal species on broadleaved trees had on average larger spores than those inhabiting conifers. This result is in line with Kausserud et al. (2008) who found that polypore species inhabiting broadleaved dead wood had significantly larger spores than species inhabiting coniferous dead wood. They speculated that because coniferous trees are evolutionary older, their wood is easier

to penetrate and thus colonizing spores do not need as much energy and inoculum potential as spores colonizing broadleaved trees. Our results show that this may also relate to the relationship between fruit body morphology and spore size, as pyrenomycetoids had on average the largest and most elongated spores, and they were also as a group specialized on broadleaved trees (birch in particular).

We expected aspen dead trees to have species with smaller spores, because these trees show clustered and isolated distributional patterns in the boreal forest landscape, and smaller spores are able to disperse larger distances (Norros et al., 2014). Yet, our results showed the opposite, the fungal species occurring on broadleaved dead wood having on average larger, and more specifically more elongated, spores. Some studies have suggested that spore elongation increases attachment to substrates (Ingold, 1965; Calhim et al., 2018). It remains to be tested what is the primary reason for larger spore size on species inhabiting broadleaved trees.

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 were more common on large logs, whereas species with elongated and small spores were more common on 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 (Eräjää et al., 2010; Abrego and Salcedo, 2013).

We did not find clear differences in spore ornamentation frequency between the tree species. This might be because the spore ornamentation is not likely to influence airborne dispersal substantially (Hussein et al., 2013). Instead, ornamentation 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). However, in our study 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). We note that we treated spore ornamentation as a categorical variable (classified as yes/no), and thus ignored the great variation of ornamentation types and their possible functional roles.

The vast majority of the variation in species occurrences at the level of logs was not explained by the fitted model. This result is in accordance with previous studies from temperate Europe (Bässler et al., 2012; Abrego et al., 2014, 2017), which concluded that random processes dominate in shaping wood-inhabiting fungal communities at small spatial scales. Most fungal species were rare (55% occurring three or fewer times), which is a common feature of ecological communities in which random processes dominate (White et al., 2006; Vellend, 2016). However, there might be many other variables we did not include, but which could have improved the models predictive power, such as microclimatic factors or direct measurements of wood composition such as C/N ratio. This result was also partially influenced by the fact that we conducted only two surveys, one in each of the peak fruiting season in boreal forests (Halme and Kotiaho, 2012; Abrego et al., 2016; Purhonen et al., 2017). Since many wood-inhabiting fungi have ephemeral fruit bodies, repeating surveys over several years in the peak fruiting seasons would have decreased the proportion of rare species and thus increased the

predictive power of our model. Also molecular surveys of mycelia might have decreased the proportion of rare species and increased predictability of their occurrence (e.g. Kubartová *et al.* 2012; Mäkipää *et al.* 2017). However, in comparison to molecular surveys, fruit body based surveys provide direct information about the “breeding” populations of fungi. As a large portion of the species groups in the present study is taxonomically poorly known, some of the results should be considered with caution. For example *Mollisia* sp., which shared several host-tree species, might indeed be specialized in different host trees (see also Runnel *et al.* 2014).

We found that broadleaved dead trees have higher species richness than coniferous dead trees. In particular, aspen hosted the highest and pine the lowest species richness. Higher species richness in broadleaved trees may result from the lack of defensive chemicals that conifer tree species have, making them easier to colonize and decay (Stokland, 2012a; Hoppe *et al.*, 2016). However, fungal fruiting patterns may differ between tree species, and thus to observe the true differences in species richness between tree species, fruit body surveys should be accompanied by molecular data of mycelia within wood. Furthermore, different tree species have different residence times, and thus the total species richness may be higher for tree species with longer life-span as a log.

Conclusions

Our study showed that the occurrence of fungal species in dead wood with different characteristics is related to the morphological traits of fungi. Our results also revealed that specialization to host-tree species occurs at the level of fruit body morphological groups, and that the size and shape of the fungal spores relate to the preference for logs of different sizes.

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REFERENCES

- Abrego, N., García-Baquero, G., Halme, P., Ovaskainen, O., Salcedo, I., 2014. Community turnover of wood-inhabiting fungi across hierarchical spatial scales. *PLoS One* 9, e103416. <https://doi.org/10.1371/journal.pone.0103416>
- Abrego, N., Halme, P., Purhonen, J., Ovaskainen, O., 2016. Fruit body based inventories in wood-inhabiting fungi: Should we replicate in space or time? *Fungal Ecol.* 20, 225–232. <https://doi.org/10.1016/j.funeco.2016.01.007>
- Abrego, N., Norberg, A., Ovaskainen, O., 2017. Measuring and predicting the influence of

- traits on the assembly processes of wood-inhabiting fungi. *J. Ecol.* <https://doi.org/10.1111/1365-2745.12722>
- Abrego, N., Salcedo, I., 2014. Response of wood-inhabiting fungal community to fragmentation in a beech forest landscape. *Fungal Ecol.* 8, 18–27. <https://doi.org/10.1016/j.funeco.2013.12.007>
- Abrego, N., Salcedo, I., 2013. Variety of woody debris as the factor influencing wood-inhabiting fungal richness and assemblages: Is it a question of quantity or quality? *For. Ecol. Manage.* 291, 377–385. <https://doi.org/10.1016/j.foreco.2012.11.025>
- Aguilar-Trigueros, C.A., Hempel, S., Powell, J.R., Anderson, I.C., Antonovics, J., Bergmann, J., Cavagnaro, T.R., Chen, B., Hart, M.M., Klironomos, J., Petermann, J.S., Verbruggen, E., Veresoglou, S.D., Rillig, M.C., 2015. Branching out: Towards a trait-based understanding of fungal ecology. *Fungal Biol. Rev.* 29, 34–41. <https://doi.org/10.1016/j.fbr.2015.03.001>
- Ahti, T., Hämet-Ahti, L., Jalas, J., 1968. Vegetation zones and their sections in northwestern Europe. *Ann. Bot. Fenn.* 5, 169–211.
- Bader, P., Jansson, S., Jonsson, B.G., 1995. Wood-inhabiting fungi and substratum decline in selectively logged boreal spruce forests. *Biol. Conserv.* 72, 355–362. [https://doi.org/10.1016/0006-3207\(94\)00029-P](https://doi.org/10.1016/0006-3207(94)00029-P)
- Bässler, C., Ernst, R., Cadotte, M., Heibl, C., Müller, J., 2014. Near-to-nature logging influences fungal community assembly processes in a temperate forest. *J. Appl. Ecol.* 51, 939–948. <https://doi.org/10.1111/1365-2664.12267>
- Bässler, C., Müller, J., Cadotte, M.W., Heibl, C., Bradtka, J.H., Thorn, S., Halbwachs, H., Forest, B., Park, N., Str, F., 2016. Functional response of lignicolous fungal guilds to bark beetle deforestation. *Ecol. Indic.* 65, 149–160. <https://doi.org/10.1016/j.ecolind.2015.07.008>
- Bässler, C., Müller, J., Dziock, F., Brandl, R., 2010. Effects of resource availability and climate on the diversity of wood-decaying fungi. *J. Ecol.* 98, 822–832. <https://doi.org/10.1111/j.1365-2745.2010.01669.x>
- Bässler, C., Müller, J., Svoboda, M., Lepšová, A., Hahn, C., Holzer, H., Pouska, V., 2012. Diversity of wood-decaying fungi under different disturbance regimes-A case study from spruce mountain forests. *Biodivers. Conserv.* 21, 33–49. <https://doi.org/10.1007/s10531-011-0159-0>
- Berglund, H., Hottola, J., Penttilä, R., Siitonen, J., 2011. Linking substrate and habitat requirements of wood-inhabiting fungi to their regional extinction vulnerability. *Ecography (Cop.)*. 34, 864–875. <https://doi.org/10.1111/j.1600-0587.2010.06141.x>
- Boddy, L., Frankland, J.C., van West, P. (Eds.), 2008. *Ecology of saprotrophic basidiomycetes*. Elsevier Ltd, London.
- Boddy, L., Heilmann-Clausen, J., 2008. Basidiomycete community development in temperate angiosperm wood, in: Boddy, L., Frankland, J.C., van West, P. (Eds.), *Ecology of Saprotrophic Basidiomycetes*. Elsevier, London, pp. 211–237.
- Caiafa, M. V., Gómez-Hernández, M., Williams-Linera, G., Ramírez-Cruz, V., 2017. Functional diversity of macromycete communities along an environmental gradient in a Mexican seasonally dry tropical forest. *Fungal Ecol.* 28, 66–75. <https://doi.org/10.1016/j.funeco.2017.04.005>
- Cajander, A.K., 1949. Forest types and their significance. *Acta For. Fenn.* 56, 1–69.
- Calhim, S., Halme, P., Petersen, J.H., Læssøe, T., Bässler, C., Heilmann-Clausen, J., 2018. Fungal spore diversity reflects substrate-specific deposition challenges. *Sci. Rep.* 8, 1–9. <https://doi.org/10.1038/s41598-018-23292-8>
- Crowther, T.W., Maynard, D.S., Crowther, T.R., Peccia, J., Smith, J.R., Bradford, M. a, 2014. Untangling the fungal niche: the trait-based approach. *Front. Microbiol.* 5, 579.

- <https://doi.org/10.3389/fmicb.2014.00579>
- Dawson, S.K., Boddy, L., Halbwegs, H., Bässler, C., Crowther, T.W., Heilmann-Clausen, J., Nordén, J., Ovaskainen, O., Jönsson, M., 2018. Handbook for standardised measurement of macrofungal functional traits; a start with basidiomycete wood fungi. *Funct. Ecol.* doi: 10.1111/1365-2435.13239. <https://doi.org/10.1111/1365-2435.13239>
- Dowding, P., 1981. Nutrient uptake and allocation during substrate exploitation by fungi, in: Wicklow, D.T., Carroll, G.C. (Eds.), *The Fungal Community. Its Organization and Role in the Ecosystems*. Marcel Dekker Inc, New York, pp. 612–636.
- Edman, M., Kruys, N., Jonsson, B.G., 2004. Local Dispersal Sources Strongly Affect Colonization Patterns of Wood-Decaying Fungi on Spruce Logs. *Ecol. Appl.* 14, 893–901.
- Eräjää, S., Halme, P., Kotiaho, J.S., Markkanen, A., Toivanen, T., 2010. The volume and composition of dead wood on traditional and forest fuel harvested clear-cuts. *Silva Fenn.* 44, 203–211. <https://doi.org/10.14214/sf.150>
- Esseen, P.A., Ehnström, B., Ericson, L., Sjöberg, K., 1997. Boreal forests. *Ecol. Bull.* 46, 16–47.
- Grime, J.P., 1988. The C-S-R model of primary plant strategies – origins, implications and tests, in: Gottlieb, L.D., Jain, S. (Eds.), *Plant Evolutionary Biology*. Chapman and Hall, London, pp. 371–393.
- Halbwegs, H., Brandl, R., Bässler, C., 2015. Spore wall traits of ectomycorrhizal and saprotrophic agarics may mirror their distinct lifestyles. *Fungal Ecol.* 17, 197–204. <https://doi.org/10.1016/j.funeco.2014.10.003>
- Halme, P., Kotiaho, J.S., 2012. The importance of timing and number of surveys in fungal biodiversity research. *Biodivers. Conserv.* 21, 205–219. <https://doi.org/10.1007/s10531-011-0176-z>
- Heilmann-Clausen, J., Aude, E., van Dort, K., Christensen, M., Piltaver, A., Veerkamp, M., Walley, R., Siller, I., Standovár, T., Ódor, P., 2014. Communities of wood-inhabiting bryophytes and fungi on dead beech logs in Europe - reflecting substrate quality or shaped by climate and forest conditions? *J. Biogeogr.* 41, 2269–2282. <https://doi.org/10.1111/jbi.12388>
- Heilmann-Clausen, J., Christensen, M., 2005. Wood-inhabiting macrofungi in Danish beech-forests? conflicting diversity patterns and their implications in a conservation perspective. *Biol. Conserv.* 122, 633–642. <https://doi.org/10.1016/j.biocon.2004.10.001>
- Hoppe, B., Purahong, W., Wubet, T., Kahl, T., Bauhus, J., Arnstadt, T., Hofrichter, M., Buscot, F., Krüger, D., 2016. Linking molecular deadwood-inhabiting fungal diversity and 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., Borken, 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. Aphyllophoroid fungi of Finland. A checklist with ecology, distribution, and threat categories. *Norrinia* 19, 1–223.
- Krah, F.S., Bässler, C., Heibl, C., Soghigian, J., Schaefer, H., Hibbett, D.S., 2018a. Evolutionary dynamics of host specialization in wood-decay fungi. *BMC Evol. Biol.* 18, 1–13. <https://doi.org/10.1186/s12862-018-1229-7>
- Krah, F.S., Seibold, S., Brandl, R., Baldrian, P., Müller, J., Bässler, C., 2018b. Independent effects of host and environment on the diversity of wood-inhabiting fungi. *J. Ecol.* 1–15. <https://doi.org/10.1111/1365-2745.12939>
- Kruys, N., Fries, C., Jonsson, B.G., Lämås, T., Ståhl, G., 1999. Wood-inhabiting cryptogams on dead Norway spruce (*Picea abies*) trees in managed Swedish boreal forests. *Can. J. For. Res.* 29, 178–186. <https://doi.org/10.1139/x98-191>
- Kubartová, A., Ottosson, E., Dahlberg, A., Stenlid, J., 2012. Patterns of fungal communities among and within decaying logs, revealed by 454 sequencing. *Mol. Ecol.* 21, 4514–4532. <https://doi.org/10.1111/j.1365-294X.2012.05723.x>
- Küffer, N., Gillet, F., Senn-Irlet, B., Aragno, M., Job, D., 2008. Ecological determinants of fungal diversity on dead wood in European forests. *Fungal Divers.* 30, 83–95.
- Lindblad, I., 2001. Diversity of poroid and some corticoid wood-inhabiting fungi along the rainfall gradient in tropical forests, Costa Rica. *J. Trop. Ecol.* 17, 353–369.
- Löhmus, A., 2011. Silviculture as a disturbance regime: The effects of clear-cutting, planting and thinning on polypore communities in mixed forests. *J. For. Res.* 16, 194–202. <https://doi.org/10.1007/s10310-011-0256-7>
- Lumley, T.C., Gignac, L.D., Currah, R.S., 2001. Microfungus communities of white spruce and trembling aspen logs at different stages of decay in disturbed and undisturbed sites in the boreal mixedwood region of Alberta. *Can. J. Bot.* 79, 76–92. <https://doi.org/10.1139/cjb-79-1-76>
- Mäkipää, R., Rajala, T., Schigel, D., Rinne, K.T., Pennanen, T., Abrego, N., Ovaskainen, O., 2017. Interactions between soil- and dead wood-inhabiting fungal communities during the decay of Norway spruce logs. *ISME J.* 11, 1964–1974. <https://doi.org/10.1038/ismej.2017.57>
- McGill, B.J., Enquist, B.J., Weiher, E., Westoby, M., 2006. Rebuilding community ecology from functional traits. *Trends Ecol. Evol.* 21, 178–185. <https://doi.org/10.1016/j.tree.2006.02.002>
- Nordén, J., Penttilä, R., Siitonen, J., Tomppo, E., Ovaskainen, O., 2013. Specialist species of wood-inhabiting fungi struggle while generalists thrive in fragmented boreal forests. *J. Ecol.* 101, 701–712. <https://doi.org/10.1111/1365-2745.12085>
- Norros, V., Karhu, E., Nordén, J., Vähätalo, A. V., Ovaskainen, O., 2015. Spore sensitivity to sunlight and freezing can restrict dispersal in wood-decay fungi. *Ecol. Evol.* 5, 3312–3326. <https://doi.org/10.1002/ece3.1589>
- Norros, V., Rannik, Ü., Hussein, T., Petäjä, T., Vesala, T., Ovaskainen, O., 2014. Do small spores disperse further than large spores? *Ecology* 95, 1612–1621. <https://doi.org/10.1890/13-0877.1>
- Ordynets, A., Heilmann-Clausen, J., Savchenko, A., Bässler, C., Volobuev, S., Akulov, O.,

- Karadelev, M., Kotiranta, H., Saitta, A., Langer, E., Abrego, N., 2018. Do plant-based biogeographical regions shape aphylloroid fungal communities in Europe? *J. Biogeogr.* 45, 1182–1195. <https://doi.org/10.1111/jbi.13203>
- Ottosson, E., Kubartova, A., Edman, M., Jönsson, M., Lindhe, A., Stenlid, J., Dahlberg, A., 2015. Diverse ecological roles within fungal communities in decomposing logs of *Picea abies*. *FEMS Microbiol. Ecol.* 91, 1–13. <https://doi.org/10.1093/femsec/fiv012>
- Ovaskainen, O., Abrego, N., Halme, P., Dunson, D., 2016. Using latent variable models to identify large networks of species-to-species associations at different spatial scales. *Methods Ecol. Evol.* 7, 549–555. <https://doi.org/10.1111/2041-210X.12501>
- Ovaskainen, O., Tikhonov, G., Norberg, A., Guillaume Blanchet, F., Duan, L., Dunson, D., Roslin, T., Abrego, N., 2017. How to make more out of community data? A conceptual framework and its implementation as models and software. *Ecol. Lett.* 20, 561–576. <https://doi.org/10.1111/ele.12757>
- Peay, K.G., Kennedy, P.G., Bruns, T.D., 2008. Fungal community ecology: A hybrid beast with a molecular master. *Bioscience* 58, 799–810.
- Pouska, V., Macek, P., Zibarová, L., Ostrow, H., 2017. How does the richness of wood-decaying fungi relate to wood microclimate? *Fungal Ecol.* 27, 178–181. <https://doi.org/10.1016/j.funeco.2016.06.006>
- Purhonen, J., Huhtinen, S., Kotiranta, H., Kotiaho, J.S., 2017. Detailed information on fruiting phenology provides new insights on wood-inhabiting fungal detection. *Fungal Ecol.* 27, 175–177. <https://doi.org/10.1016/j.funeco.2016.06.007>
- Rajala, T., Peltoniemi, M., Pennanen, T., Mäkipää, R., 2010. Relationship between wood-inhabiting fungi determined by molecular analysis (denaturing gradient gel electrophoresis) and quality of decaying logs. *Can. J. For. Res.* 40, 2384–2397. <https://doi.org/10.1139/X10-176>
- Renvall, P., 1995. Community structure and dynamics of wood-rotting Basidiomycetes on decomposing conifer trunks in northern Finland. *Karstenia* 35, 1–51.
- Royal Botanic Gardens Kew, Landcare Research-NZ, Chinese Academy of Science, 2017. Index fungorum [WWW Document]. www.indexfungorum.org.
- Royal Botanic Gardens Kew, Landcare Research-NZ, Chinese Academy of Science, 2015. Index Fungorum [WWW Document]. www.indexfungorum.org.
- Runnel, K., Pöldmaa, K., Lõhmus, A., 2014. “Old-forest fungi” are not always what they seem: The case of *Antrodia crassa*. *Fungal Ecol.* 9, 27–33. <https://doi.org/10.1016/j.funeco.2014.02.006>
- Ruokolainen, A., Shorohova, E., Penttilä, R., Kotkova, V., Kushnevskaia, H., 2018. A continuum of dead wood with various habitat elements maintains the diversity of wood-inhabiting fungi in an old-growth boreal forest. *Eur. J. For. Res.* <https://doi.org/10.1007/s10342-018-1135-y> <https://doi.org/10.1007/s10342-018-1135-y>
- Siitonen, J., 2001. Forest management, coarse woody debris and saproxylic organisms: Fennoscandian boreal forests as an example. *Ecol. Bull.* 49, 11–41.
- Sippola, A.-L., Lehesvirta, T., Renvall, P., 2001. Effect of selective logging on coarse woody debris and diversity of wood-decaying polypores in eastern Finland. *Ecol. Bull.* 49, 243–254.
- Sippola, A.L., Renvall, P., 1999. Wood-decomposing fungi and seed-tree cutting: A 40-year perspective. *For. Ecol. Manage.* 115, 183–201. [https://doi.org/10.1016/S0378-1127\(98\)00398-3](https://doi.org/10.1016/S0378-1127(98)00398-3)
- Stokland, J.N., 2012a. Host-tree associations, in: Stokland, J.N., Siitonen, J., Jonsson, B.G. (Eds.), *Biodiversity in Dead Wood*. Cambridge University Press, Cambridge, pp. 82–109.
- Stokland, J.N., 2012b. Wood decomposition, in: Stokland, J.N., Siitonen, J., Jonsson, B.G. (Eds.), *Biodiversity in Dead Wood*. Cambridge University Press, Cambridge, pp. 10–28.

- Stokland, J.N., Siitonen, J., Jonsson, B.G., 2012. Biodiversity on dead wood. Cambridge University Press, Cambridge.
- Stokland, J.N., Tomter, S.M., Söderberg, U., 2004. Development of dead wood indicators for biodiversity monitoring: experiences from Scandinavia, in: Marchetti, M. (Ed.), *Monitoring and Indicators of Forest Biodiversity in Europe, from Ideas to Operationality*. EFI-Proceedings No. 51, pp. 207–226.
- Tikhonov, G., Opedal, Ø., Lehtikoinen, A., Ovaskainen, O., 2019. Joint species distribution modelling with HMSC-R. *bioRxiv*.
- Tjur, T., 2009. Coefficients of determination in logistic regression models - A new proposal: The coefficient of discrimination. *Am. Stat.* 63, 366–372. <https://doi.org/10.1198/tast.2009.08210>
- Vellend, M., 2016. *The theory of ecological communities*. Princeton University Press, New Jersey.
- Warton, D.I., Blanchet, F.G., O'Hara, R.B., Ovaskainen, O., Taskinen, S., Walker, S.C., Hui, F.K.C., 2015. So Many Variables: Joint Modeling in Community Ecology. *Trends Ecol. Evol.* 30, 766–779. <https://doi.org/10.1016/j.tree.2015.09.007>
- Weiher, E., Freund, D., Buntun, T., Stefanski, A., Lee, T., Bentivenga, S., 2011. Advances, challenges and a developing synthesis of ecological community assembly theory. *Philos. Trans. R. Soc. B Biol. Sci.* 366, 2403–2413. <https://doi.org/10.1098/rstb.2011.0056>
- White, E.P., Adler, P.B., Lauenroth, W.K., Gill, R.A., Greenberg, D., Kaufman, D.M., Rassweiler, A., Rusak, J.A., Smith, M.D., Steinbeck, J.R., Waide, R.B., Yao, J., 2006. A comparison of the species time relationship across ecosystems and taxonomic groups. *Oikos* 112, 185–195. <https://doi.org/10.1111/j.0030-1299.2006.14223.x>

Figures:

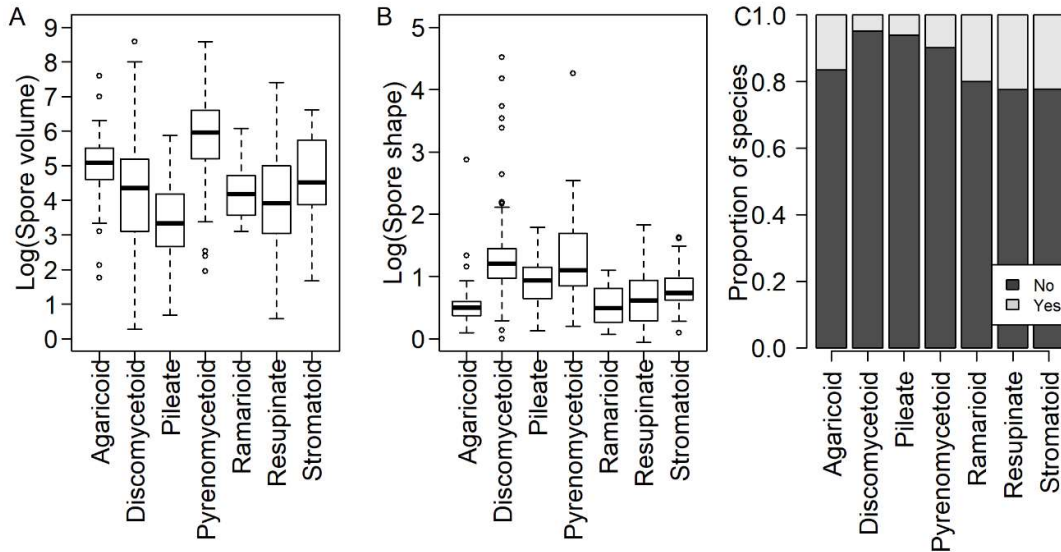


Fig. 1 Relationship between spore morphological traits and fruit body types. The relationship between (A) the fruit body type and spore volume, (B) spore shape, (C) and spore ornamentation.

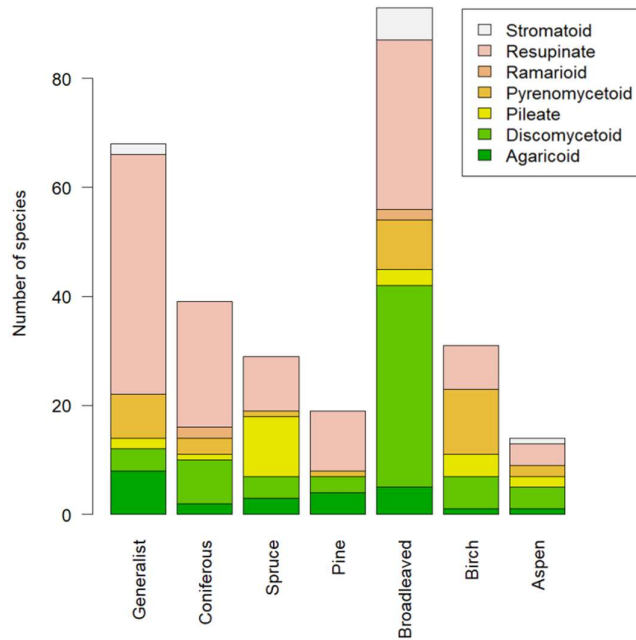


Fig. 2 Numbers of host-tree generalist and specialist fungal species. The bars show the numbers of fungal species classified to the seven host-tree specialization classes, with colours representing different fruit body types. Note that the figure includes only those species that occur at least four times in the data, as reliable classification for host-tree specialization is not possible for rare species.

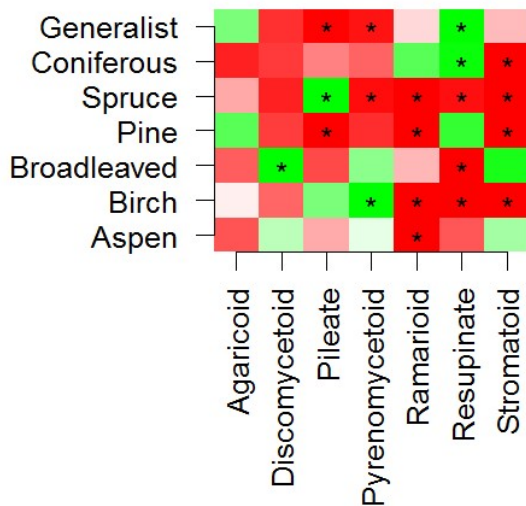


Fig. 3 Host-tree specialization-level of fungi with different fruit body types. Green colours (respectively, red colours) indicate that the fungal species groups have a given host-tree classification more often (respectively, less often) than expected by chance, the asterisks indicating those results that are supported by at least 95% posterior probability. Note that this analysis is restricted to those species that occur at least 4 times in the data.

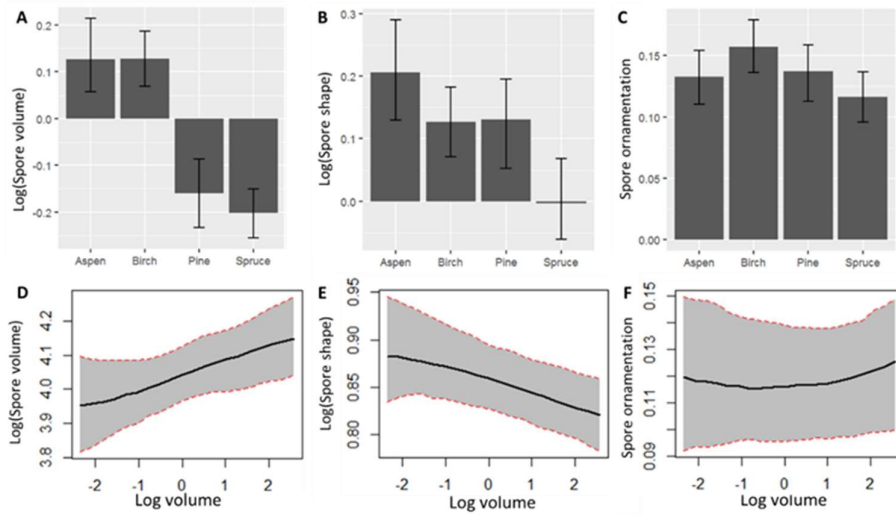


Fig. 4 Community-weighted mean spore trait values for (A-C) different host-tree species and for (D-F) logs of different sizes. The first column shows the mean spore volume, the second column shows the mean spore shape, and the third column shows the mean proportions of species with ornamented spores. The error bars (A-C) and shaded areas (D-F) show the 95% credibility interval.

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

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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 (m³/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 fruit body type (7 categories, see Methods), spore volume (μm^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>Amylocorticium</i> <i>cremeoisabellinum</i>	Resupinate	57.73	1.71	No	-	-	-	1	1
<i>Amylocorticium</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>Annulohyoxylon</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 joanea</i>	Discomycetoid	71.57	4.63	No	-	-	-	1	1
<i>Arachnopeziza sp nov</i>	Discomycetoid	105.85	4.84	No	-	-	-	1	1
<i>Arachnopeziza sp1.</i>	Discomycetoid	226.19	4.50	No	-	1	1	-	2
<i>Arachnopeziza sp3.</i>	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 coll</i>	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>Basidiodendron caesiocinereum</i>	Resupinate	453.96	0.94	Yes	2	6	1	-	9
<i>Basidiodendron 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 sp1.</i>	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 complex</i>	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 cf mansonii</i>	Pyrenomycetoid	1256.64	1.60	No	-	-	1	-	1
<i>Capronia cf pilosella</i>	Pyrenomycetoid	337.57	2.26	No	4	5	3	8	20
<i>Capronia cf 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 cf 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>Cerioporus leptocephalus</i>	Pileate	74.32	2.30	No	-	-	-	2	2
<i>Cerioporus 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</i> sp nov	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</i> sp1.	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</i> sp1.	Discomycetoid	381.70	5.33	No	-	-	1	1	2
<i>Cyathicula</i> sp2.	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</i> sp1.	Discomycetoid	954.26	1.67	No	-	-	1	-	1
<i>Dacrymyces</i> sp2.	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 stylifera</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 vikkultorum</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>Hypoxylon fuscum</i>	Stromatoid	447.97	2.08	No	1	-	-	-	1
<i>Hypoxylon 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 spl.	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 leptocephala</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>Mycocacia aurea</i>	Resupinate	10.82	2.57	No	-	-	2	-	2
<i>Mycocacia 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 ligneola</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>Orbilina auricolor</i>	Discomycetoid	4.64	14.00	No	-	-	-	2	2
<i>Orbilina delicatula</i>	Discomycetoid	1.78	2.27	Yes	30	40	29	23	122
<i>Orbilina</i> sp1.	Discomycetoid	2.54	7.67	No	16	1	1	12	30
<i>Orbilina</i> sp2.	Discomycetoid	6.28	8.00	No	3	-	-	1	4
<i>Orbilina</i> sp3.	Discomycetoid	17.49	2.09	No	4	2	-	9	15
<i>Orbilina</i> sp4.	Discomycetoid	3.80	3.64	No	7	5	2	10	24
<i>Orbilina</i> sp5.	Discomycetoid	8.03	5.92	No	1	-	-	1	2
<i>Orbilina</i> sp6.	Discomycetoid	1.31	4.86	No	5	-	-	3	8
<i>Orbilina</i> sp7.	Discomycetoid	38.84	7.21	No	1	1	-	2	4
<i>Orbilina</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 femsjoeensis</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>Protoungicularia 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 himantioides</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</i> aff binucleosporum	Resupinate	7.59	2.15	No	-	-	2	-	2
<i>Sistotrema</i> aff farinaceum	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 amorpha</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 stuposa</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</i> sp1.	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 congregata</i>	Pyrenomycetoid	10.93	1.22	No	-	1	-	-	1
<i>Vararia investiens</i>	Resupinate	82.96	3.08	No	1	-	-	-	1
<i>Veluticeps abietina</i>	Pileate	174.95	2.44	No	-	3	-	-	3
<i>Xenasma pulverulentum</i>	Resupinate	282.74	1.67	Yes	-	-	-	1	1
<i>Xenasma rimicola</i>	Resupinate	306.80	1.60	Yes	-	-	-	1	1
<i>Xenasma tulasnellodeum</i>	Resupinate	87.47	1.22	Yes	-	-	-	2	2
<i>Xenasmatella borealis</i>	Resupinate	45.63	1.69	Yes	-	-	1	-	1
<i>Xenasmatella subflavidocrisea</i>	Resupinate	15.90	1.78	Yes	-	-	1	-	1
<i>Xenasmatella vaga</i>	Resupinate	74.48	1.24	Yes	14	12	18	11	55
<i>Xenolachne longicornis</i>	Discomycetoid	87.11	3.23	No	-	-	1	1	2
<i>Xeromphalina campanella</i>	Agaricoid	67.35	2.00	No	-	1	1	-	2
<i>Xeromphalina picta</i>	Agaricoid	119.28	1.67	No	1	-	-	-	1
<i>Xylodon asperus</i>	Resupinate	60.75	1.47	No	3	6	6	6	21
<i>Xylodon borealis</i>	Resupinate	55.22	1.33	No	-	-	-	1	1
<i>Xylodon brevisetus</i>	Resupinate	37.33	1.38	No	5	32	26	3	66
<i>Xylodon detriticus</i>	Resupinate	74.48	1.24	No	2	-	-	7	9
<i>Xylodon nespori</i>	Resupinate	20.87	2.33	No	-	-	1	-	1
<i>Xylodon radula</i>	Resupinate	74.66	2.77	No	2	1	-	-	3
<i>Xylodon rimosissimus</i>	Resupinate	60.75	1.47	No	-	1	-	2	3
<i>Xylodon 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., Marincowitz, S., Spatafora, J.W., Schoch, C.L., 2009. A molecular phylogenetic reappraisal of the Hysteriaceae, Mytilinidiaceae and Gloniaceae (Pleosporomycetidae, Dothideomycetes) with keys to world species. *Stud. Mycol.* 64, 49–83S3. <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, Aphyllophoroid 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. Norrlinna 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.
- 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 fruit body 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			