

ARTICLES

Major Wood-Decay Fungal Groups Have Distinct Occurrence Patterns on Woody Substrates

PANU KUNTTU^{1*}, KAISA JUNNINEN², MATTI KULJU³ AND JARI KOUKI¹

¹ University of Eastern Finland, School of Forest Sciences, P.O. Box 111, FI-80101, Joensuu, Finland

² Metsähallitus Parks & Wildlife Finland, c/o UEF/Borealis, P.O. Box 111, FI-80101, Joensuu, Finland

³ Biodiversity Unit P.O. Box 3000, FI-90014 University of Oulu, Finland

* Corresponding author: panu.kunttu@iki.fi

Kunttu, P., Junninen, K., Kulju, M. and Kouki, J. 2018. Major Wood-Decay Fungal Groups Have Distinct Occurrence Patterns on Woody Substrates. *Baltic Forestry* 24(2): 164-180.

Abstract

Conservation of wood-inhabiting fungi requires sufficient knowledge of their occurrences on woody substrates. We studied and compared two major wood-decay fungal groups (polypores and corticioids) on dead wood. Eight fungal or substrate groups were separated in the analyses. In total, 6,102 dead wood units were surveyed, and 5,682 occurrences of 302 fungal species were recorded. Our analyses included also empty dead wood units, which is rather rare in quantitative ecological studies of dead wood species. In general, the occurrence of fungal species did not exactly follow the availability of dead wood substrates, indicating high importance of substrate quality on species. Furthermore, polypores and corticioids differed from each other in their substrate occurrence patterns. The largest differences were found in diameter classes, corticioids occurring more often on small dead wood units. Our findings emphasize the importance of maintaining the variation in dead wood quality when preserving the diversity of wood-inhabiting fungi.

Keywords: aphylophoroid fungi, corticioids, dead wood, habitat preferences, kelo tree, polypores, species assemblages, wood-inhabiting fungi, woody debris

Introduction

Since the recognition of dead wood as an important substrate for forest biodiversity (Essen et al. 1997, Siitonen 2001, Stokland et al. 2004, Jonsson et al. 2005), numerous studies have focused on the ecology and substrate requirements of dead-wood-inhabiting species. One of the most studied groups is fungi, especially polypores (reviewed by Junninen and Komonen, 2011), while the occurrence of other major wood-decay fungi, such as corticioids, has been studied much less (but see Penttilä and Kotiranta 1996, Küffer and Senn-Irlet 2005, Küffer et al. 2008, Juutilainen et al. 2011).

From the biodiversity conservation point of view, it is essential to know the habitat factors affecting these species. On a stand-scale, several factors are likely to be important, including age of the forest, successional stage,

management history, size and connectivity of forest patches, tree species composition and amount and quality of dead wood (Junninen et al. 2006, Stokland and Larsson 2011, Yli-Sirniö et al. 2012, Magnusson et al. 2014). Also, on the tree level several dead wood factors are known to affect the occurrence of wood-inhabiting (polypore) fungi. For example, tree decay stage, tree species, size and type of the dead wood units are known to affect species-richness and abundance of wood-decay fungi (Høiland and Bendiksen 1997, Sippola and Renvall 1999, Heilmann-Clausen and Christensen 2004, Yli-Sirniö et al. 2012).

Despite many studies, comparative studies containing quantitative data on wood-inhabiting fungi other than polypores are still rather rare. For example, polypores and corticioids have often been analysed together as one group (e.g. Penttilä and Kotiranta 1996, Heilmann-Clausen 2001, Juutilainen et al. 2011), and thus the group-

specific distribution patterns are not clear. If any differences between their occurrence exists, this would suggest that polypores and corticioids have different roles in wood decomposition and, consequently, also their roles in ecosystem functioning may differ. Polypores and corticioids were chosen as focal taxa, since they play an ecologically valuable role in dead wood and they have an important role as indicator species. Furthermore, conservation issues are topical based on the results of their Red List evaluation.

In general, different fungi have a different role in wood decay process (Hakala et al. 2004, Fukasawa et al. 2011, Rajala et al. 2015). Since wood decay is related to the availability of dead wood to other organisms and also to carbon release from forest ecosystem (Janisch and Harmon 2002), more specific knowledge is needed not only for biodiversity conservation but also to build more accurate ecosystem-level models (see also Venugopal et al. 2016b).

The species-specific occurrence patterns of fungi on different substrates have usually been documented in identification books (e.g. Niemelä 2005, Bernicchia and Gorjón 2010). Unfortunately, these data are based on highly descriptive observations. In general, it is a notable shortage in ecological studies of dead wood species that null records or uninhabited substrates and microhabitats are dismissed. For this reason, it is almost impossible to document habitat associations reliably. It is often possible that some specific substrates have not been studied at all, and this explains why they are not reported as potential substrates for a species.

In this study, we explored substrates of two groups of wood decay fungi: polypores and corticioids. Our overall aim was to analyse if these two groups have similar ecological roles in relation to dead wood substrates. We (1) compared the occurrence of the mentioned two fungal groups among all surveyed dead wood units, with special emphasis on the species of conservation concern. Our

data include also null records, i.e. “empty” dead wood units. “Empty” dead wood units can maintain fungal hyphae, but units were lacking visible sporocarps at the moment of the survey. Our second (2) specific objective was to find out if polypores and corticioids as groups differ on their substrate requirements.

Materials and Methods

Study area

We selected 27 islands (Figure 1) from the eastern part of the Archipelago Sea within the Baltic Sea (approx. 60° N, 22° E; 0–42 m a.s.l.), based on their size, dominant forest habitat type and location in the archipelago zone of Finland (Kunttu et al. 2015a).

The forests in the study area were dominated by Scots pine (*Pinus sylvestris* L.), black alder (*Alnus glutinosa* (L.) Gaertn.) and downy birch (*Betula pubescens* Ehrh.). Also, Norway spruce (*Picea abies* (L.) Karst.), aspen (*Populus tremula* L.), common hazel (*Corylus avellana* L.), and rowan (*Sorbus aucuparia* L.) occurred fairly commonly. Silver birch (*Betula pendula* Roth) grows in the middle archipelago zone, but not in the outer zone. Forest habitat types included herb-rich forests, mesic heath forests, xeric heath forests and barren heath forests (Kunttu et al. 2015a).

The study area was situated in the hemiboreal zone (Ahti et al. 1968). In the study area, the length of the growing is on average 191 days and the temperature sum is 1,250–1,300 (Kersalo and Pirinen 2009). The mean annual temperature is +6.5 °C, and the annual precipitation 549 mm. The prevailing winds blow from the southwest (20%) (Pirinen et al. 2012). The islands consist mainly of gneiss and granite bedrock with soil layers of moraine, sand or gravel deposition (Anon. 2015). The recorded number of aphylloroid species in the Archipelago Sea National Park comprises 303 species (Kunttu et al. 2015b).

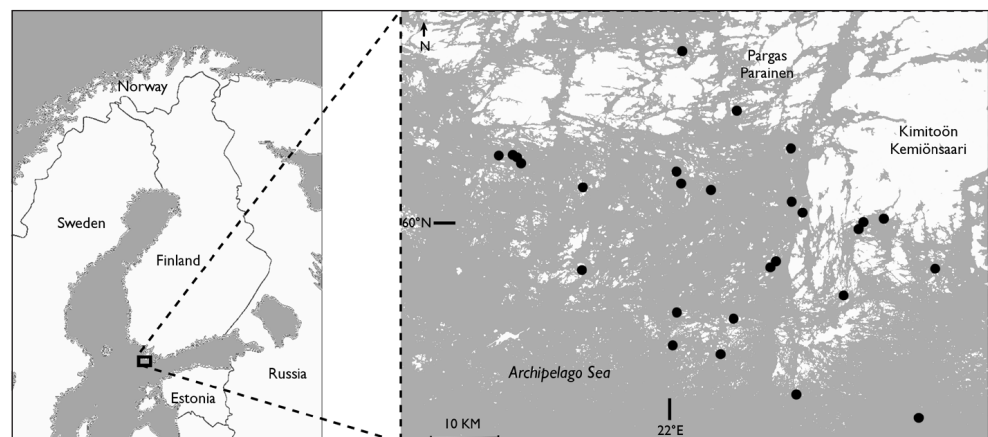


Figure 1. Location of the study sites

Data collection

Polypore and corticioid fungi were surveyed during the years 2008–2010 between late July and early November which corresponds to the peak sporocarp formation season for these fungal groups in Finland (Halme and Kotiaho 2012). In the sampling, we surveyed all kinds of dead wood types with the minimum diameter of 3 cm and minimum length of 30 cm. The surveyed dead wood units were divided into five categories according to their diameter and position (four categories for downed wood: 3–9 cm, 10–19 cm, 20–29 cm, ≥ 30 cm, and one for dead standing trees ≥ 10 cm). Furthermore, four tree species or tree species groups were separated: Scots pine, black alder, birches and other tree species (“other” including all non-dominant tree species, like Norway spruce, aspen, common hazel and rowan). The diameter was measured at breast height (1.3 m) for whole trunks and as the basal diameter for other dead wood units.

The search effort of dead wood and fungi was proportional to the size of the island (i.e. substrates were inventoried in relation to island area): for four tree species and five diameter categories, one dead wood unit was surveyed for every two hectares. The first appropriate dead wood unit was selected when encountered and each dead wood unit was surveyed once. The aim was to have an equal number of dead wood units in each category within an island, but not enough dead wood was available for all wood categories on all islands. Altogether, 6,102 units of dead wood were measured and searched for fungi. Each fungal species found on one dead wood unit was considered as one record.

Classification of dead wood variables and fungi

For dead wood, four substrate variables were recorded as follows: tree species, dead wood type, diameter class and decay stage. For the analyses, tree species were divided into four species groups: black alder, birches, other deciduous trees and conifers. Dead wood types were divided into four classes, based on the classification by Tonteri and Siitonen (2001): 1) dead standing trees and snags, 2) fallen trunks and logs, 3) fallen branches and logging residue, and 4) natural and cut stumps. Four diameter classes were used for downed wood: 3–9 cm, 10–19 cm, 20–29 cm, ≥ 30 cm, and one for dead standing trees (≥ 10 cm). Decay stage was assessed based on method that was originally developed by McCullough (1948). In the current study, we used the method with five classes following Renvall (1995): stage 1 means fresh dead wood, 2 slightly decayed, 3 intermediately decayed, 4 advanced decayed, and 5 completely decayed.

We also separated kelo trees (772 dead wood units) because they are a distinct substrate type for dead wood species. In boreal forests a kelo tree means an old, dead

Scots pine with silver grey and decorticated trunk surface (Niemelä et al. 2002, Venugopal et al. 2016a). In this study, we included in kelo all dead wood units originated from kelo trees, not only dead standing or whole fallen trunks but also cut logs, fallen branches and stumps. In total, we separated 18 types of dead wood in the analyses.

For statistical analyses, the fungal species were divided into five, partly overlapping groups (Table 1): polypores, corticioids, species of conservation concern, rare species, and species on kelo trees. The substrate material (i.e. dead wood units) was divided into three groups (Table 1): polypore-rich substrates, corticioid-rich substrates, and species-rich substrates. Empty dead wood units (i.e. those that completely lacked fungal sporocarps) constituted one group. The proportional frequency distributions of fungal records or substrates were compared to the distributions of all surveyed dead wood within each dead wood variable.

The species division into polypores and corticioids was based on Niemelä (2005), Kotiranta et al. (2009) and Bernicchia and Gorjón (2010). In general, the two groups differ from each other based on the appearance of sporocarps (polypores have a poroid and corticioids a non-poroid hymenophore). Only wood-inhabiting species of these groups were included. Both fungal groups are highly diverse and taxonomically polyphyletic. They both belong to an artificial non-gilled form-group of apyllophoroid fungi (Basidiomycota).

Polypore-rich substrates were defined as having a minimum of three polypore species and corticioid-rich substrates a minimum of four corticioid species on a dead wood unit. Species-rich substrates had a minimum of five species of either group. To define the group of species of conservation concern, we selected all red-listed species from the two latest Finnish Red List assessments

Table 1. The groups of fungi and substrates, the numbers of fungal records or dead wood units within these groups, and the number of species within fungal groups

Group	Number of fungal records ¹ or substrates	Number of species
Fungal groups		
Records of polypores	2049	84
Records of corticioids	3633	218
Records of conservation concern species	399	64
Records of rare species	238	74
Records of kelo species	608	87
Substrate groups		
Polypore-rich substrates	34	-
Corticioid-rich substrates	104	-
Species-rich substrates	70	-
Species-empty substrates	2597	-

¹A unit is either the number of fungal records or the number of dead wood units (substrate) depending on group.

(Rassi et al. 2001, Kotiranta et al. 2010) and the listed indicator species of forest conservation value (Kotiranta and Niemelä 1996, Savola 2012). Both indicator lists include mainly polypores. The number of units in each of the categories is presented in Table 1.

Rare species were defined according to the Finnish apophylloporoid checklist (Kotiranta et al. 2009). A rare species was defined as a species with fewer than 10 known records from Finland or as a species with a very narrow ecological niche (Kotiranta et al. 2009). We also separated fungal records on kelo trees. The distribution of records of these kelo species was compared only to dead wood units in the kelo category.

Statistical analyses

We used the G-test of goodness-of-fit to find out if the relative frequency distributions of fungal records on the available substrates followed the availability of dead wood categories, or if they appeared more often than expected on specific substrates. We used Williams' correction for continuity to improve statistical accuracy when the expected numbers were small (McDonald 2014).

We tested the independence of the frequency distributions of the attribute categories between the groups (polypores vs. corticioids) using Goodman-Kruskal tau-test (G-K τ) with Monte Carlo estimations of the p -values.

When reporting the results of distributions, we used both statistical significances and percentage point differences, focusing on those cases where there were both

statistically significant difference and where magnitude of any of the pairwise proportional differences was 20 percentage points (p.p.) or more in tests according to G-test, and 15 p.p. or more in tests of Goodman-Kruskal Tau-tests. These limiting values were chosen for the sake of clarity when presenting the results. All the original p.p. differences are also reported.

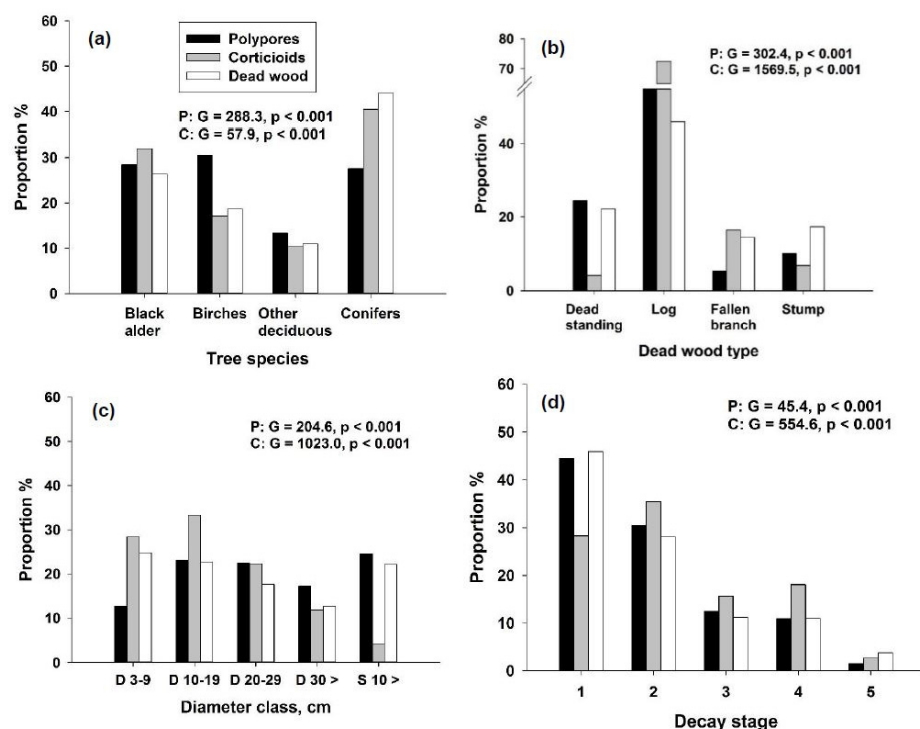
Statistical analyses were performed using SPSS™ 21, except that the G-tests were run by McDonald's (2014) algorithm.

Results

The relative frequency distributions of total fungal records among dead wood variables differed from the distribution of the comparable dead wood units; this applied to both polypores and corticioids (both $p < 0.001$, Figure 2a-d). The greatest difference was in the distribution of corticioids among dead wood types, where the fungal abundance on logs was 26 p.p. larger than the share of logs among all studied dead wood units.

The distributions of polypore-rich substrates differed most in terms of dead wood type and diameter class from the distribution of all surveyed dead wood units (both $p < 0.001$, Figure 3b, c), and to some extent also in terms of decay stage and tree species (both $p = 0.043$, Figure 3a, d). Polypore-rich substrates were much more often logs (54 p.p. difference) and ≥ 30 cm downed dead wood (difference 34 p.p.) than expected on the basis of all surveyed dead wood. On the other hand, dead stand-

Figure 2. Frequency distributions of polypore records (P), corticioid records (C) and all surveyed dead wood units (dead wood) in different dead wood variables. Y-axis shows the proportion of records (% of all records) in each dead wood category. In diameter classes, D refers to downed dead wood and S to standing dead trees. Decay class indicates decay stage from fresh dead wood (1) to completely decayed (5). More details on the classifications of the dead wood categories in the text (chapter Classification of dead wood variables and fungi)



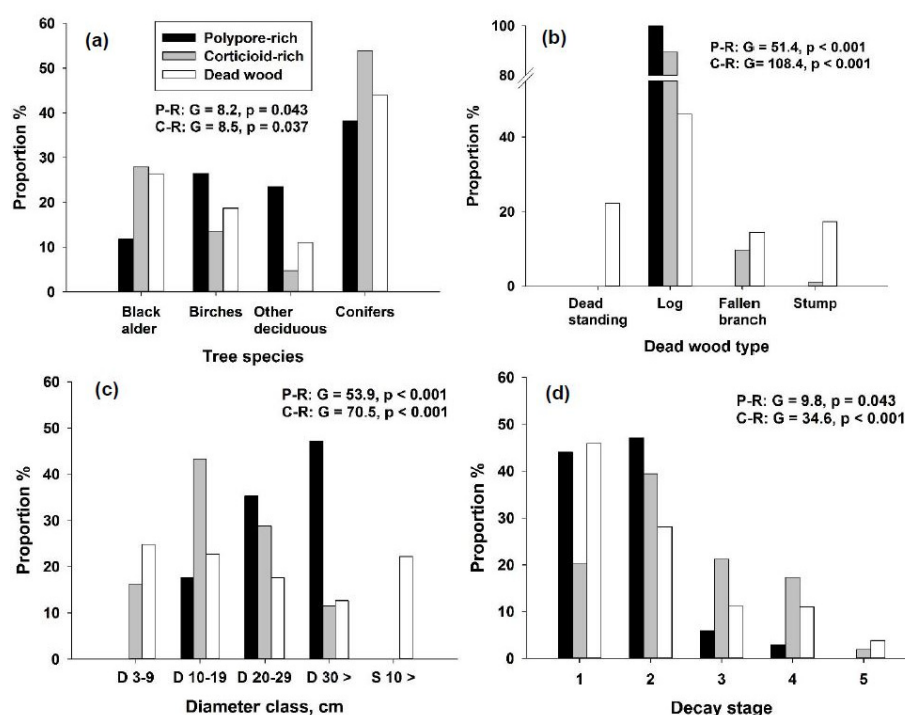


Figure 3. Frequency distributions of polypore-rich substrates (P-R), corticioid-rich substrates (C-R) and all surveyed dead wood units (dead wood) in different dead wood variables. Y-axis shows the proportion of records (% of all records) in each dead wood category. In diameter classes, D refers to downed dead wood and S to standing dead trees. Decay class indicates decay stage from fresh dead wood (1) to completely decayed (5). More details on the classifications of the dead wood categories in the text (chapter Classification of dead wood variables and fungi)

ing trees and dead wood units of diameter class 3–9 cm were underrepresented in polypore-rich substrates (differences 22 p.p. and 25 p.p., respectively).

The distributions of corticioid-rich substrates differed most in terms of decay stage, dead wood type and diameter class from the distribution of all surveyed dead wood units (all $p < 0.001$, Figure 3b-d) and to some extent also in terms of tree species ($p = 0.037$, Figure 3a). Corticioid-rich substrates were rarely on decay stage 1, where the difference was 26 p.p compared to all surveyed dead wood units. Furthermore, corticioid-rich substrates were more often logs (difference 43 p.p.) and more often of diameter class 10–19 cm (difference 21 p.p.) than the proportion of all surveyed dead wood units would have suggested; also, none of the corticioid-rich substrates was a dead standing tree (difference 22 p.p.).

The distributions of species-rich substrates differed from the distribution of all surveyed dead wood units in terms of three dead wood variables (all $p < 0.001$, Figure 4b-d). Only in tree species the distributions did not differ ($p = 0.471$, Figure 4a). Species-rich substrates were more seldom on decay stage 1 than expected, where the difference was 26 p.p. None of the species-rich substrates was a dead standing tree (difference 22 p.p.) but instead they were more often logs (difference 50 p.p.) than the distribution of all surveyed dead wood units would have suggested.

The distributions of species-empty substrates differed from the distribution of all surveyed dead wood units in terms of all dead wood variables (all $p < 0.001$,

Figure 4a-d). The majority of species-empty substrates were dead standing trees and stumps, dead wood units with decay stage 1, and conifers in general.

The distributions of the species of conservation concern differed in all dead wood variables from the distribution of all surveyed dead wood units (all $p < 0.001$, Figure 5a-d). The largest difference (22 p.p.) was in dead wood type: the species of conservation concern were concentrated on logs more often than their proportion in all surveyed dead wood units would have suggested.

Rare species had a consistent distribution with all surveyed dead wood units in terms of tree species ($p = 0.306$, Figure 5a). Otherwise there were clear differences in distributions of other dead wood variables (all $p < 0.001$, Figure 5b-d). The proportion of rare species occurrences on decay stage 1 was clearly lower (25 p.p.) than the proportion of all dead wood units on this stage. Rare species were also concentrated on logs (difference 34 p.p.) instead of dead standing trees (21 p.p.).

Compared to the distribution of all surveyed kelo wood units, the distributions of kelo species were clearly different in all three dead wood variables (decay stage, dead wood type and diameter class) (all $p < 0.001$, Figure 6a-c). Tree species was not tested because a kelo tree is always Scots pine. The greatest difference (30 p.p.) between the proportions was in dead wood type: kelo species were concentrated on logs.

According to Goodman-Kruskal tau-test there was a clear difference between polypore records and corticioid records in their occurrence on dead wood. Groups

Figure 4. Frequency distributions of species-rich substrates (S-R), species-empty substrates (E) and all surveyed dead wood units (dead wood) in different dead wood variables. Y-axis shows the proportion of records (% of all records) in each dead wood category. In diameter classes, D refers to downed dead wood and S to standing dead trees. Decay class indicates decay stage from fresh dead wood (1) to completely decayed (5). More details on the classifications of the dead wood categories in the text (chapter Classification of dead wood variables and fungi)

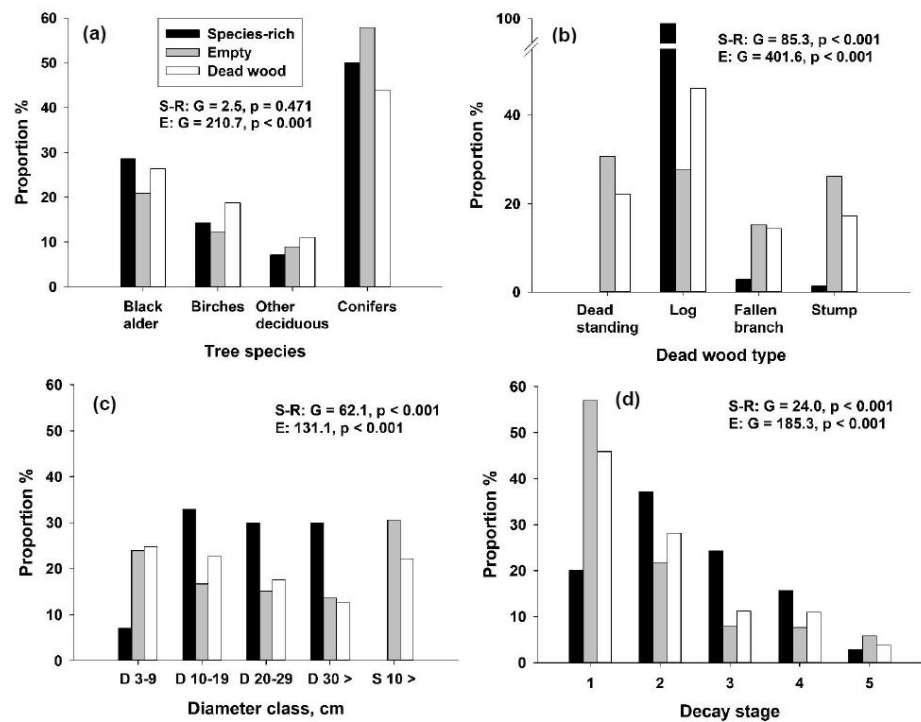
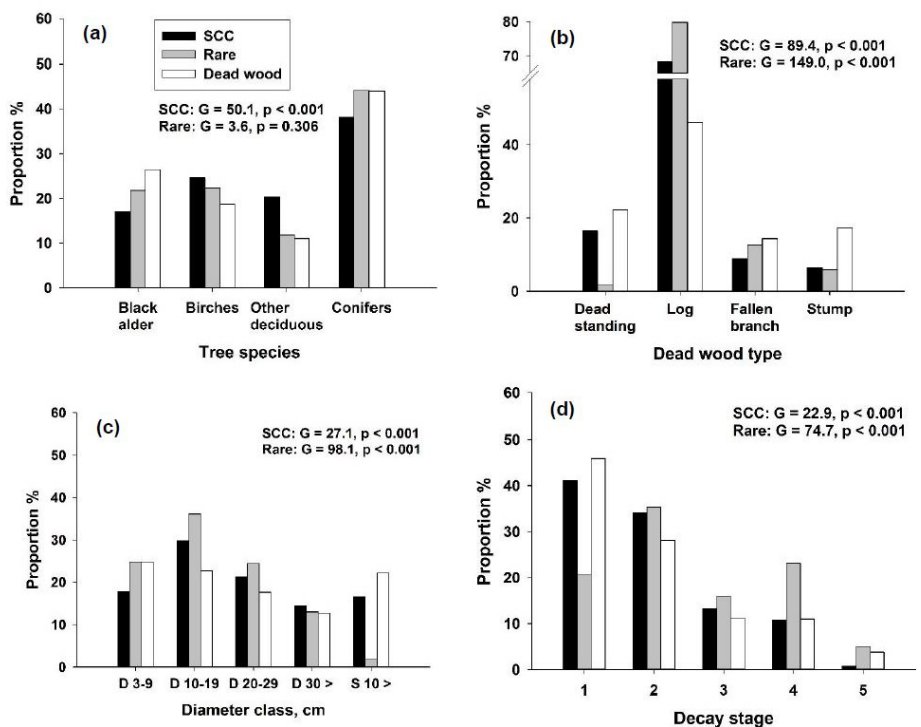


Figure 5. Frequency distributions of records of species of conservation concern (SCC), records of rare species (rare) and all surveyed dead wood units (dead wood) in different dead wood variables. Y-axis shows the proportion of records (% of all records) in each dead wood category. In diameter classes, D refers to downed dead wood and S to standing dead trees. Decay class indicates decay stage from fresh dead wood (1) to completely decayed (5). More details on the classifications of the dead wood categories in the text (chapter Classification of dead wood variables and fungi)



differed from each other in all four dead wood variables (all tests $p < 0.001$). The largest difference (20 p.p.) was in the proportion of records on dead standing trees where polypores were found more often than corticioids. Corticioids were found on the wood in the smallest diameter class clearly more than polypores (difference 16

p.p.). Polypores grew more often on fresh dead wood than corticioids (difference 16 p.p.) and were most often found on birch, whereas corticioids were most often found on conifers.

The polypore-rich substrates and the corticioid-rich substrates were different in terms of tree species

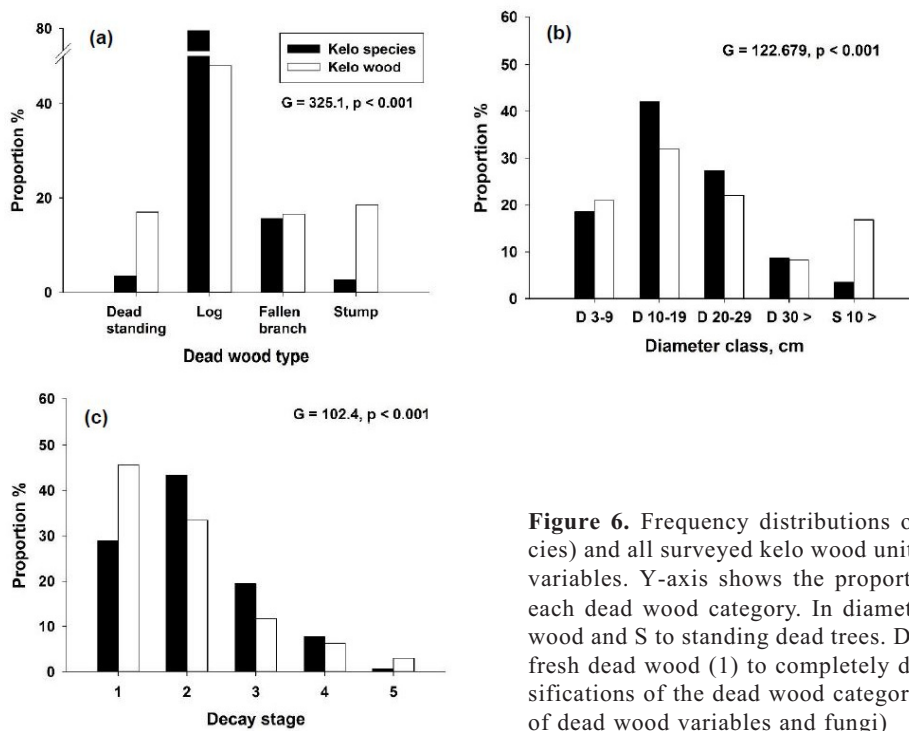


Figure 6. Frequency distributions of records of kelo species (kelo species) and all surveyed kelo wood units (kelo wood) in different dead wood variables. Y-axis shows the proportion of records (% of all records) in each dead wood category. In diameter classes, D refers to downed dead wood and S to standing dead trees. Decay class indicates decay stage from fresh dead wood (1) to completely decayed (5). More details on the classifications of the dead wood categories in the text (chapter Classification of dead wood variables and fungi)

(G-K $t = 0.117, p = 0.001$), diameter class (G-K $t = 0.191, p = 0.000$) and decay stage (G-K $t = 0.101, p = 0.006$), but both fungal groups were associated with similar dead wood types (G-K $t = 0.028, p = 0.201$). The polypore-rich substrates were more often ‘other deciduous trees’ (difference 19 p.p.) than the corticioid-rich substrates, and the corticioid-rich substrates were more often black alders and conifers (both with differences 16 p.p.). Furthermore, the corticioid-rich substrates belonged more often into the two smallest diameter classes (differences 16 p.p. and 26 p.p. respectively), whereas the polypore-rich substrates were dominant in diameter class ≥ 30 cm (difference 36 p.p.). The polypore-rich substrates were more often (difference 24 p.p.) fresh dead wood (decay stage 1) than the corticioid-rich substrates, and vice versa: the corticioid-rich substrates were more often in advanced decay stage (decay stage 3) (difference 15 p.p.). Dead standing trees did not provide species-rich substrate at all.

Fungal species, number of records of each species and their contribution to the species groupings are listed in the Appendix.

Discussion and Conclusions

The two main findings in the current study are that (1) the occurrence of both polypore and corticioid wood decay fungi does not always follow the availability of different woody substrates in forests, and (2) polypores and corticioids have several occurrence patterns dis-

tinct from each other. Our study is among the first ones that has been able to quantitatively analyse the complete fungal wood-decayer assemblages on all available substrates (with diameter ≥ 3 cm) and that includes also data of zero occurrences on substrates. Our main findings have implications to wood-decay patterns and processes in forest ecosystems and to conservation of biodiversity of wood-inhabiting fungi in forests.

While discussing the main findings, we note also a few shortcomings that must be taken into account when interpreting and applying the results. First, the fruiting body abundance does not necessarily reflect abundance of growing mycelia within substrates. However, from the conservation viewpoint fruiting body abundance is still probably a relevant indicator of long-term population viability, because it is related to reproductive behaviour of the population. For this reason, we feel that counting fruiting bodies is still very informative and valuable. Second, our sampling scheme did not control for the availability of different substrate types in the data. Thus, the results must be interpreted only as relative distributions of groups (fungal group or null occurrences) rather than as absolute preference patterns of these groups. This latter fact largely also precludes further analyses of joint effects of the variables. This would ideally be done in a setting where sampling is controlled for the categorial variables and their ranges. Overall, thus, we discuss the findings primarily in terms of relative differences between the groups.

Tree species

The diversity of tree species and their composition are one of the most influential factors on the species assemblages of wood-inhabiting fungi (Heilmann-Clausen et al. 2005, Sippola et al. 2005, Yli-Sirniö et al. 2012, Kutszegi et al. 2015). Most wood-inhabiting fungi favour specific host tree species (Boddy and Heilmann-Clausen 2008), at least on the level of coniferous or deciduous trees (Junninen and Komonen 2011, Lindner et al. 2006, Küffer et al. 2008). Lindhe et al. (2004) found that the number of fungal records from spruce, birch and aspen were more or less the same when the number of surveyed dead wood units were equal.

In our data, despite the statistically significant difference, the records of corticioids seemed to follow the availability of different tree species fairly closely, unlike the polypores which were more common on birch and less common on conifer trees than expected from the availability of these tree species. The high number of polypores on birch can be explained by two very common polypore species *Fomes fomentarius* and *Piptoporus betulinus* that together accounted for 55% of all records on birch. One of the most common tree species in the study area, black alder, showed no importance larger than expected from its availability. However, it has been found that black alder can host diverse fungal assemblages and many rare species (Kunttu et al. 2016). Other deciduous trees than birch and alder, seemed to harbor a disproportionately large share of the polypore-rich substrates. These were mainly aspen and goat willow, of which particularly aspen is known to host diverse fungal communities (Junninen et al. 2007).

Dead wood type

Logs (fallen trunks) were found to be clearly the most important substrate for all studied groups. Logs were especially important as species-rich substrates, for rare species and for kelo species (proportions ca 80–100% of all records in these groups). The importance of downed dead wood has been recognized in several other studies as well, although in most of these the availability of different dead wood types has not been taken into account (e.g. see Junninen and Komonen 2011). Especially fallen trunks or logs are the most important dead wood types among the downed dead wood (Sippola and Renvall 1999, Sippola et al. 2005).

Of the other substrate types, only dead standing trees seemed to be of importance for polypores, mostly because of *Inonotus radiatus*, *Fomes fomentarius*, and *Piptoporus betulinus* which grew in high numbers on dead standing deciduous trees. Also, dead standing trees were inhabited by polypore species of conservation concern to some extent, including mainly a few pine-dwelling old-growth forest indicator species which were fairly

common in the study area (*Phellinus pini*, *Phaeolus schweinitzii* and *Meruliopsis taxicola*). Most of the species that grow on dead standing trees can grow also on downed dead wood (Lindhe et al. 2004, Sippola and Renvall 1999). In general, dead standing trees (including snags) had a smaller role as substrate for wood-inhabiting fungi in our data, as has been found also in other studies (Rydin et al. 1997, Heilmann-Clausen and Christensen 2004, Sippola et al. 2005, Pasanen et al. 2014).

Diameter

Polypores were represented in the smallest diameter fraction of dead wood much less than expected from the availability of different diameter classes. The importance of large-diameter dead wood for polypores was clearly seen in the distribution of polypore-rich substrates among all available dead wood substrates (diam. ≥ 3 cm): from the smallest diameter fraction polypore-rich substrates lacked totally, and the larger the diameter the larger the share of polypore-rich substrates was. In contrast, with corticioids the pattern was almost the opposite. Similar results have also been reported by Nordén et al. (2004) with 79% of corticioid records derived from fine woody debris (< 10 cm) and 51% of polypore records derived from coarse woody debris (≥ 10 cm).

Somewhat unexpectedly, species of conservation concern, rare species or species living on kelo trees were not overrepresented on largest dead wood diameters but on the second smallest diameter class (10–19 cm). In total, 90% of records of rare species were corticioids and this at least partly explains the result. Also, Juutilainen et al. (2011, 2014) found many rare corticioid species on small-diameter dead wood.

The importance large-diameter dead wood for wood-inhabiting fungi has been shown in several studies (e.g. Ohlson et al. 1997, Nilsson et al. 2001, Siitonen et al. 2001). However, small-diameter dead wood plays also an essential role for wood-inhabiting fungi (mainly corticioids) (e.g. Küffer et al. 2008, Abrego and Salcedo 2013). Juutilainen et al. (2011) found that excluding very fine woody debris (≤ 5 cm) resulted in underestimation of the occurrences of species by 66%; and more than 38% of the species and 75% of records would be undetected if only the largest diameter class (≥ 10 cm) was included in the data. Our results support these findings, especially importance of fine woody debris for corticioids.

Decay stage

Regarding all records, the occurrence of polypores followed the availability of different decay stages of dead wood fairly closely, whereas corticioids were found on slightly more decayed wood. The corticioid-rich substrates were concentrated on later decay stages than

the polypore-rich substrates. More than half of the species-empty substrates were fresh dead wood, whereas the species-rich substrates (both fungal groups together) were concentrated on slightly and intermediately decayed wood. Our results revealed the important role of slightly decayed (decay stage 2) wood for fungi. Most of wood-inhabiting aphyllorphoroid species favour intermediately decayed wood, corresponding to decay stage 3 of our study (Bader et al. 1995, Kruys et al. 1999, Groven et al. 2002, Heilmann-Clausen et al. 2005, Siitonen et al. 2005, Sippola et al. 2005, Junninen et al. 2006, Jönsson et al. 2008). In our data, the detected relative importance of less decayed wood was probably due to some numerous species which were concentrated on fresh or slightly decayed wood, including, for example, *Inonotus radiatus*, *Stereum rugosum* and *Trichaptum abietinum*.

Red-listed species have been found to favour wood on intermediately or advanced decay stages (Tikkanen et al. 2006, Pouska et al. 2011, Magnusson et al. 2014), but in our study most of the occurrences of species of conservation concern were found on earlier decay stages. This resulted from several old-growth forest indicator species on pine which commonly grew also on fresh dead wood, like *Sistotremastrum suecicum* and *Meruliopsis taxicola*. Rare species of our study, however, were found in later decay stages, which is in agreement with decay stage preference of red-listed species.

The kelo species were found most often on slightly and intermediately decayed wood, when the availability of different decay stages is taken into account. Like in all fallen trees, also in the kelo trees fungal composition has its own succession in the course of decay (Niemelä et al. 2002, Venugopal et al. 2016a). Due to the slow development and extremely slow decay rate of the kelo trees, also the fungal species specialized on kelos seem to be slow in their colonization, needing a continuity in the supply of the substrate (Niemelä et al. 2002). In our study area occurrence of kelo trees varied between the study sites (Kunttu et al. 2015a), and the continuity of kelo trees may have been broken on some study islands.

Dead wood in the final stage of degradation had only a minor role for the studied fungal groups. This has been found also in other studies (e.g. Høiland and Bendiksen 1997, Renvall 1995). Although the occurrence of sporocarps decreases towards the end of the decay process, in molecular studies it has been found that within the wood, the number of wood decay fungi, represented by operational taxonomic units, generally increases as the log becomes more decomposed (Rajala et al. 2015). Also, in our data, empty substrates were overrepresented in the latest decay stage.

Implications to conservation of wood-decay fungal diversity

The amount of dead wood has an essential role for the occurrence of saproxylic species (Hottola et al. 2009, Müller and Bütler 2010, Yli-Sirmiö et al. 2014). However, wood quality and its variation are also very important (Penttilä et al. 2006, Ylläsjärvi et al. 2011). Variation of dead wood quality is typical to natural forests (Siitonen et al. 2000), and many fungal species have specialized on specific substrate (Lindblad 1998, Nordén et al. 2013). Assemblage-level occurrence patterns have, however, remained quite unexplored so far.

As expected, the substrate patterns of different fungal groups varied, and this demonstrates the importance of maintaining diverse dead wood in forests. Downed logs seem to be disproportionately important substrates compared to dead standing trees, fallen branches or tree stumps. In addition to the large-diameter dead wood, however, also small-diameter dead wood was found to be important substrate for wood-inhabiting fungi, especially corticioids. Forest management and clear-cut harvests have traditionally left small-diameter wood to harvest sites as logging residues. This is, however, changing since nowadays also these residues are often collected for bioenergy production. Since small diameter wood may be significant substrate for fungi, it is possible that recent trends in biomass harvest may affect fungi more widely than previously (Eräjää et al. 2010, Hämäläinen et al. 2015).

Wood-quality associations of fungi have major implications for their conservation and challenges for restoration. For example, ecological restoration aims to bring back natural structures and processes into altered forests, to facilitate and promote habitats and substrates for natural occurring species (Halme et al. 2013). Dead wood creation is one of the key restoration activities in forests but restoration does not automatically lead to high fungal species diversity (Pasanen et al. 2014). According to our results, special attention must be paid to restoration of different dead wood types and not to focus only on restoring sufficient amounts of dead wood.

Finally, based on our results, we emphasize that polypores and corticioids may have different roles in how they affect overall wood decay and carbon dynamics in forest ecosystems because of their different occurrence patterns on dead wood. This aspect warrants further studies to improve the mechanistic analyses on how carbon may be released from forest ecosystem and how these processes may modify the climate effects that forests have. Based on our findings, it would be important to develop forest management to maintain the variation in dead wood quality in every phase of silviculture. This would improve the possibilities to preserve the diversity of wood-inhabiting fungi also in managed forests.

Acknowledgements

We are grateful to Heikki Kotiranta and Jorma Pennanen who helped to identify some specimens, and to Sanna-Mari Kunttu and Timo Kosonen who assisted in the field work. Sanna-Mari Kunttu drew the map. Author PK is grateful to Ella and Georg Ehrnrooth Foundation, The Education Fund, and Societas pro Fauna et Flora Fennica for financial support.

References

- Abrego, N. and 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? *Forest Ecology Management* 291: 377–385.
- Ahti, T., Hämet-Ahti, L. and Jalas J. 1968. Vegetation zones and their sections in northwestern Europe. *Annales Botanici Fennici* 5(3): 169–211.
- Anon. 2015. Maankamara – the web map application of precise elevation data hillshading, superficial deposits and bedrock maps and aerial photographs. The Geological Survey of Finland. Access through: http://en.gtk.fi/information-services/map_services/index.html (last accessed 7.1.2018).
- Bader, P., Jansson, S. and Jonsson, B.G. 1995. Wood-inhabiting fungi and substratum decline in selectively logged boreal spruce forests. *Biological Conservation* 72: 355–362.
- Bernicchia, A. and Gorjón, S.P. 2010. Corticiaceae s. l. Fungi Europaei vol. 12. Edizioni Candusso, Alassio, 1008 pp.
- Boddy, L. and Heilmann-Clausen, J. 2008. Basidiomycete community development in temperate angiosperm wood. In: Boddy, L., Frankland, J.C., van West, P. (Eds.). Academic Press, London, p. 211–237.
- Eräjää, S., Halme, P., Kotiaho, J.S., Markkanen, A. and Toivanen, T. 2010. The volume and composition of dead wood on traditional and forest fuel harvested clear-cuts. *Silva Fennica* 44: 203–211.
- Essen, P.-A., Ehnström, B., Ericson, L. and Sjöberg, K. 1997. Boreal forests. *Ecological Bulletins* 46: 16–47.
- Fukasawa, Y., Osono, T. and Takeda, H. 2011. Wood decomposing abilities of diverse lignicolous fungi on non-decayed and decayed beech wood. *Mycologia* 103: 474–482.
- Groven, R., Rolstad, J., Storaunet, K.O. and Rolstad, E. 2002. Using forest stand reconstructions to assess the role of structural continuity for late-successional species. *Forest Ecology and Management* 164: 39–55.
- Hakala, T.K., Maijala, P., Konn, J. and Hatakka, A. 2004. Evaluation of novel wood-rotting polypores and corticoid fungi for the decay and biopulping of Norway spruce (*Picea abies*) wood. *Enzyme and Microbial Technology* 34: 255–263.
- Halme, P., Allen, K.A., Auniņš, A., Bradshaw, R.H.W., Brūmelis, G., Čada, V., Clear, J.L., Eriksson, A.-M., Hannon, G., Hyvärinen, E., Ikaunieca, S., Iršėnaitė, R., Jonsson, B.G., Junninen, K., Kareksela, S., Komonen, A., Kotiaho, J.S., Kouki, J., Kuuluvainen, T., Mazziotta, A., Mönkkönen, M., Nyholm, K., Oldén, A., Shorohova, E., Strange, N., Toivanen, T., Vanha-Majamaa, I., Wallenius, T., Ylisirniö, A.-L. and Zin, E. 2013. Challenges of ecological restoration: lessons from forests in northern Europe. *Biological Conservation* 167: 248–256.
- Halme, P. and Kotiaho, J.S. 2012. The importance of timing and number of surveys in fungal biodiversity research. *Biodiversity and Conservation* 21: 205–219.
- Hämäläinen, A., Kouki, J. and Lohmus, P. 2015. Potential biodiversity impacts of forest biofuel harvest: lichen assemblages on stumps and slash of Scots pine. *Canadian Journal of Forest Research* 45: 1239–1247.
- Heilmann-Clausen, J. 2001. A gradient analysis of communities of macrofungi and slime moulds on decaying beech logs. *Fungal Biology* 105: 575–596.
- Heilmann-Clausen, J., Aude, E. and Christensen, M. 2005. Cryptogam communities on decaying deciduous wood – does tree species diversity matter? *Biodiversity and Conservation* 14: 2061–2078.
- Heilmann-Clausen, J. and Christensen, M. 2004. Does size matter? On the importance of various dead wood fractions for fungal diversity in Danish beech forests. *Forest Ecology and Management* 201: 105–117.
- Hjortstam, K. and Ryvarde, L. 2009. A checklist of names in Hyphodontia sensu stricto – sensu lato and Schizopora with new combinations in Lagarobasidium, Lyomyces, Kneiffiella, Schizopora and Xylodon. *Synopsis Fungorum* 26: 33–55.
- Høiland, K. and Bendiksen, E. 1997. Biodiversity of wood-inhabiting fungi in a boreal coniferous forest in Sor-Trondelag County, Central Norway. *Nordic Journal of Botany* 16: 643–659.
- Hottola, J., Ovaskainen, O. and Hanski, I. 2009. A unified measure of the number, volume and diversity of dead trees and the response of fungal communities. *Journal of Ecology* 97: 1320–1328.
- Janisch, J.E. and Harmon, M.E. 2002. Successional changes in live and dead wood carbon stores: implications for net ecosystem productivity. *Tree Physiology* 22(2–3): 77–89.
- Jonsson, B.G., Kruys, N. and Ranius, T. 2005. Ecology of species living on dead wood – Lessons for dead wood management. *Silva Fennica* 39: 289–309.
- Jönsson, M.T., Edman, M. and Jonsson, B.G. 2008. Colonization and extinction patterns of wood-decaying fungi in a boreal old-growth *Picea abies* forest. *Journal of Ecology* 96: 1065–1075.
- Junninen, K. and Komonen, A. 2011. Conservation ecology of boreal polypores: A review. *Biological Conservation* 144: 11–20.
- Junninen, K., Penttilä, R. and Martikainen, P. 2007. Fallen retention aspen trees on clear-cuts can be important habitats for red-listed polypores: a case study in Finland. *Biodiversity and Conservation* 16: 475–490.
- Junninen, K., Similä, M., Kouki, J. and Kotiranta, H. 2006. Assemblages of wood-inhabiting fungi along the gradients of succession and naturalness in boreal pine-dominated forests in Fennoscandia. *Ecography* 29: 75–83.
- Juutilainen, K., Halme, P., Kotiranta, H. and Mönkkönen, M. 2011. Size matters in studies of dead wood and wood-inhabiting fungi. *Fungal Ecology* 4: 342–349.
- Juutilainen, K., Mönkkönen, M., Kotiranta, H. and Halme, P. 2014. The effects of forest management on wood-inhabiting fungi occupying dead wood of different diameter fractions. *Forest Ecology and Management* 313: 283–291.
- Kersalo, J. and Pirinen, P. (Eds.) 2009. The climate of Finnish regions. Finnish Meteorological Institute, reports 8/2009. Helsinki, 185 pp.

- Kotiranta, H., Junninen, K., Saarenoksa, R., Kinnunen, J. and Kytövuori, I.** 2010. Aphyllphorales and Heterobasidiomycetes. – In: Rassi, P., Hyvärinen, E., Juslén, A., Mannerkoski, I., (Eds.): The 2010 Red List of Finnish Species. Ministry of the Environment and Finnish Environment Institute, Helsinki, p. 249–263.
- Kotiranta, H. and Niemelä, T.** 1996. Uhanalaiset käävät Suomessa. [Threatened polypores in Finland.] Ympäristöopas 10. The Finnish Environment Institute, 184 pp. (in Finnish with English summary).
- Kotiranta, H., Saarenoksa, R. and Kytövuori, I.** 2009. Aphyllphoroid fungi of Finland. A check-list with ecology, distribution, and threat categories. *Norrinia* 19: 1–223.
- Kruys, N. and Jonsson, B.G.** 1999. Fine woody debris is important for species richness on logs in managed boreal spruce forests of northern Sweden. *Canadian Journal of Forest Research* 29: 1295–1299.
- Küffer, N., Gillet, F., Senn-Irlet, B., Aragno, M. and Job, D.** 2008. Ecological determinants of fungal diversity on dead wood in European forests. *Fungal Diversity* 30: 83–95.
- Küffer, N. and Senn-Irlet, B.** 2005. Influence of forest management on the species richness and composition of wood-inhabiting Basidiomycetes in Swiss forests. *Biodiversity and Conservation* 14: 2419–2435.
- Kunttu, P., Junninen, K. and Kouki, J.** 2015a. Dead wood as an indicator of forest naturalness: a comparison of methods. *Forest Ecology and Management* 353: 30–40.
- Kunttu, P., Kotiranta, H., Kulju, M., Pasanen, H. and Kouki, J.** 2016. Occurrence patterns, diversity and ecology of aphyllphoroid fungi on the black alder (*Alnus glutinosa*) in an archipelago of the Baltic Sea. *Annales Botanici Fennici* 53: 173–189.
- Kunttu, P., Kulju, M. and Kotiranta, H.** 2015b. Checklist of aphyllphoroid fungi (Basidiomycota) of the Archipelago Sea National Park, Southwest Finland. *Check List* 11(2): 1587.
- Kutszegi, G., Siller, I., Dima, B., Takács, K., Merényi, Z., Varga, T., Turcsányi, G., Bidló, A. and Ódor, P.** 2015. Drivers of macrofungal species composition in temperate forests, West Hungary: functional groups compared. *Fungal Ecology* 17: 69–83.
- Lindblad, I.** 1998. Wood-inhabiting fungi on fallen logs of Norway spruce: relations to forest management and substrate quality. *Nordic Journal of Botany* 18: 243–255.
- Lindhe, A., Åsenblad, N. and Toresson, H.-G.** 2004. Cut logs and high stumps of spruce, birch, aspen and oak - nine years of saproxylic fungi succession. *Biological Conservation* 119: 443–454.
- Lindner, D.L., Burdsall Jr., H.H. and Stanosz, G.R.** 2006. Species diversity of polyporoid and corticioid fungi in northern hardwood forests with differing management histories. *Mycologia* 98: 195–217.
- Magnusson, M., Olsson, J. and Hedenäs, H.** 2014. Red-listed wood-inhabiting fungi in natural and managed forest landscapes adjacent to the timberline in central Sweden. *Scandinavian Journal of Forest Research* 29: 455–465.
- McCullough, H.A.** 1948. Plant succession on fallen logs in a virgin spruce-fir forest. *Journal of Ecology* 29: 508–513.
- McDonald, J.H.** 2014. Handbook of Biological Statistics. (3rd ed.). Sparky House Publishing, Baltimore, Maryland. <http://www.biostathandbook.com/>
- Müller, J. and Bütler, R.** 2010. A review of habitat thresholds for dead wood: a baseline for management recommendations in European forests. *European Journal of Forest Research* 129: 981–992.
- Niemelä, T.** 2005. Käävät, puiden sienet. [Polypores, lignicolous fungi] *Norrinia* 13: 1–320. (in Finnish with English summary)
- Niemelä, T., Wallenius, T. and Kotiranta, H.** 2002. The kelo tree, a vanishing substrate of specified wood-inhabiting fungi. *Polish Botanical Journal* 47: 91–101.
- Nilsson, S.G., Hedin, J. and Niklasson, M.** 2001. Biodiversity and its assessment in boreal and nemoral forests. *Scandinavian Journal of Forest Research*, suppl. 3: 10–26.
- Nordén, B., Ryberg, M., Götmarm, F. and Olausson, B.** 2004. Relative importance of coarse and fine woody debris for the diversity of wood-inhabiting fungi in temperate broadleaf forests. *Biological Conservation* 117: 1–10.
- Nordén, J., Penttilä, R., Siitonen, J., Tomppo, E. and Ovaskainen, O.** 2013. Specialist species of wood-inhabiting fungi struggle while generalists thrive in fragmented boreal forests. *Journal of Ecology* 101: 701–712.
- Ohlson, M., Söderström, L., Hörnberg, G. and Zackrisson, O.** 1997. Habitat qualities versus long-term continuity as determinants of biodiversity in boreal old-growth swamp forests. *Biological Conservation* 81: 221–231.
- Pasanen, H., Junninen, K. and Kouki, J.** 2014. Restoring dead wood in forests diversifies wood-decaying fungal assemblages but does not quickly benefit red-listed species. *Forest Ecology and Management* 312: 92–100.
- Penttilä, R. and Kotiranta, H.** 1996. Short-term effects of prescribed burning on wood-rotting fungi. *Silva Fennica* 30: 399–419.
- Penttilä, R., Lindgren, M., Miettinen, O., Rita, H. and Hanski, I.** 2006. Consequences of forest fragmentation for polyporous fungi at two spatial scales. *Oikos* 114: 225–240.
- Pirinen, P., Simola, H., Aalto, J., Kaukoranta, J.-P., Karlsson, P. and Ruuhela, R.** 2012. Tilastoja Suomen ilmastosta 1981–2010. [Climatological statistics of Finland 1981–2010.] Finnish Meteorological Institute, reports 1/2012. Helsinki, 83 pp. (in Finnish with English summary)
- Pouska, V., Lepša, J., Svobodac, M. and Lepšová, A.** 2011. How do log characteristics influence the occurrence of wood fungi in a mountain spruce forest? *Fungal Ecology* 4: 201–209.
- Rajala, T., Tuomivirta, T., Pennanen, T. and Mäkipää, R.** 2015. Habitat models of wood-inhabiting fungi along a decay gradient of Norway spruce logs. *Fungal Ecology* 18: 48–55.
- Rassi, P., Alanen, A., Kanerva, T. and Mannerkoski, I.** (Eds.) 2001. The 2000 red list of Finnish species. Ministry of the Environment and Finnish Environment Institute, Helsinki, 432 pp.
- Renvall, P.** 1995. Community structure and dynamics of wood-rotting Basidiomycetes on decomposing conifer trunks in northern Finland. *Karstenia* 35: 1–51.
- Rydin, H., Diekmann, M. and Hallingbäck, T.** 1997. Biological characteristics, habitat associations, and distribution of macrofungi in Sweden. *Conservation Biology* 11: 628–640.
- Savola, K.** 2012. Helsingin metsien kääpäselvitys 2011. [The polypore survey of the forests in Helsinki 2011.] Publications by City of Helsinki Environment Centre, Helsinki, 46 pp. (in Finnish)
- Siitonen, J.** 2001. Forest management, coarse woody debris and saproxylic organisms: Fennoscandian boreal forests as an example. *Ecological Bulletins* 49: 11–41.
- Siitonen, J., Penttilä, R. and Kotiranta, H.** 2001. Coarse woody debris, polyporous fungi and saproxylic insects in an old-growth spruce forest in Vodlozero National Park, Russian Karelia. *Ecological Bulletins* 49: 231–242.

- Siitonen, J., Martikainen, P., Punttila, P. and Rauh, J.** 2000. Coarse woody debris and stand characteristics in mature managed and old-growth boreal mesic forest in southern Finland. *Forest Ecology and Management* 128: 211–225.
- Siitonen, P., Lehtinen, A. and Siitonen, M.** 2005. Effects of forest edges on the distribution, abundance, and regional persistence of wood-rotting fungi. *Conservation Biology* 19: 250–260.
- Sippola, A.-L., Mönkkönen, M. and Renvall, P.** 2005. Polypore diversity in the herb-rich woodland key habitats of Koli National Park in eastern Finland. *Biological Conservation* 126: 260–269.
- Sippola, A.-L. and Renvall, P.** 1999. Wood-decomposing fungi and seed-tree cutting: A 40-year perspective. *Forest Ecology and Management* 115: 183–201.
- Stokland, J.N. and Larsson, K.-H.** 2011. Legacies from natural forest dynamics: Different effects of forest management on wood-inhabiting fungi in pine and spruce forests. *Forest Ecology and Management* 261: 1707–1721.
- Stokland, J.N., Tomter, S.M. and Söderberg, U.** 2004. Development of dead wood indicators for biodiversity monitoring: Experiences from Scandinavia. *EFI Proceedings* 51: 207–226.
- Tikkanen, O.-P., Martikainen, P., Hyvärinen, E., Junninen, K. and Kouki, J.** 2006. Red-listed boreal forest species of Finland: associations with forest structure, tree species, and decaying wood. *Annales Zoologici Fennici* 43: 373–383.
- Tontteri, T. and Siitonen, J.** 2001. Lahopuu talousmetsissä 9.valtakunnan metsien tulosten mukaan – vertailu luonnonmetsiin. [Dead wood in economy forests according to 9. Finnish national forest inventory comparison to natural forests] In: Siitonen, J. (Ed.): Monimuotoinen metsä. Metsäluonnon monimuotoisuuden tutkimusohjelman loppuraportti. *Metsäntutkimuslaitoksen tiedonantaja* 812: 57–72 (in Finnish).
- Venugopal, P., Julkunen-Tiitto, R., Junninen, K. and Kouki, J.** 2016a. Phenolic compounds in Scots pine heartwood: are kelo trees a unique woody substrate? *Canadian Journal of Forest Research* 46: 225–233.
- Venugopal, P., Junninen, K., Linnakoski, R., Edman, M. and Kouki, J.** 2016b. Climate and wood quality have decayer-specific effects on fungal wood decomposition. *Forest Ecology and Management* 360: 341–351.
- Ylisirniö, A.-L., Penttilä, R., Berglund, H., Hallikainen, V., Isaeva, L., Kauhanen, H., Koivula, M. and Mikkola, K.** 2012. Dead wood and polypore diversity in natural post-fire succession forests and managed stands – Lessons for biodiversity management in boreal forests. *Forest Ecology and Management* 268: 16–27.
- Ylläsjärvi, I., Berglund, H. and Kuuluvainen, T.** 2011. Relationships between wood-inhabiting fungal species richness and habitat variables in old-growth forest stands in the Pallas-Yllästunturi National Park, northern boreal Finland. *Silva Fennica* 45: 995–1013.

Appendix. Recorded fungal species and their abundance and groups

Only records identified to species level are included here. The total data included 12 records of polypores and 101 records of corticioids not identified to species-level. Nomenclature is mainly according to Kotiranta et al. (2009) and Hjortstam and Ryvarden (2009), but the names of some species follow literature mentioned in references. Species of conservation concern are from red-listed evaluations (Rassi et al. 2001, Kotiranta et al. 2010), and from two indicator species lists (Kotiranta and Niemelä 1996, Savola 2012)

Species and authors	Fungal group	Number of records	Species of conservation concern	Rare species	Kelo species ¹
<i>Alutaceodontia alutacea</i> (Fr.) Hjortstam & Ryvarden	corticioid	7			+
<i>Amphinema byssoides</i> (Pers. : Fr.) J. Erikss.	corticioid	60			+
<i>Amylocorticium subillaqueatum</i> (Litsch.) Spirin & Zmitr.	corticioid	5			+
<i>Amyloporia xantha</i> (Fr. : Fr.) Bondartsev & Singer	polypore	25			+
<i>Amylostereum areolatum</i> (Chaillat ex Fr.) Boidin	corticioid	1	+	+	
<i>Amyloxyasma grisellum</i> (Bourdot) Hjortstam & Ryvarden	corticioid	1			
<i>Antrodia mappa</i> (Overh. & J. Lowe) Miettinen & Vlasák	polypore	1	+	+	
<i>Antrodia ramentacea</i> (Berk. & Broome) Donk	polypore	2	+	+	
<i>Antrodia serialis</i> (Fr.: Fr.) Donk	polypore	34			+
<i>Antrodia sinuosa</i> (Fr.: Fr.) P. Karst.	polypore	20			+
<i>Antrodiella faginea</i> Vampola & Pouzar	polypore	9	+		
<i>Antrodiella pallescens</i> (Pilát) Niemelä & Miettinen	polypore	10			
<i>Antrodiella serpulata</i> (P. Karst.) Spirin & Niemelä	polypore	44	+		
<i>Aphanobasidium pseudotsugae</i> (Burt) Boid. & Gilles	corticioid	101			+
<i>Aporpium canescens</i> (P. Karst.) Bondartsev & Singer	polypore	5	+	+	
<i>Asterostroma laxum</i> Bres.	corticioid	2	+	+	+
<i>Athelia acrospora</i> Jülich	corticioid	1			+
<i>Athelia arachnoidea</i> (Berk.) Jülich	corticioid	3			
<i>Athelia decipiens</i> (Höhn. & Litsch.) J. Erikss.	corticioid	4			+
<i>Athelia epiphylla</i> Pers. : Fr. coll.	corticioid	78			
<i>Athelia neuhoffii</i> (Bres.) Donk	corticioid	1			
<i>Athelopsis lembospora</i> (Bourdot) Oberw.	corticioid	1		+	
<i>Athelopsis subinconspicua</i> (Litsch.) Jülich	corticioid	1			
<i>Basidioidendron caesiocinereum</i> (Höhn. & Litsch.) Luck-Allen	corticioid	4			
<i>Basidiouradulum radula</i> (Fr.) Nobles	corticioid	57			
<i>Bjerkandera adusta</i> (Willd. : Fr.) P. Karst.	polypore	11			
<i>Boidinia furfuracea</i> (Bres.) Stalpers & Hjortstam	corticioid	5			
<i>Botryobasidium aureum</i> Parmasto stat. conid.	corticioid	1		+	
<i>Botryobasidium botryosum</i> (Bres.) J. Erikss.)	corticioid	52			+
<i>Botryobasidium candidans</i> J. Erikss.	corticioid	54			
<i>Botryobasidium conspersum</i> J. Erikss.	corticioid	22		+	+
<i>Botryobasidium isabellinum</i> (Fr.) D.P. Rogers	corticioid	7			
<i>Botryobasidium laeve</i> (J. Erikss.) Parmasto	corticioid	12			
<i>Botryobasidium obtusisporum</i> J. Erikss.	corticioid	16			+
<i>Botryobasidium subcoronatum</i> (Höhn. & Litsch.) Donk	corticioid	261			+
<i>Brevicellicium exile</i> (H.S. Jacks.) K.H. Larsson & Hjortstam	corticioid	1		+	
<i>Brevicellicium olivascens</i> (Bres.) K.H. Larsson & Hjortstam	corticioid	4			
<i>Bulbillomyces farinosus</i> (Bres.) Jülich	corticioid	1			
<i>Byssomerulius corium</i> (Fr.) Parmasto	corticioid	2			
<i>Ceraceomyces eludens</i> K.H. Larsson	corticioid	15			+
<i>Ceraceomyces microsporus</i> K.H. Larsson	corticioid	13			+
<i>Ceraceomyces serpens</i> (Tode: Fr.) Ginns	corticioid	4			
<i>Ceraceomyces tessulatus</i> (Cooke) Jülich	corticioid	2			
<i>Ceraceomyces violascens</i> (Fr. : Fr.) Jülich	corticioid	1	+		
<i>Ceratobasidium cornigerum</i> (Bourdot) D.P. Rogers	corticioid	1			
<i>Ceriporia excelsa</i> (S. Lundell) Parmasto	polypore	3	+	+	
<i>Ceriporia reticulata</i> (H. Hoffm. : Fr.) Domanski	polypore	19			
<i>Ceriporia viridans</i> (Berk. & Broome) Donk	polypore	3	+		
<i>Ceriporiopsis aneirina</i> (Sommerf.) Domanski	polypore	1	+		
<i>Cerrena unicolor</i> (Bull. : Fr.) Murrill	polypore	16	+		
<i>Chaetoderma luna</i> (Romell ex Rogers & Jacks.) Parmasto	corticioid	5	+	+	+
<i>Chondrostereum purpureum</i> (Pers. : Fr.) Pouzar	corticioid	30			
<i>Cinereomyces lindbladii</i> (Berk.) Jülich	polypore	2	+		+
<i>Colacogloea peniophorae</i> (Bourdot & Galzin) Oberw. & Bandoni	corticioid	8	+	+	+
<i>Conferticium ochraceum</i> (Fr. : Fr.) Hallenb.	corticioid	2			
<i>Coniophora arida</i> (Fr.) P. Karst.	corticioid	35			+

Appendix. (Continued)

<i>Coniophora fusispora</i> (Cooke & Ellis) Sacc.	corticoid	1		+	
<i>Coniophora puteana</i> (Schumach. : Fr.) P. Karst.	corticoid	9			+
Corticaceae sp. nova	corticoid	2		+	
<i>Corticium boreoroseum</i> Boidin & Lanquetin	corticoid	2		+	
<i>Corticium roseum</i> Pers.: Fr.	corticoid	5			
<i>Cristinia helvetica</i> (Pers.) Parmasto	corticoid	21			+
<i>Crustoderma corneum</i> (Bourd. & Galz.) Nakasone	corticoid	1	+	+	+
<i>Cylindrobasidium evolvens</i> (Fr. : Fr.) Jülich	corticoid	4			
<i>Cytidia salicina</i> (Fr.) Burt	corticoid	1			
<i>Dacryobolus karstenii</i> (Bres.) Oberw. ex Parmasto	corticoid	2			+
<i>Dacryobolus sudans</i> (Fr.) Fr.	corticoid	3			+
<i>Daedaleopsis confragosa</i> (Bolton : Fr.) J. Schröt.	polypore	8	+		
<i>Datronia mollis</i> (Sommerf.) Donk	polypore	7			
<i>Dendrothele amygdalispora</i> Hjortstam	corticoid	1		+	
<i>Exidiopsis calcea</i> (Pers. : Fr.) K. Wells	corticoid	28			
<i>Fomes fomentarius</i> (L. : Fr.) Fr.	polypore	203			
<i>Fomitopsis pinicola</i> (Sw. : Fr.) P. Karst.	polypore	90			+
<i>Galzinia incrustans</i> Parmasto	corticoid	2			
<i>Ganoderma applanatum</i> (Pers.) Pat.	polypore	22			
<i>Ganoderma lucidum</i> (M.A. Curtis : Fr.) P. Karst.	polypore	3	+		
<i>Globulicium hiemale</i> (Laurila) Hjortstam	corticoid	3			+
<i>Gloeocystidiellum porosum</i> (Berk. & M.A. Curtis) Donk	corticoid	5			
<i>Gloeophyllum sepiarium</i> (Wulfen : Fr.) P. Karst.	polypore	24			+
<i>Gloeoporus dichrous</i> (Fr. : Fr.) Bres.	polypore	14	+		
<i>Gloeoporus pannocinctus</i> (Romell) J. Erikss.	polypore	3	+	+	
<i>Hapalopilus rutilans</i> (Pers. : Fr.) P. Karst.	polypore	28	+		
<i>Hastodontia halonata</i> (J. Eriksson & Hjortstam) Hjortstam & Ryvarde	corticoid	1		+	+
<i>Hastodontia hastata</i> (Litsch.) Hjortstam & Ryvarde	corticoid	25			+
<i>Helicogloea lagerheimii</i> Pat.	corticoid	2		+	
<i>Henningsomyces candidus</i> (Pers. : Fr.) Kuntze	corticoid	2			
<i>Heterobasidion annosum</i> (Fr.) Bref.	polypore	5			+
<i>Heterobasidion parviporum</i> Niemelä & Korhonen	polypore	6			
<i>Hymenochaete fuliginosa</i> (Pers.) Bres.	corticoid	1			+
<i>Hymenochaete tabacina</i> (Fr.) Lév.)	corticoid	5			
<i>Hyphoderma argillaceum</i> (Bres.) Donk	corticoid	16			
<i>Hyphoderma definitum</i> (H.S. Jacks.) Donk	corticoid	1			
<i>Hyphoderma medioburiense</i> (Burt) Donk	corticoid	2			
<i>Hyphoderma obtusifforme</i> J. Erikss. & Å. Strid	corticoid	3			
<i>Hyphoderma obtusum</i> J. Erikss.	corticoid	2	+	+	
<i>Hyphoderma occidentale</i> (D.P. Rogers) Boidin & Gilles	corticoid	1			
<i>Hyphoderma roseocreteum</i> (Bres.) Donk	corticoid	59			
<i>Hyphoderma setigerum</i> (Fr.) Donk	corticoid	41			
<i>Hyphodontia "globisporum"</i>	corticoid	1		+	
<i>Hyphodontia "langeri"</i>	corticoid	22		+	
<i>Hyphodontia alutaria</i> (Burt) J. Erikss.	corticoid	33			+
<i>Hyphodontia arguta</i> (Fr.) J. Erikss.	corticoid	7		+	
<i>Hyphodontia pallidula</i> (Bres.) J. Erikss.	corticoid	28			+
<i>Hyphodontia</i> sp. (species nova)	corticoid	2		+	
<i>Hypochnicium albostramineum</i> (Bres.) Hallenb.	corticoid	4			+
<i>Hypochnicium bombycinum</i> (Sommerf. & Fr.) J. Erikss.	corticoid	1			
<i>Hypochnicium cremicolor</i> (Bres.) H. Nilsson & Hallenb.	corticoid	2	+	+	
<i>Hypochnicium erikssonii</i> Hallenb. & Hjortstam	corticoid	7		+	
<i>Hypochnicium geogenium</i> (Bres.) J. Erikss.	corticoid	3			
<i>Hypochnicium lundellii</i> (Bourdot) J. Erikss.	corticoid	2			
<i>Hypochnicium multiforme</i> (Berk. & Broome) Hjortstam	corticoid	1			+
<i>Hypochnicium punctulatum</i> (Cooke) J. Erikss.	corticoid	2			+
<i>Hypochnicium subrigescens</i> Boidin	corticoid	1	+	+	
<i>Inonotus obliquus</i> (Pers. : Fr.) Pilát	polypore	79			
<i>Inonotus radiatus</i> (Sowerby : Fr.) P. Karst.	polypore	478			
<i>Inonotus rheades</i> (Pers.) Bondartsev & Singer	polypore	10	+		
<i>Irpex</i> cf. <i>lacteus</i> (Fr. : Fr.) Fr.	polypore	1	+		
<i>Irpicodon pendulus</i> (Alb. & Schwein. : Fr.) Pouzar	corticoid	1	+	+	
<i>Ischnoderma benzoinum</i> (Wahlenb. : Fr.) P. Karst.	polypore	18	+		+
<i>Jaapia ochroleuca</i> (Bres.) Nannf. & J. Erikss.	corticoid	1		+	
<i>Kavinia albovidis</i> (Morgan) Gilb. & Budington	corticoid	1	+	+	
<i>Kneiffiella abieticola</i> (Bourdot & Galzin) Jülich & Stalpers	corticoid	9			+
<i>Kneiffiella barba-jovis</i> (Bull.: Fr.) J. Erikss.	corticoid	1			
<i>Kneiffiella subalutacea</i> (P. Karst.) Jül. & Stalpers	corticoid	23			+

Appendix. (Continued)

<i>Lagarobasidium detriticum</i> (Bourdot & Galzin) Jül.	corticoid	1			
<i>Laxitextum bicolor</i> (Pers. : Fr.) Lentz	corticoid	4			
<i>Lenzites betulinus</i> (L. : Fr.) Fr.	polypore	1			
<i>Leptosporomyces galzinii</i> (Bourdot) Jülich	corticoid	69			+
<i>Leucogyrophana romellii</i> (Fr.) Ginns	corticoid	4			
<i>Leucogyrophana sororia</i> (Burt) Ginns	corticoid	2			
<i>Lindtneria chordulata</i> (D.P. Rogers) Hjortstam	corticoid	3	+		+
<i>Luellia recondita</i> (H.S. Jacks.) K.H. Larsson & Hjortstam	corticoid	2			+
<i>Lyomyces sambuci</i> (Pers.: Fr.) P. Karst.	corticoid	1			
<i>Megalocystidium leucoxanthum</i> (Bres.) Jül.	corticoid	3			
<i>Meruliopsis taxicola</i> (Pers.: Fr.) Bondartsev	polypore	36	+		+
<i>Metulodontia nivea</i> (P. Karst.) Parmasto	corticoid	4	+		
<i>Mycoacia fuscoatra</i> (Fr. : Fr.) Donk	corticoid	1	+		
<i>Oligoporus rennyi</i> (Berk. & Broome) Donk	polypore	3	+		
<i>Oligoporus sericeomollis</i> (Romell) Bondartsev	polypore	2	+		+
<i>Oliveonia fibrillosa</i> (Burt) Donk	corticoid	7			+
<i>Peniophora cinerea</i> (Pers. : Fr.) Cooke	corticoid	3			
<i>Peniophora incarnata</i> (Pers. : Fr.) P. Karst.	corticoid	16			
<i>Peniophora limitata</i> (Chaillet ex Fr.) Cooke	corticoid	1			
<i>Peniophora nuda</i> (Fr.) Bres.	corticoid	2			
<i>Peniophora pithya</i> (Pers.) J. Erikss.	corticoid	14			+
<i>Peniophora polygonia</i> (Pers. : Fr.) Bourdot & Galzin	corticoid	10			
<i>Peniophora violaceolivida</i> (Sommerf.) Masee	corticoid	5			
<i>Peniophorella echinocystis</i> (J. Erikss. & Strid) K.H. Larss.	corticoid	3	+		+
<i>Peniophorella guttulifera</i> (P. Karst.) K.H. Larss.	corticoid	4	+		+
<i>Peniophorella pallida</i> (Bres.) K.H. Larss.	corticoid	5			
<i>Peniophorella praetermissa</i> (P. Karst.) K.H. Larss.	corticoid	67			+
<i>Peniophorella pubera</i> (Fr.) P. Karst.	corticoid	204			+
<i>Peniophorella tsugae</i> (Burt) K.H. Larss.	corticoid	1			+
<i>Phaeolus schweinitzii</i> (Fr.) Pat.	polypore	2	+		+
<i>Phanerochaete laevis</i> (Pers. : Fr.) J. Erikss. & Ryvarden	corticoid	7			
<i>Phanerochaete magnoliae</i> (Berk. & M.A. Curtis) Burdsall	corticoid	2			+
<i>Phanerochaete sanguinea</i> (Fr.) Pouzar	corticoid	55			+
<i>Phanerochaete sordida</i> (P. Karst.) J. Erikss. & Ryvarden	corticoid	32			+
<i>Phanerochaete tuberculata</i> (P. Karst.) Parmasto	corticoid	5			
<i>Phanerochaete velutina</i> (DC. : Fr.) P. Karst.	corticoid	32			
<i>Phellinus alni</i> (Bondartsev) Parmasto	polypore	1			
<i>Phellinus cinereus</i> (Niemelä) M. Fisch.	polypore	20			
<i>Phellinus conchatus</i> (Pers. : Fr.) Quél.	polypore	44			
<i>Phellinus igniarius</i> s. str. (L. : Fr.) Quél.	polypore	4			
<i>Phellinus laevigatus</i> (P. Karst.) Bourdot & Galzin	polypore	28	+		
<i>Phellinus lundellii</i> Niemelä	polypore	4	+		+
<i>Phellinus nigrolimitatus</i> (Romell) Bourdot & Galzin	polypore	2	+		
<i>Phellinus pini</i> (Brot. : Fr.) A. Ames	polypore	16	+		+
<i>Phellinus populicola</i> Niemelä	polypore	9	+		
<i>Phellinus punctatus</i> (P. Karst.) Pilát	polypore	18			
<i>Phellinus tremulae</i> (Bondartsev) Bondartsev & Borisov	polypore	46			
<i>Phlebia albida</i> H. Post	corticoid	2			+
<i>Phlebia cremeoalutacea</i> (Parmasto) K.H. Larss. & Hjortstam	corticoid	3			+
<i>Phlebia radiata</i> Fr.	corticoid	21			+
<i>Phlebia rufa</i> (Pers. : Fr.) M.P. Christ.	corticoid	1			
<i>Phlebia segregata</i> (Bourdot & Galzin) Parmasto	corticoid	1			
<i>Phlebia tremellosa</i> (Schrad. : Fr.) Nakasone	corticoid	10			
<i>Phlebiella christiansenii</i> (Parmasto) K.H. Larsson & Hjortstam	corticoid	1	+		
<i>Phlebiella sulphurea</i> (Pers. : Fr.) Ginns & Lefebvre	corticoid	75			+
<i>Phlebiella tulasnelloidea</i> (Höhn. & Litsch.) Ginns & Lefebvre	corticoid	3			
<i>Phlebiopsis gigantea</i> (Fr. : Fr.) Jülich	corticoid	9			
<i>Physisporinus vitreus</i> (Pers. : Fr.) P. Karst.	polypore	1	+		
<i>Piloderma byssinum</i> (P. Karst.) Jülich	corticoid	9			+
<i>Piloderma fallax</i> (Liberta) Stalpers	corticoid	136			+
<i>Piloderma</i> sp. (species nova)	corticoid	1			+
<i>Piloderma sphaerosporum</i> Jülich	corticoid	2			+
<i>Piptoporus betulinus</i> (Bull. : Fr.) P. Karst.	polypore	156			
<i>Polyporus ciliatus</i> Fr. : Fr.	polypore	9			
<i>Polyporus leptcephalus</i> (Jacq. : Fr.) Fr.	polypore	2	+		
<i>Postia alni</i> Niemelä & Vampola	polypore	1			

Appendix. (Continued)

<i>Postia caesia</i> (Schrad. : Fr.) P. Karst.	polypore	15			
<i>Postia fragilis</i> (Fr.) Jülich	polypore	2			
<i>Postia hibernica</i> (Berk. & Broome) Jülich	polypore	1	+	+	
<i>Postia immitis</i> (Peck) Niemelä	polypore	1	+	+	
<i>Postia leucomallella</i> (Murrill) Jülich	polypore	8	+		+
<i>Postia ptychogaster</i> (F. Ludw.) Vesterh.	polypore	2	+		
<i>Postia stiptica</i> (Pers.: Fr.) Jülich	polypore	23			+
<i>Postia tephroleuca</i> (Fr.) Jülich	polypore	7			+
<i>Pseudomerulius montanus</i> (Burt) Kotir., Larss. & Kulju	corticoid	1		+	+
<i>Pseudotomentella tristis</i> (P. Karst.) M.J. Larsen	corticoid	1			
<i>Pycnoporus cinnabarinus</i> (Jacq. : Fr.) P. Karst.	polypore	1			
<i>Radulomyces confluens</i> (Fr. : Fr.) M.P. Christ.	corticoid	26			
<i>Repetobasidium vile</i> (Bourd. & Galz.) J. Erikss.	corticoid	1		+	
<i>Resinicium bicolor</i> (Alb. & Schwein. : Fr.) Parmasto	corticoid	53			+
<i>Resinicium furfuraceum</i> (Bres.) Parmasto	corticoid	6			+
<i>Resinicium pinicola</i> (J. Erikss.) J. Erikss. & Hjortstam	corticoid	1		+	
<i>Rigidoporus corticola</i> (Fr.) Pouzar	polypore	32			
<i>Rigidoporus populinus</i> (Schumach. : Fr.) Pouzar	polypore	4	+		
<i>Schizopora flavipora</i> (Berk. & M.A. Curtis ex Cooke)					
Ryvarden	polypore	1	+	+	
<i>Schizopora paradoxa</i> (Schrad. : Fr.) Donk	polypore	4	+		
<i>Schizopora radula</i> (Pers.: Fr.) Hallenb.	polypore	9			
<i>Scopuloides rimosa</i> (Cooke) Jülich	corticoid	27			
<i>Scytinostroma portentosum</i> (Berk. & M.A. Curtis) Donk	corticoid	12			
<i>Serpula himantioides</i> (Fr. : Fr.) P. Karst.	corticoid	3			
<i>Sidera lunata</i> (Romell ex Bourdot & Galzin) K.H. Larsson	corticoid	2		+	+
<i>Sistotrema brinkmannii</i> (Bres.) J. Erikss.	corticoid	30			
<i>Sistotrema coroniferum</i> (v. Höhn. & Litsch.) Donk	corticoid	3		+	
<i>Sistotrema muscicola</i> (Pers.) S. Lundell	polypore	1	+		
<i>Sistotrema raduloides</i> (P. Karst.) Donk	corticoid	4	+	+	
<i>Sistotrema sermanderi</i> (Litsch.) Donk	corticoid	7			
<i>Sistotremastrum niveocremaum</i> (Höhn. & Litsch.) J. Erikss.	corticoid	4			
<i>Sistotremastrum suecicum</i> Litsch. ex J. Erikss.	corticoid	36	+	+	+
<i>Skeletocutis amorphia</i> (Fr.) Kotl. & Pouzar	polypore	22			+
<i>Skeletocutis biguttulata</i> (Romell) Niemelä	polypore	7			+
<i>Skeletocutis papyracea</i> A. David	polypore	1	+		+
<i>Spongipellis fissilis</i> (Berk. & M.A. Curtis) Murrill	polypore	3	+	+	
<i>Steccherinum fimbriatum</i> (Pers. : Fr.) J. Erikss.	corticoid	14			
<i>Steccherinum lacerum</i> (P. Karst.) Kotir. & Saaren.	polypore	1	+		
<i>Steccherinum luteoalbum</i> (P. Karst.) Vesterholt	polypore	9	+		+
<i>Steccherinum nitidum</i> (Pers. : Fr.) Vesterholt	polypore	1			
<i>Steccherinum ochraceum</i> (Pers.) Gray	corticoid	1	+		
<i>Stereum hirsutum</i> (Willd. : Fr.) Gray	corticoid	49			
<i>Stereum rugosum</i> Pers. : Fr.	corticoid	242			
<i>Stereum sanguinolentum</i> (Alb. & Schwein. : Fr.) Fr.	corticoid	87			+
<i>Stereum subtomentosum</i> Pouzar	corticoid	70			
<i>Stypella dubia</i> (Bourdot & Galzin) P. Roberts	corticoid	1			
<i>Stypella livida</i> (Bres.) comb. ined.	corticoid	1		+	
<i>Subulicystidium longisporum</i> (Pat.) Parmasto	corticoid	14			
<i>Thanatephorus fusisporus</i> (J. Schröt.) P. Roberts & Hauerslev	corticoid	1			
<i>Thelephora terrestris</i> Ehrh. : Fr.	corticoid	5			
<i>Tomentella albomarginata</i> (Bourdot & Galzin) M.J. Larsen	corticoid	3		+	+
<i>Tomentella atramentaria</i> Rostr.	corticoid	1		+	
<i>Tomentella bryophila</i> (Pers.) M.J. Larsen	corticoid	2		+	
<i>Tomentella cinereoumbrina</i> (Bres.) Stalpers	corticoid	1		+	
<i>Tomentella coerulea</i> (Bres.) Höhn. & Litsch	corticoid	4		+	
<i>Tomentella ellisii</i> (Sacc.) Jülich & Stalpers	corticoid	5			
<i>Tomentella fuscocinerea</i> (Pers.) Donk	corticoid	1		+	
<i>Tomentella galzinii</i> Bourdot	corticoid	2			
<i>Tomentella radiosa</i> (P. Karst.) Rick	corticoid	3			+
<i>Tomentella stuposa</i> (Link) Stalpers	corticoid	4			
<i>Tomentella subuliacina</i> (Ellis & Holw.) Wakef. coll.	corticoid	20			+
<i>Tomentella terrestris</i> (Berk. & Broome) M.J. Larsen	corticoid	1		+	
<i>Tomentellopsis echinospora</i> (Ellis) Hjortstam	corticoid	5			+
<i>Tomentellopsis submollis</i> (Svrček) Hjortstam	corticoid	2			
<i>Tomentellopsis zygodesmoides</i> Ellis & Hjortstam	corticoid	3		+	
<i>Trametes hirsuta</i> (Wulfen : Fr.) Pilát	polypore	20			
<i>Trametes ochracea</i> (Pers.) Gilb. & Ryvarden	polypore	24			

Appendix. (Continued)

<i>Trametes pubescens</i> (Schumach. : Fr.) Pilát	polypore	3			
<i>Trametes velutina</i> (Fr.) G. Cunn.	polypore	2	+		
<i>Trechispora araneosa</i> (Höhnelt & Litsch.) K.H. Larss.	corticoid	2			+
<i>Trechispora byssinella</i> (Bourdote) Liberta	corticoid	2			
<i>Trechispora caucasica</i> (Parm.) Liberta	corticoid	1			+
<i>Trechispora cohaerens</i> (Schw.) Jülich & Stalpers	corticoid	3			
<i>Trechispora confinis</i> (Bourdote & Galzin) Liberta	corticoid	63			+
<i>Trechispora farinacea</i> (Pers. : Fr.) Liberta	corticoid	144			+
<i>Trechispora hymenocystis</i> (Berk. & Broome) K.H. Larsson	polypore	29			+
<i>Trechispora invisitata</i> (H.S. Jacks.) Liberta ssp. hauerlevii K.H. Larsson	corticoid	2			+
<i>Trechispora kavinioides</i> de Vries	corticoid	1	+		
<i>Trechispora laevis</i> K.H. Larsson	corticoid	5			+
<i>Trechispora microspora</i> (P. Karst.) Liberta	corticoid	3			+
<i>Trechispora minima</i> K.H. Larsson	corticoid	1			+
<i>Trechispora minuta</i> K.H. Larsson	corticoid	3			+
<i>Trechispora mollusca</i> (Pers. : Fr.) Liberta	corticoid	2	+		
<i>Trechispora nivea</i> (Pers.) K.H. Larsson	corticoid	3			
<i>Trechispora praefocata</i> (Bourdote & Galzin) Liberta	corticoid	19			
<i>Trechispora stellulata</i> (Bourdote & Galzin) Liberta	corticoid	1			+
<i>Trechispora stevensonii</i> (Berk. & Broome) K.H. Larsson	corticoid	32			+
<i>Trechispora subsphaerospora</i> (Litsch.) Liberta	corticoid	5			+
<i>Trichaptum abietinum</i> (Pers. : Fr.) Ryvarden	polypore	158			+
<i>Trichaptum fuscoviolaceum</i> (J.C. Schmidt : Fr.) Kreisel	polypore	33			+
<i>Tubulicium vermiferum</i> (Bourdote) Oberw. ex Jülich	corticoid	1			+
<i>Tubulicrinis accedens</i> (Bourdote & Galzin) Donk	corticoid	1			+
<i>Tubulicrinis angustus</i> (D.P. Rogers & Weresub) Donk	corticoid	1			+
<i>Tubulicrinis borealis</i> J. Erikss.	corticoid	1			
<i>Tubulicrinis calothrix</i> (Pat.) Donk	corticoid	3			
<i>Tubulicrinis glebulosus</i> (Bres.) Donk	corticoid	4			
<i>Tubulicrinis medius</i> (Bourdote & Galzin) Oberw.	corticoid	1			+
<i>Tubulicrinis propinquus</i> (Bourdote & Galzin) Donk	corticoid	5			+
<i>Tubulicrinis subulatus</i> (Bourdote & Galzin) Donk	corticoid	116			+
<i>Tulasnella danica</i> Hauerl.	corticoid	1			+
<i>Tulasnella pinicola</i> Bres.	corticoid	3			
<i>Tulasnella subglobispora</i> Hjortstam	corticoid	1			
<i>Tulasnella violea</i> (Quél.) Bourdote & Galzin	corticoid	6			
<i>Tylospora fibrillosa</i> (Burt) Donk	corticoid	3			
<i>Tyromyces chioneus</i> (Fr.) P. Karst.	polypore	4			
<i>Vesiculomyces citrinus</i> (Pers.) Hagström	corticoid	77			+
<i>Vuilleminia comedens</i> (Nees : Fr.) Maire	corticoid	1			
<i>Xylodon asperus</i> (Fr.) Hjortstam & Ryvarden	corticoid	2			
<i>Xylodon borealis</i> (Kotir. & Saaren.) Hjortstam & Ryvarden	corticoid	1			
<i>Xylodon brevisetus</i> (P. Karst.) Hjortstam & Ryvarden	corticoid	91			+
<i>Xylodon crustosus</i> (Pers. : Fr.) Chevall	corticoid	2			
<i>Xylodon rimosissimus</i> (Peck) Hjortstam & Ryvarden	corticoid	33			

¹ In analyses, only records from kelo trees were considered.