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Polypore–beetle associations in Finland

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Seven old-growth, mostly spruce- and pine-dominated, protected forests rich in dead wood were inventoried for polypores and polypore-associated beetles in Finland in 2001–2007. A total of 198 polypore species (86% of the Finnish species list) were examined for associated Coleoptera. Of these, 116 species (59% of the studied species, or 50% of the Finnish polypore mycota) were found to host adults and/or larvae of 176 beetle species. Fifty-six polypore species were utilized by larvae of 21 beetle species. Many new fungus–beetle associations were discovered among 544 species pairs, including 421 polypore fruit body–adult Coleoptera species co-occurrences, and 123 fruit body–larva associations. Eighty-two species of fungi (41% of the studied species, or 36% of the Finnish polypores) were neither visited nor colonized by Coleoptera.

Introduction

During recent decades polypores have become one of the taxonomically best-studied groups of forest organisms in Finland (Niemelä 2005). Polypores are important indicator species as some of them survive only in old-growth forests with plenty of dead wood at different stages of decay (Kotiranta & Niemelä 1996, Niemelä *et al*. 2005, Halme *et al*. 2009), and many are red-listed (Rassi *et al*. 2010).

Saalas (1917, 1923) and Palm (1951, 1959) were among the first to document saproxylic (including fungivorous) Coleoptera in the Nordic region. Hundreds of fungus–beetle associations have been documented by Scheerpeltz and Höfler (1948), Benick (1952), Nuss (1975) and Koch (1989a, b) for central Europe, by Alexander (2002) for the UK, and by Nikitsky *et al*. (1996) and Nikitsky and Schigel (2004) for the southern taiga of the Moscow region, Russia. Nikitsky (1993) reported the host fungi of Mycetophagidae of Russia and adjacent countries, and Krasutskiy (2005) reported 208 fungicolous beetles and 89 species of their host fungi in the Urals and Transurals. Ehnström and Axelsson (2002) provided 18 main fungal hosts for 26 polyporicolous beetles with illustrations of their galleries. Selonen *et al*. (2005) reared 33 beetle species from 55 species of polypores, but reported beetles for only three hosts. At present, insect communities occurring in the fruit bodies of wood-decaying macrofungi are considered hotspots of insect diversity in boreal forests (Komonen 2003b). Only a few host fungi have been studied for associated beetles with sampling efforts sufficient for statistical analyses of the data (for a detailed review of the literature, *see* Schigel 2009). Four polypore species, *Fomes fomentarius*, *Fomitopsis pinicola*, *F. rosea*, and *Amylocystis lapponica* have been particularly thoroughly studied (Thunes 1994, Nilsson 1997,

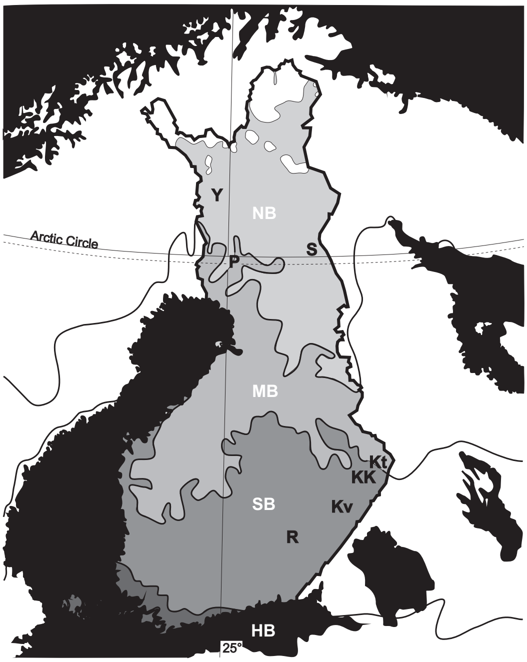

Fig. 1. Study areas in Finland, from north to south: Y = Ylläs–Aakenustunturi fell area, 2001, S = Salla fell area, 2005, P = Pisavaara Strict Nature Reserve, 2003, Kt = Koitajoki Natura 2000 site, including Koivusuo Strict Nature Reserve, 2002, KK = Kolvananuuro–Kirjovaara Nature Reserve areas, 2004, R = Repovesi National Park, 2004, Kv = Kolovesi National Park, 2006. Study sites in southern Finland are not shown. NB = northern boreal zone (white areas are predominantly fell ranges above the timberline), MB = middle boreal zone, SB = southern boreal zone, HB = hemiboreal zone.

Fossli & Andersen 1998, Jonsell 1998, Rukke & Midtgaard 1998, Hågvar 1999, Olberg & Andersen 2000, Jonsell *et al.* 1999, 2001, 2003, Jonsell & Nordlander 1995, 2002, 2004, Jonsson *et al.* 1997, 2001, Jonsson 2003, Komonen 2003c, Komonen *et al.* 2003, 2004, Lik 2005). Recent literature references on fungus-associated beetles from northern Europe is given in the relevant species sections in the Results and Discussion below, but self-citations are omitted.

The beetle records from my earlier studies in Finnish Karelia (Schigel *et al.* 2004), Lapland (Schigel *et al.* 2006), and Häme (Schigel 2005), and on certain species of wood-decaying fungi (Schigel & Toresson 2005, Schigel 2007) are included in the present country-wide overview of the polypore–beetle associations, but most of the records, in particular those from southern Finland and the Åland Islands, are new. The goal here is to document the associations of Coleoptera (fungivorous larvae and visiting adults) with polypore species (fruit bodies), also taking into account rare and poorly known fungi and their novel taxonomy.

Material and methods

Study sites

The main study sites, listed from north to south, were the Yllästunturi and Aakenustunturi fells and highland in western Finnish Lapland, the Sallatunturi fell area in eastern Finnish Lapland, the Pisavaara Strict Nature Reserve (Rovaniemi commune), the Koitajoki Natura 2000 site, the Kolvananuuro Nature Reserve and Kirjovaara Forest Reserve, the Kolovesi National Park, and the Repovesi National Park. Ylläs, Salla, and Pisavaara are collectively referred to as the North (northern boreal vegetation zone), and Koitajoki, Kolvananuuro and Kirjovaara, Kolovesi, and Repovesi in northern Karelia and the Lake District (southern boreal zone) are referred to as the Southeast (Fig. 1). Supplementary field collections and rearings of beetles were carried out in various localities in southern Finland in Etelä-Häme (communes Hämeenlinna, Juupajoki, Lammi, Padasjoki, and Ruovesi), Satakunta (Ikaalinen, Viljakkala), and in the hemiboreal zone in Uusimaa (Helsinki, Karjaa, Kerava, Kirkkonummi, Sipoo, Tammisaari, and Vantaa), Varsinais-Suomi (Hanko, Naantali, and Turku), and the Åland Islands.

Fungi were recorded by the inventory team in the field by examining live and dead trees, fallen trunks and woody debris along a roughly planned route between the compartments based on age-class maps, aerial photographs and expert opinions from the Metsähallitus Natural Heritage Services to include all forest types of the study site. We prioritized the compartments with the oldest age classes of trees and highest amounts of coarse woody debris, but all forest site types present in the area were sampled. These included mainly spruce- and pine-dominated forests, but also small-sized targets with supplementary host trees (*Salix*, *Populus* etc., brookside thickets) or forest histories (windthrow, forest fire).

Study system

Polypores (poroid non-bolete, mostly wood-decaying) Basidiomycota fungi were surveyed. These bracket fungi mostly live off live and dead wood, but a few species also grow on the soil. Most species are saprotrophic, but some are pathogens of live trees. In this study, the fruit body was the primary life stage we examined. Adult Coleoptera were collected from the polypore fruit bodies in the field, while their larvae and pupae were reared into adults in the laboratory. In addition to species feeding on the interior of the fruit body, species exploiting the fruit body surface were also studied. Additional notes on beetles attracted to spore masses and anamorphic fungi were made where possible.

The polypore data

During species inventories, the presence of a polypore species was verified by fruit body observations in each of the forest compartments (*metsäkuviot*, the smallest contiguous, uniform and single-aged forest stand) visited. Detectability of polypores depended on species abundance within the forest compartment, longevity (apparency) and seasonality of the fruit body (dead fruit bodies were also recorded if they could be identified), and yearly climatic variation. Specimens that could not be identified with certainty were collected for microscopic study. These specimens were dried in ventilated fungus dryers at 40–45 °C, and subsequenty identified. The fungal nomenclature follows Niemelä (2005). Polypore specimens are preserved in the Herbarium of the Botanical Museum of the University of Helsinki (H).

The beetle data

In order to study beetles associated with polypores, one fungal sample was represented by an individual fruit body or a dense and compact cluster of fruit bodies (usually no more than 15) having similar characteristics, presumably belonging to one genet, or "fungal individual", and collected from a single tree. Fruit bodies from the soil were always treated individually.

Details regarding the methodology and practical advice on collecting and rearing fungivorous Coleoptera are given in a separate paper (Schigel 2008). All polypore fruit bodies examined for adult beetles were also checked in the field for larvae or their traces. Intact fruit bodies were not collected for rearing, except for the rarest fungal species. Larvae inside pieces of a colonized fruit body were reared into adults in the laboratory. Collected pieces of colonized fruit bodies were dried in open plastic bags for 2–3 days at room temperature until their surface became dry, then plastic bags were closed and kept at outdoor temperatures in sheltered storage for 2–3 months, and then again for an additional 2–3 months at room temperature. After rearing, results were checked and adult beetles preserved for identification, and the remaining larvae, if any, were left for one extra cycle of rearing. From each sample of fungi examined for Coleoptera, all adults collected from the field and all adults reared in the laboratory were identified and treated separately. The beetle nomenclature follows Silfverberg (2004) and Müller *et al.* (2001). After completing the mountings, beetles were be donated to the Zoological Museum, Finnish Museum of Natural History, University of Helsinki.

In this paper, names of the species whose larvae undoubtedly developed in polypore fruit bodies are set in ***boldface italics***, all the remaining reared species require further sampling. These undoubted breeding records were defined in accordance with Lawrence's (1973: 165) criteria, quoted below. "A breeding record consists of any one of the following: (1) Ten or more fully pigmented adults. (2) Two or more teneral adults. (3) One teneral and two or more fully pigmented adults. (4) One or more larvae and/or pupae (when these can be identified). This breakdown is somewhat arbitrary, but it tends to eliminate accidental records, which are common enough, especially in situations where several very different host fungi […] grow on a single log […] The added weight given to the presence of teneral individuals is based on the assumption that dispersal flights occur only after full pigmentation (and thus hardening of the cuticle) has been attained. Thus, a teneral adult (if it does not represent a contaminant from an adjacent fruiting body) has almost certainly developed *in situ*." My collections from outside Finland are omitted from this national checklist. Intensively studied *Fomes fomentarius*, *Fomitopsis pinicola*, *F. rosea*, and *Amylocystis lapponica* were excluded from the rearing routine.

Results and discussion

Altogether 6501 specimens of polypores were examined for Coleoptera. Of the 198 (86% of the Finnish polypore mycota: Niemelä 2005) species of polypores, a total of 116 species (59% of the studied species, or 50% of the Finnish polypore mycota) hosted Coleoptera; of which 56 (48% of the studied species) hosted beetle larvae. The real number of larval hosts will however increase, when some of the doubtful breeding records are confirmed, and rearing data from *Fomes fomentarius*, *Fomitopsis pinicola*, *F. rosea* and *Amylocystis lapponica* are added. Numbers of polypore samples, those examined for and visited by adult beetles, those collected for rearing beetle larvae into adults, and numbers of successful rearings are indicated for each polypore species together with numbers of beetle species collected from the field or reared in the laboratory (Table 1). Eighty-two (41% of the studied species, or 36% of the Finnish species pool) polypore species were neither visited nor colonized by Coleoptera in spite of considerable attention paid to many of such fungi.

A total of 421 fungus–beetle association pairs (fruit body–adult) were recorded. A total of 1737 polypore specimens were selected for rearing larvae into adults, and disclosed 123 fungus–beetle species association pairs (fruit body–larva). *Laetiporus sulphurous* hosted the highest number of beetle species (47), followed by *Fomes fomentarius* (25) and *Grifola frondosa* (24) (Table 1). Altogether 176 species of Coleoptera were documented to be associated with 116 polypore species in Finland, including 21 (12%) beetle species reared from larvae from 56 polypore species (Table 2). The following list of Finnish polypores visited or colonized by Coleoptera is annotated with a description of fruit body architecture, growth and decomposition charachteristics. Polypore genera and/or species are grouped according to their characteristics and fruit body growth, from hardest and most intact-wood-dependent groups to softest and most mushroom-like ones. Species with similar fructifications are discussed collectively.

Phellinus subg. *Fomitiporia*

Phellinus hippophaeicola H. Jahn
Phellinus punctatus (P. Karst.) Pilát
Phellinus robustus (P. Karst.) Bourdot & Galzin

These three *Phellinus* species belong to *Phellinus* subg. *Fomitoporia* and are among the hardest, densest and most slowly-growing polypore species in Finland. Resupinate *P. punctatus* occupies various deciduous hosts, except birch, and hoof-shaped *P. hippophaeicola* and *P. robustus* are specialists of sea-buckthorn (*Hippophae*) and oak (*Quercus*), respectively (Niemelä & Kotiranta 1982, Niemelä 2005). *Phellinus hippophaeicola* is locally common along the western coastline of Finland, and *P. robustus* is a rare polypore confined to old oak stands in southwestern Finland, red-listed as near-threatened (Rassi *et al*. 2010). I studied these in the Åland Islands and Ruissalo (Turku) only. *Phellinus punctatus* is widespread in southern Finland and the Lake District (Niemelä & Kotiranta 1982), but was not found in the North. I studied it also in the Helsinki metropolitan area, Häme, and the Åland Islands. *Phellinus* species, like many other perennial polypores, were seldom attacked by beetle colonizers when alive, and were visited by adults mostly during sporulation, if at all. Unlike the majority of other *Phellinus* in Finland, old and dying fruit bodies of *Fomitiporia* are favoured by moth caterpillars. From *P. robustus*, single beetle rearings of *Ennearthron cornutum* and *E. laricinum* were recorded. *E. cornutum* and *Orthoperus corticalis* were the only visitors of *P. robustus*. *P. hippophaeicola* and *P. punctatus* were never colonized by beetles. *P. punctatus* was visited by *Rhizophagus dispar*, and *P. hippophaeicola* by

Table 1. Polypores associated with Coleoptera in Finland. Species of fungi arranged according to the number of associated Coleoptera species, recorded as adult visitors. * = polypore species excluded from the rearing routine (*see* Material and methods).

Polypore species	Number of polypore specimens				Number of species of Coleoptera	
	Examined for adult beetles	Visited by adult beetles	Selected for rearing	Successful rearings	Adult visitors	Reared
Laetiporus sulphureus	78	73	24	22	45	2
*Fomes fomentarius**	355	46			25	
Grifola frondosa	8	8	5		24	
Trametes ochracea	185	23	68	63	18	3
*Amylocystis lapponica**	13	12			16	
Piptoporus betulinus	45	31	29	26	15	4
Climacocystis borealis	35	21	25	25	15	4
Inonotus obliquus	262	27	16	11	14	5
*Fomitopsis pinicola**	336	40			12	
Fistulina hepatica	14	11	14		11	
Phaeolus schweinitzii	15	13	11		10	
Phellinus igniarius	68	17	20	16	9	4
Skeletocutis odora	47	23	10	3	9	1
Rhodonia placenta	24	16	11	1	9	1
Bjerkandera adusta	29	9	12	8	8	3
Heterobasidion parviporum	29	14	12	10	7	1
Daedalea quercina	17	9	10		7	
Antrodiella pallescens	57	18	15	5	7	3
Inonotus radiatus	20	9	10	7	7	2
Phellinus conchatus	110	8	24	5	6	2
Ganoderma applanatum	34	14	29	23	6	4
Gloeophyllum odoratum	17	7	11	8	6	1
Polyporus pseudobetulinus	5	5	5	5	6	3
Rigidoporus corticola	74	18	11	6	6	3
Oligoporus lateritius	32	9	15	7	6	1
Phellinus tremulae	209	6	14	6	5	1
Trichaptum pargamenum	20	11	9	9	5	3
Inonotus rheades	43	16	22	13	5	5
Antrodia serialis	221	14	22	9	5	3
Pycnoporellus fulgens	13	9	5	3	5	1
Postia leucomallella	74	6	4	4	5	1
Tyromyces chioneus	13	7	13		5	
Phellinus laevigatus	135	4	14		4	
Gloeophyllum sepiarium	164	4	43		4	
Funalia trogii	2	2	2	2	4	1
Gloeoporus pannocinctus	35	11	11		4	
Polyporus squamosus	7	4	7		4	
Onnia leporina	29	4	16		4	
Phellinus viticola	245	4	27	6	4	1
Antrodia sinuosa	212	1	19		4	
Leptoporus mollis	34	4	19		4	
Oligoporus stipticus	16	9	14		4	
Spongipellis fissilis	2	2	2		4	
Phellinus populicola	45	3	36	5	3	1
Perenniporia subacida	22	3	12		3	
Trametes pubescens	32	3	17	12	3	4
Pycnoporus cinnabarinus	16	2	18	18	3	1
Antrodiella serpula	23	2	19	1	3	1
Antrodia infirma	27	3	6	1	3	1

continued

Table 1. Continued.

Polypore species	Number of polypore specimens				Number of species of Coleoptera	
	Examined for adult beetles	Visited by adult beetles	Selected for rearing	Successful rearings	Adult visitors	Reared
Hapalopilus croceus	3	3	2		3	
Oligoporus fragilis	24	3	16		3	
Oligoporus guttulatus	12	5	23		3	
Postia caesia	94	3	26		3	
Postia tephroleuca	50	4	16	11	3	2
Phellinus hippophaeicola	26	2	9		2	
Phellinus robustus	9	4	4	2	2	2
Phellinus lundellii	93	3	18	7	2	2
Phellinus chrysoloma	127	2	7	5	2	1
Phellinus pini	100	3	14	6	2	1
Haploporus odorus	12	2	20	13	2	4
Trametes hirsuta	12	3	9	7	2	3
Cerrena unicolor	133	2	4	4	2	2
Lenzites betulinus	9	2	3	3	2	1
Daedaleopsis septentrionalis	7	2	4	1	2	1
Daedaleopsis tricolor	3	2	3		2	
Gloeoporus dichrous	78	2	7	7	2	1
Datronia mollis	22	2	7	3	2	1
Dichomitus squalens	14	2	2		2	
Inonotus dryophilus	8	2	7	6	2	4
Ischnoderma benzoinum	51	2	5	5	2	2
Hyphodontia paradoxa	26	1	13		2	
Cinereomyces lindbladii	20	2	7		2	
Ceriporia purpurea	2	2	2		2	
Junghuhnia luteoalba	73	2	14		2	
Protomerulius caryae	21	2	6		2	
Hapalopilus rutilans	18	2	7		2	
Oligoporus sericeomollis	134	3	17		2	
Albatrellus ovinus	29	2	4		2	
Antrodia xantha	195	1	44		1	
Phellinus ferrugineofuscus	137	1	46		?1	
Phellinus punctatus	16	1	7		1	
*Fomitopsis rosea**	6	2			1	
Perenniporia medulla-panis	2	2	2		1	
Trametes suaveolens	9	1	6	6	1	4
Diplomitoporus flavescens	1	1	1		1	
Antrodiella canadensis	1	1	1		1	
Antrodiella faginea	23	1	4		1	
Trichaptum fuscoviolaceum	97	2	29	9	1	1
Polyporus brumalis	22	1	9		1	
Polyporus ciliatus	9	1	9		1	
Polyporus leptocephalus	27	1	14	12	1	5
Inonotus ulmicola	3	3	3	2	1	1
Ceriporiopsis pseudogilvescens	22	1	3	1	1	2
Meruliopsis taxicola	37	1	10		1	
Antrodia albobrunnea	63	1	22		1	
Antrodia pulvinascens	16	1	12	2	1	1
Skeletocutis nivea	44	1	24		1	
Skeletocutis stellae	36	1	17		1	
Junghuhnia nitida	1	1	1		1	
Hapalopilus aurantiacus	6	1	1		1	

continued

Table 1. Continued.

Polypore species	Number of polypore specimens				Number of species of Coleoptera	
	Examined for adult beetles	Visited by adult beetles	Selected for rearing	Successful rearings	Adult visitors	Reared
Erastia salmonicolor	3	1	3	3	1	1
Oligoporus balsameus	6	2	7	6	1	1
Oligoporus immitis	1	1	1		1	
Postia alni	76	1	12		1	
Postia lactea	18	1	15		1	
Postia luteocaesia	3	1	1		1	
Spongipellis spumea	5	1	5		1	
Ganoderma lucidum	11		7	5		1
Trametes velutina	18		9	9		2
Trametes versicolor	7		4	4		1
Bjerkandera fumosa	3		1	1		1
Dichomitus campestris	18		9	8		1
Trichaptum abietinum	26		16	5		1
Phellinus ferruginosus	14		5	4		1
Total	5740	721	1404	497	492	122

Dinaraea aequata and *Philorhizus sigma*. These seem to be the first data on associated beetles for these fungi in the Nordic region, but Möller (2005) reported an association between *P. robustus* and *Osmoderma eremita* (Scopoli, 1763), both species found in Ruissalo.

Phellinus s. str.

Phellinus igniarius (L. : Fr.) Quél. (incl. *Phellinus alni* (Bondartsev) Parmasto, *Phellinus nigricans* (Fr.) P. Karst.
Phellinus laevigatus (P. Karst.) Bourdot & Galzin
Phellinus lundellii Niemelä
Phellinus populicola Niemelä
Phellinus tremulae (Bondartsev) Bondartsev & P.N. Borisov

These corky-woody, heavily brown-pigmented *Phellinus* species were found in mixed forests on various deciduous hosts, including alder, birch (*P. igniarius*, *P. lundellii*), and aspen (*P. populicola*, *P. tremulae*). These massive polypores are often found high above the ground, while resupinate, more thin-contexted fruit bodies of *P. laevigatus* appear under birch logs (Niemelä 2005). Most species in this group were found at all study sites. The interior (mostly context) of dead or dying fruit bodies was occupied by larvae of ***Dorcatoma dresdensis*** (except for *P. laevigatus*, but it did host unidentified *Dorcatoma* larvae), and ***Ennearthron cornutum*** (except the aspen species *P. populicola* and *P. tremulae*). Such a *Dorcatoma*–Ciidae type of decomposition is also characteristic of the other voluminous perennial fruit bodies of polypores, and beetle species change with the host. During earlier stages of polypore colonization, larval galleries are interwoven or located in certain parts of the fruit body (Schigel *et al*. 2006), but merge at later stages. *Phellinus igniarius* hosted larvae of *Cis nitidus* and *Abdera flexuosa* and was visited by adult *Cerylon ferrugineum*, *Cis bidentatus*, *C. boleti*, *C. hispidus*, *Gyrophaena strictula*, and *Scaphisoma subalpinum*. Visitors of *P. laevigatus* were *Rhizophagus dispar* (numerous), *Acrulia inflata*, *Leptusa pulchella*, and *Orthoperus atomus*; and visitors of *P. lundellii* were *Cis dentatus* and *Leptusa pulchella*. Adult *Glischrochilus quadripunctatus*, *Orchesia micans*, *Orthoperus corticalis*, *Sepedophilus marshami* were collected from *Phellinus tremulae*. Beetles of the *Phellinus igniarius* complex were earlier reported by Kaila *et al*. (1994), Fossli and Andersen (1998), Reibnitz (1999), Økland (1995), Olberg and Andersen 2000, Ehnström and Axelsson (2002), Süda and Nagirniy (2002), and Jonsell and Nordlander (2004).

Table 2. Coleoptera associated with polypore fungi in Finland. In the systematic list of families, genera and species are listed alphabetically. The fungi *Fomes fomentarius*, *Fomitopsis pinicola*, *F. rosea* and *Amylocystis lapponica* were not included in the rearings, therefore some beetle species breeding in Finnish polypores (such as *Bolitophagus reticulatus*, *Dorcatoma* spp.) are missing from this list, but *see* references in the Introducion (the fungus species sections) and Silfverberg (2004). The species whose larvae proved to develop in polypore fruit bodies are set in ***boldface italics***.

Carabidae Latreille, 1802
- *Philorhizus sigma* (Rossi, 1790)

Hydrophilidae Latreille, 1802
- *Cercyon analis* (Paykull, 1798)
- *Megasternum concinnum* (Marsham, 1802)

Histeridae Gyllenhal, 1808
- *Plegaderus caesus* (Herbst, 1792)

Leiodidae Fleming, 1821
- *Agathidium arcticum* Thomson, 1862
- *Agathidium confusum* Brisout de Barneville, 1863
- *Agathidium discoideum* Erichson, 1845
- *Agathidium pisanum* Brisout de Barneville, 1872
- *Catops coracinus* Kellner, 1846
- *Colenis immunda* (Sturm, 1807)

Staphylinidae Latreille, 1802
- *Acidota crenata* (Fabricius, 1793)
- *Acrotona aterrima* (Gravenhorst, 1802)
- *Acrotona exigua* (Erichson, 1837)
- *Acrulia inflata* (Gyllenhal, 1813)
- *Aleochara stichai* Likovský, 1965
- *Anomognathus cuspidatus* (Erichson, 1839)
- *Anopleta corvina* (Thomson, 1856)
- *Atheta aeneipennis* (Thomson, 1856)
- *Atheta boleticola* J.Sahlberg, 1876
- *Atheta boletophila* (Thomson, 1856)
- *Atheta castanoptera* (Mannerheim, 1830)
- *Atheta crassicornis* (Fabricius, 1793)
- *Atheta celata* (Erichson, 1837)
- *Atheta dadopora* Thomson, 1867
- *Atheta fungi* (Gravenhorst, 1806)
- *Atheta gagatina* (Baudi, 1848)
- *Atheta graminicola* (Gravenhorst, 1806)
- *Atheta macrocera* (Thomson, 1856)
- *Atheta marcida* (Erichson, 1837)
- *Atheta nesslingi* Bernhauer, 1928
- *Atheta nigricornis* (Thomson, 1852)
- *Atheta nigritula* (Gravenhorst, 1802)
- *Atheta orphana* (Erichson, 1837)
- *Atheta pallidicornis* (Thomson, 1856)
- *Atheta paracrassicornis* Brundin, 1954
- *Atheta picipes* (Thomson, 1856)
- *Atheta pilicornis* (Thomson, 1852)
- *Atheta sodalis* (Erichson, 1837)
- *Atheta subtilis* (Scriba, 1866)
- *Atrecus pilicornis* (Paykull, 1790)
- *Autalia impressa* (Olivier, 1795)
- *Autalia longicornis* Scheerpeltz, 1947
- *Bisnius subuliformis* (Gravenhorst, 1802)
- *Bolitochara pulchra* (Gravenhorst, 1806)
- *Bolitochara mulsanti* Sharp, 1875
- *Cadaverota cadaverina* (Brisout de Barneville, 1860)
- *Deliphrum tectum* (Paykull, 1789)
- *Dinaraea aequata* (Erichson, 1837)
- *Euryusa castanoptera* Kraatz, 1856
- *Gabrius splendidulus* (Gravenhorst, 1802)
- *Gyrohypnus angustatus* Stephens, 1833
- *Gyrophaena affinis* Mannerheim, 1830
- *Gyrophaena angustata* (Stephens, 1832)
- *Gyrophaena bihamata* Thomson, 1867
- *Gyrophaena boleti* (Linnaeus, 1758)
- *Gyrophaena joyi* Wendeler, 1924
- *Gyrophaena strictula* Erichson, 1839
- *Ishnoglossa prolixa* (Gravenhorst, 1802)
- *Leptusa pulchella* (Mannerheim, 1830)
- *Liogluta micans* (Mulsant & Rey, 1852)
- *Lordithon bimaculatus* (Schrank, 1798)
- *Lordithon lunulatus* (Linnaeus, 1761)
- *Lordithon speciosus* (Erichson, 1840)
- *Lordithon thoracicus* (Fabricius, 1777)
- *Megarthrus depressus* (Paykull, 1789)
- *Myrmecocephalus concinnus* (Erichson, 1839)
- *Nudobius lentus* (Gravenhorst, 1806)
- *Omalium caesum* Gravenhorst, 1806
- *Omalium rivulare* (Paykull, 1789)
- *Othius lapidicola* Märkel & Kiesenwetter, 1847
- *Oxypoda alternans* (Gravenhorst, 1802)
- *Oxypoda brevicornis* (Stephens, 1832)
- *Oxypoda hansseni* Strand, 1946
- *Oxypoda opaca* (Gravenhorst, 1802)
- *Philhygra malleus* (Joy, 1913)
- *Philonthus fumarius* (Gravenhorst, 1806)
- *Phloeocharis subtilissima* Mannerheim, 1830
- *Phloeonomus punctipennis* Thomson, 1867
- *Phloeonomus pusillus* (Gravenhorst, 1806)
- *Phyllodrepa linearis* (Zetterstedt, 1828)
- *Phyllodrepa nigra* (Gravenhorst, 1806)
- *Phymatura brevicollis* (Kraatz, 1856)
- *Placusa tachyporoides* (Waltl, 1838)
- *Proteinus brachypterus* (Fabricius, 1792)
- *Quedius brevicornis* (Thomson, 1860)
- *Quedius maurus* (Sahlberg, 1830)
- *Quedius plagiatus* Mannerheim, 1843
- *Quedius xanthopus* Erichson, 1839
- *Rugilus rufipes* Germar, 1836
- *Scaphisoma agaricinum* (Linnaeus, 1758)
- *Scaphisoma boreale* Lundblad, 1952
- *Scaphisoma inopinatum* Löbl, 1967
- *Scaphisoma subalpinum* Reitter, 1881
- *Sepedophilus constans* (Fowler, 1888)
- *Sepedophilus littoreus* (Linnaeus, 1758)
- *Sepedophilus marshami* (Stephens, 1832)
- *Sepedophilus testaceus* (Fabricius, 1793)
- *Stenus carbonarius* Gyllenhal, 1827
- *Stenus clavicornis* (Scopoli, 1763)

continued

Table 2. Continued.

Tachinus laticollis Gravenhorst, 1802
Tachinus proximus Kraatz, 1855
Tachyporus abdominalis (Fabricius, 1781)
Clambidae Fischer v. Waldheim, 1821
Clambus nigrellus Reitter, 1914
Scirtidae Fleming, 1821
Cyphon laevipennis Tournier, 1868
Dermestidae Latreille, 1804
Reesa vespulae (Milliron, 1939)
Anobiidae Fleming, 1821
Dorcatoma dresdensis Herbst, 1792
Trogossitidae Latreille, 1802
Ostoma ferruginea (Linnaeus, 1758)
Nitidulidae Latreille, 1802
Glischrochilus hortensis (Geoffroy, 1785)
Glischrochilus quadripunctatus (Linnaeus, 1758)
Epuraea biguttata (Thunberg, 1784)
Epuraea boreella (Zetterstedt, 1828)
Epuraea contractula J.Sahlberg, 1889
Epuraea oblonga (Herbst, 1793)
Epuraea unicolor (Olivier, 1790)
Epuraea variegata (Herbst, 1793)
Monotomidae Laporte de Castelnau, 1840
Rhizophagus bipustulatus (Fabricius, 1793)
Rhizophagus depressus (Fabricius, 1793)
Rhizophagus dispar (Paykull, 1800)
Rhizohpagus nitidulus (Fabricius, 1798)
Silvanidae Kirby, 1837
Dendrophagus crenatus (Paykull, 1799)
Cryptophagidae Latreille, 1802
Atomaria affinis (F. Sahlberg, 1834)
Atomaria alpina Heer, 1841
Cryptophagus distinguendus Sturm, 1845
Cryptophagus quercinus Kraatz, 1852
Cryptophagus saginatus Sturm, 1845
Cryptophagus scanicus (Linnaeus, 1758)
Henoticus serratus (Gyllenhal, 1808)
Erotylidae Latreille, 1802
Dacne bipustulata (Thunberg, 1781)
Triplax rufipes (Fabricius, 1781)
Triplax russica (Linnaeus, 1758)
Cerylonidae Billberg, 1820
Cerylon histeroides (Fabricius, 1793)
Cerylon ferrugineum Stephens, 1830
Endomychidae Leach, 1815
Endomychus coccineus (Linnaeus, 1758)
Corylophidae LeConte, 1852
Orthoperus atomus (Gyllenhal, 1808)
Orthoperus corticalis (Redtenbacher, 1849)
Orthoperus rogeri Kraatz, 1874
Latridiidae Erichson, 1842
Corticaria lapponica (Zetterstedt, 1838)
Corticaria longicollis (Zetterstedt, 1838)
Corticaria rubripes Mannerheim, 1844
Corticarina lambiana (Sharp, 1910)
Enicmus rugosus (Herbst, 1793)
Latridius consimilis Mannerheim, 1844
Latridius hirtus Gyllenhal, 1827
Ciidae Leach, 1819
Cis bidentatus (Olivier, 1790)
Cis boleti (Scopoli, 1763)
Cis comptus Gyllenhal, 1827
Cis dentatus Mellié, 1848
Cis glabratus Mellié, 1848
Cis hanseni Strand, 1965
Cis hispidus (Paykull, 1798)
Cis jacquemartii Mellié, 1848
Cis lineatocribratus Mellié, 1848
Cis micans (Fabricius, 1792)
Cis nitidus (Fabricius, 1792)
Cis punctulatus Gyllenhal, 1827
Cis quadridens Mellié, 1848
Ennearthron cornutum (Gyllenhal, 1827)
Ennearthron laricinum (Mellié, 1848)
Octotemnus glabriculus (Gyllenhal, 1827)
Rhopalodontus strandi Lohse, 1969
Sulcacis affinis (Gyllenhal, 1827)
Sulcacis fronticornis (Panzer, 1809)
Mycetophagidae Leach, 1815
Mycetophagus decempunctatus Fabricius, 1801
Mycetophagus multipunctatus Fabricius, 1792
Mycetophagus quadripustulatus (Linnaeus, 1761)
Mycetophagus salicis Brisout de Barneville, 1862
Tetratomidae Billberg, 1820
Tetratoma fungorum Fabricius, 1790
Melandryidae Leach, 1815
Hallomenus axillaris (Illiger, 1807)
Hallomenus binotatus (Quensel, 1790)
Abdera affinis (Paykull, 1799)
Abdera flexuosa (Paykull, 1799)
Orchesia fasciata (Illiger, 1798)
Orchesia micans (Panzer, 1794)
Tenebrionidae Latreille, 1802
Diaperis boleti (Linnaeus, 1758)
Eledona agricola (Herbst, 1783)
Curculionidae Latreille, 1802
Rhyncolus ater (Linnaeus, 1758)
Trypodendron signatum (Fabricius, 1792)

Phellinus conchatus **(Pers. : Fr.) Quél.**

Tough and corky fruit bodies of *P. conchatus* vary in shape from slender (up to 2 cm) imbricate pilei to resupinate. Context and the hymenophore are thin, and therefore even old fruit bodies never become hoof-shaped (Niemelä 2005). This specialist species was found throughout Finand wherever goat willow (*Salix caprea*) is present, lacking only in northernmost Lapland (Niemelä

& Kotiranta 1982). *Phellinus conchatus* holds a taxonomically intermediate position between *Phellinus s. str.* and subg. *Porodaedalea*, which is also seen in the architecture and way of growth of fruit bodies. Similarly to other polypores with perennial fruit bodies, and *Phellinus* in particular, the pilei of *P. conchatus* were never colonized when growing; also resupinate fruit bodies were free from beetle larvae. Beetles were only reared from the largest senescent or dead fruit bodies, with ***Cis bidentatus*** (present in all rearings), and *Ennearthron cornutum*. Unlike *Phellinus s. str.*, *P. conchatus* is not favoured by *Dorcatoma*, with only one unidentified larva recorded. Visitors included beetles breeding in other fungi, such as *Sulcacis affinis*, *S. fronticornis*, *Cis boleti*, *C. hispidus*, *Abdera affinis*, *A. flexuosa*, as well as *Orthoperus rogeri* and *Rhizophagus dispar*, all collected from hymenophore surfaces. Ehnström and Axelsson (2002) reported Coleoptera of *P. conchatus*, but most of the above-mentioned species are newly reported here. Hymenophore tubes of this fungus host the smallest beetle in Europe, *Baranowskiella ehnstromi* reported from Sweden, Finland (Sörensson 1997, 2000), and Norway (Andersen *et al.* 2003). Even though I actively searched for this beetle, I did not find it in the study area.

Phellinus subg. *Porodaedalea*

Phellinus chrysoloma (Fr.) Donk
Phellinus pini (Brot. : Fr.) A. Ames

Porodaedalea species are found on coniferous trees and are characterized by massive, dry, thick, hard and large-pored pilei. *Phellinus chrysoloma* grows on spruce and *P. pini* on pine. These polypore species hosted larvae of ***Ennearthron cornutum***, the only reared beetle species. Fruit bodies of *Porodeadalea* were mostly intact, but the few colonized dead fruit bodies yielded tens of individuals of *E. cornutum*. *Phellinus chrysoloma* was visited by *Abdera flexuosa*, *Atheta crassicornis* and *Cis bidentatus*. *Phellinus pini* attracted adult *Hallomenus binotatus* and *Orthoperus rogeri*. *Phloeocharis subtilissima* lives inside the hymenophore tubes and actively moves among them. Ehnström and Axelsson (2002) provided beetle records from *P. pini*, and Johansson *et al.* (2006) reported beetles attracted by the fruit bodies of *P. chrysoloma* detached from the wood.

Fomes and *Fomitopsis*

Fomes fomentarius (L. : Fr.)
Fomitopsis pinicola (Sw. : Fr.) P. Karst.
Fomitopsis rosea (Alb. & Schwein. : Fr.) P. Karst.

Perennial, tough, hoof-shaped and, when alive, moist fruit bodies of *Fomes* and *Fomitopsis* are characterized by a crustous surface, voluminous context and thick multilayered hymenophore (Niemelä 2005). A number of Nordic studies examined beetle species associated with *Fomes fomentarius* (Kaila *et al.* 1994, Thunes 1994, Jonsell & Nordlander 1995, 2002, 2004, Økland 1995, 2002, Nilsson 1997, Thunes & Willasten 1997, Fossli & Andersen 1998, Midtgaard *et al.* 1998, Rukke & Midtgaard 1998, Sverdrup-Thygeson & Midtgaard 1998, Jonsell 1998, Fäldt *et al.* 1999, Hågvar 1999, Reibnitz 1999, Jonsell *et al.* 1999, 2001, 2003, Jonsson *et al.* 1997, 2001, 2003a, Rukke 2000, Knutsen *et al.* 2000, Olberg & Andersen 2000, Ehnström & Axelsson 2002, Süda & Nagirniy 2002, Jonsson 2003, Lik 2005, Möller 2005, Selonen *et al.* 2005, Johansson *et al.* 2006), *Fomitopsis pinicola* (Kaila *et al.* 1994, Jonsell & Nordlander 1995, 2002, 2004, Økland 1995, 2002, Hågvar & Økland 1997, Jonsson *et al.* 1997, 2003b, Fossli & Andersen 1998, Fäldt *et al.* 1999, Hågvar 1999, Reibnitz 1999, Jonsell *et al.* 1999, 2001, 2005, Thunes *et al.* 2000, Ehnström & Axelsson 2002, Süda & Nagirniy 2002, Jonsell & Weslien 2003, Komonen 2003c, Komonen *et al.* 2003, 2004, Möller 2005, Selonen *et al.* 2005, Johansson *et al.* 2006, Jonsson & Nordlander 2006), and *F. rosea* (Komonen *et al.* 2000, 2001, 2003, Komonen 2001, 2003c). I focused on adult Coleoptera visiting the fruit bodies. Most beetles were recorded during the spring sporulation of the fungi: *Abdera affinis*, *Atheta picipes*, *Cis bidentatus*, *C. boleti*, *C. lineatocribratus*, *Ennearthron cornutum*, *Epuraea oblonga*, *E. unicolor*, *E. variegata*, *Euryusa castanoptera*, *Glischrochilus hortensis*, *G. quadripunctatus*, *Gyrophaena strictula*, *Leptusa pulchella*, *Octotemnus glabriculus*, *Orchesia micans*, *Rhizophagus dispar*, *R. nitidu-

lus, *Scaphisoma agaricinum*, *S. subalpinum*, and *Trypodendron signatum* on *Fomes fomentarius*. *Epuraea biguttata*, *E. contractula*, *Corticaria lapponica* and *Latridius consimilis* were collected exclusively on spore masses covering the fruit bodies of *Fomes fomentarius* in May. *Fomitopsis pinicola* attracted adult *Acidota crenata*, *Atheta nesslingi*, *Atomaria alpina*, *Cis bidentatus*, *C. lineatocribratus*, *Corticaria lapponica*, *Latridius hirtus*, *Leptusa pulchella* and *Sepedophilus testaceus*. In the spring and early summer, hundreds of *Gyrophaena boleti* individuals were observed on the hymenophore surface of *Fomitopsis pinicola*. On this fungus, *Epuraea variegata* and *Atomaria affinis* were the next frequent adult beetles collected. *Cis dentatus* was the only visitor of *Fomitopsis rosea*.

Ganoderma applanatum (Pers.) Pat.

Cocoa-brown, flat, corky perennial fruit bodies of *Ganoderma applanatum* are found at the bases or on logs of deciduous trees, usually close to the ground. In natural forests aspen is the commonest host. Fruit bodies can grow very large, up to 1 m in diameter. Context is thinner than the layered hymenophore. *Ganoderma applanatum* is common in Southern Finland (Niemelä 2005) and reaches the northern boreal zone (Niemelä & Kotiranta 1986). ***Cis nitidus*** was abundant in all rearings, followed by ***Cis bidentatus***, ***Dorcatoma dresdensis***, and ***Cis jacquemartii***. For more information on beetles reared from *Ganoderma applanatum*, *see* Reibnitz (1999), Süda and Nagirniy (2002), Jonsell and Nordlander (2004) and Möller (2005). Visitors included *Abdera affinis*, *Cis boleti*, *C. hispidus*, *Epuraea biguttata*, *Gabrius splendidulus* and *Octotemnus glabriculus*. I set 20 Kaila traps on fruit bodies of *G. applanatum* in southern Finland and the Moscow region in Russia (to be published separately), and these harvested 262 species of Coleoptera, including 182 species of Staphylinidae. Even though this high number mostly consists of occasional visitors, it nevertheless shows the importance of perennial fruit bodies as habitats for adult beetles, and the scale of species associations to be documented even for common polypore hosts.

Heterobasidion parviporum Niemelä & Korhonen

Fruit bodies of this perennial, mostly resupinate, polypore are sheltered under spruce roots or logs. The corky context is relatively thin, but a layered hymenophore showed that the fruit body can be more than 15 years old. This species is difficult to separate from the closely related *Heterobasidion annosum* (Fr.) Bref., and the associated beetles of these polypores require further study. Both species have a characteristic pattern of fruit body growth, which rapidly reaches its maximum size, and then starts to die off from the periphery, while central parts are still sound and fertile (Niemelä 2005). *Heterobasidion* species are pathogenic in southern Finland. The only, but repeatedly and abundantly reared beetle was ***Cis bidentatus***. Live parts of the fruit body are free from larvae, but *C. bidentatus* colonizes dead fruit bodies as well as the dead margins of growing ones. Such biology makes beetles unlikely candidates for biological suppression of *H. parviporum* in spruce plantations. Records of visitors included *Agathidium arcticum*, *A. discoideum*, *Atheta pilicornis*, *Gyrophaena affinis*, *Orthoperus rogeri*, *Rhizophagus dispar*, and *Scaphisoma boreale* and these records seem to be new. Earlier reports of Ciidae on *Heterobasidion* (Nikitsky *et al*. 1996, Reibnitz 1999) seem to treat *H. parviporum* and *H. annosum* collectively.

Haploporus odorus (Sommerf.) Bondartsev & Singer

White, corky and perennial fruit bodies of this specialist of goat willow (*Salix caprea*) are characterized by a strong anise scent and thick context. Fruit bodies vary in shape from resupinate and nodulose to pileate (Niemelä 2005). Upper parts of very old fruit bodies die while lower parts continue to grow. This near-threatened and, in the South, rare species (Kotiranta & Niemelä 1996, Rassi *et al*. 2010) was missing from three of the four southeastern sites. In some hillside forests in Lapland, e.g. in Pallastunturi, it was more frequent. Beetle rearings yielded numerous individuals of ***Ennearthron laricinum***, while *Cis bidentatus*, *Cis comptus*, and

Ennearthron cornutum were reared from single samples. Beetle larvae were missing from live fruit bodies, and rearings were successful only from dead or dying fruit bodies. Single adults of *Atomaria affinis* and *Orchesia fasciata* were collected from the hymenophore of live fruit bodies.

Gloeophyllum

Gloeophyllum odoratum (Wulfen : Fr.) Imazeki
Gloeophyllum sepiarium (Wulfen : Fr.) P. Karst.

Fruit bodies of these *Gloeophyllum* species are brown-pigmented, tough and corky, growing on wood of coniferous trees, on both stumps and logging residues in open biotopes. Fruit bodies of *G. odoratum* are larger and thicker than those of *G. sepiarium*, which grows only for a couple of years (Niemelä 2005). Both species are widely distributed in Finland, but *G. odoratum* was rare at the study sites. *Gloeophyllum* species hosted larvae of ciid beetles, ***Cis nitidus*** in *G. odoratum*, and ***Ennearthron cornutum***, *Cis comptus* and *Sulcacis affinis* in *G. sepiarium*, all reared from mature or dead fruit bodies. Dead fruit bodies of *Gloeophyllum* often stayed intact on wood when dead, and, compared with other perennials, were rarely visited by adult beetles. Hymenophore visitors of live fruit bodies included *Scaphisoma agaricinum* and *S. boreale* (abundant in parks in Helsinki), *Cerylon histeroides*, *Enicmus rugosus*, *Rhizophagus dispar* and *Sepedophilus testaceus* on *G. odoratum*. *Gloeophyllum sepiarium* was visited by fungivorous beetles breeding in other fungi: *Cis bidentatus*, *C. hispidus*, *C. nitidus* and *Scaphisoma agaricinum*. Beetles recorded from *Gloeophyllum* were earlier reported by Fossli and Andersen (1998), Reibnitz (1999), Ehnström and Axelsson (2002) and Jonsell and Weslien (2003).

Perenniporia and *Daedalea*

Perenniporia medulla-panis (Jacq. : Fr.) Donk
Perenniporia subacida (Peck) Donk
Daedalea quercina L. : Fr.

Fruit bodies are tough, corky and perennial. The resupinate *Perenniporia* species grow close to the ground, but the pileate and large-pored *Daedalea* (Niemelä 2005) may also utilize dead branches and the crown. The near-threatened *Perenniporia subacida* is an indicator species of old spruce-dominated forests throughout the country, and the vulnerable *P. medulla-panis* is an extreme rarity of oak found only in southwestern Finland (Kotiranta & Niemelä 1996, Rassi *et al*. 2010). *Perenniporia subacida* was present but low in prevalence at all study sites. Occasional collections of *Daedalea quercina* were made along the southern seashore of Finland. Fruit bodies of these species were never observed with beetle larvae at any growth or decomposition stage. Old fruit bodies of *Daedalea*, unlike *Perenniporia*, were sometimes occupied by moth caterpillars. Adult *Gyrophaena strictula* were the most frequent and abundant visitors of *Daedalea quercina*, and single *Abdera affinis*, *Cis nitidus*, *C. hispidus*, *Ennearthron cornutum*, *Gyrophaena affinis* and *Hallomenus binotatus* were collected from its hymenophore. Single adults of *Cyphon laevipennis* on *Perenniporia medulla-panis* and *Agathidium confusum*, *Sepedophilus constans* and *Cis nitidus* on *P. subacida* were collected from the hymenophore surface. These seem to be among the first beetle records for *Perenniporia*. Reibnitz (1999) reports *Ennearthron cornutum* from *Daedalea quercina*.

Ganoderma lucidum (M.A. Curtis : Fr.) P. Karst.

Pileate or stipitate fruit bodies are corky, fibrous, and covered by crust, which persists even when almost the whole fruit body is rotten. New pilei appear annually at the bases of old deciduous trees and their stumps, while remnants of old fruit bodies may stay *in situ* for the following season (Niemelä 2005). This rare and southern species (Niemelä & Kotiranta 1986, Kotiranta & Niemelä 1996) was occasionally sampled in parks of southern Finland. ***Cis nitidus*** was the only, albeit abundantly reared species.

Trametes, Cerrena, Funalia, Lenzites

Trametes hirsuta (Wulfen : Fr.) Pilát
Trametes ochracea (Pers.) Gilb. & Ryvarden
Trametes pubescens (Schumach. : Fr.) Pilát

Trametes suaveolens (Fr.) Fr.
Trametes velutina (Fr.) G. Cunn.
Trametes versicolor (L. : Fr.) Pilát
Cerrena unicolor (Bull. : Fr.) Murrill
Funalia trogii (Berk.) Bondartsev & Singer
Lenzites betulinus (L. : Fr.) Fr.

Densely imbricate groups of annual, elastic, fibrous, leathery and hairy fruit bodies of *Trametes* and related genera appear on dead wood of various deciduous trees (Niemelä 2005), but their microscopic characteristics do not always allow for reliable identification. This group of polypores includes both southern and widely distributed species (*Trametes ochracea*, *Cerrena* and *Trametes pubescens*). The vulnerable *Funalia trogii*, near-threatened *T. suaveolens* (Kotiranta & Niemelä 1996, Rassi *et al*. 2010) and *T. versicolor* were all very rare and were collected only from southern Finland. All beetles reared from *Trametes* belonged to the Ciidae. From *Trametes suaveolens*, ***Cis boleti***, ***C. hispidus***, ***C. comptus***, and ***Sulcacis fronticornis*** were reared; and from *T. velutina,* ***Cis boleti*** and ***Octotemnus glabriculus***. ***Sulcacis affinis*** was the only reared species from *Trametes versicolor*. ***Cis hispidus*** (abundant in rearings) and ***Octotemnus glabriculus*** were recorded from all other *Trametes* species. From *Trametes hirsuta* I also obtained ***C. comptus***, from *Trametes ochracea* and *Trametes pubescens* also ***Cis boleti***, and from *Trametes pubescens* also ***Sulcacis affinis***. ***Cis comptus*** was reared from *Funalia trogii* and *Cerrena unicolor* and ***C. hispidus*** from *Cerrena* and *Lenzites*. Moth caterpillars were recorded in *Trametes ochracea* and *T. velutina*. Adult beetles (except for the species breeding in fruit bodies) that visited these polypores were collected from mature (Ciidae and *Scaphisoma*) or very moist and decomposed fruit bodies (Staphylinidae and others): *Trametes hirsuta* was visited by *Cis dentatus* and *Acrulia inflata, Trametes ochracea* by *Cis dentatus*, *C. hanseni*, *C. nitidus*, *Ennearthron cornutum*, *S. affinis*, *Sulcacis fronticornis*, *Mycetophagus multipunctatus*, *Scaphisoma boreale*, *S. subalpinum* and *Acrulia inflata*, *Atheta sodalis*, *A. subtilis*, *Dinaraea aequata*, *Leptusa pulchella*, *Liogluta micans*, *Orthoperus corticalis*, *Proteinus brachypterus*, *Rhizophagus dispar*. *Trametes suaveolens* and *Trametes pubescens* attracted adult *Cis nitidus*, the latter fungus also *Ennearthron cornutum* and *Rhizophagus dispar*. Adult *Philorhizus sigma* and *Rhopalodontus strandi* were collected from fruit bodies of *Cerrena*, *Dinaraea aequata*, *Mycetophagus multipunctatus* (numerous) and *Nudobius lentus*, *Rhizophagus dispar* from *Funalia trogii* and *Acrulia inflata* and *Dinaraea aequata* from *Lenzites betulinus*. Ciidae from these fungi were earlier reported by Siitonen *et al*. (1996), Fossli and Andersen (1998), Reibnitz (1999), Guevara *et al*. (2000a, 2000b, 2000c), Komonen and Kouki (2005), Möller (2005), Selonen *et al*. (2005) and Komonen (2008).

Pycnoporus cinnabarinus (Jacq. : Fr.) P. Karst.

Tough and fibrous fruit bodies of *Pycnoporus* resemble those of the *Trametes* group (above) in terms of their structure and way of growth. This species is widely distributed and is common in clear-cuts where it grows on dead wood of birch and other deciduous trees (Niemelä 2005). ***Sulcacis affinis*** was common and abundant, reared from all the collected samples. Adults of *Acrulia inflata*, *Agathidum pisanum* and *Rhizophagus dispar* were collected from live fruit bodies. Beetles associated with this fungus were studied by Økland (1995) and Reibnitz (1999).

Daedaleopsis

Daedaleopsis septentrionalis (P. Karst.) Niemelä
Daedaleopsis tricolor (Bull. : Fr.) Bond. et Sing (sometimes included in *Daedaleopsis confragosa* (Bolton: Fr.) J. Schröt.)

Daedaleopsis fruit bodies are tough and fibrous, with thin context and a gilled or labirynthoid hymenophore. Pilei are solitary or in groups on birch (*Daedaleopsis septentrionalis*) or willow trees (*D. tricolor*). Both species are rare (Niemelä 2005); *Daedaleopsis septentrionalis* occurred in the North and in Koitajoki, and *D. tricolor* in southern Finland. The only successful rearing was of *Cis bidentatus* from *Daedaleopsis septentrionalis*. Visitors of *D. septentrionalis* were *Dinaraea aequata* and *Rhizophagus dispar*, and of *D. tricolor* copulating *Dacne bipustulata*, and *Scaphisoma agaricinum*. Fruit bodies of

Daedaleopsis sporulate in the spring and during this period host a diverse and abundant community of adult beetles that cannot be observed during the rest of the year, including *Epuraea* spp. on *Daedaleopsis confragosa* (Nikitsky & Schigel 2004). I did not study the latter species in Finland. The Ciidae of *Daedaleopsis* spp. are listed by Reibnitz (1999).

Bjerkandera

Bjerkandera adusta (Willd. : Fr.) P. Karst.
Bjerkandera fumosa (Pers. : Fr.) P. Karst.

Annual, ash-gray, effused-reflexed fruit bodies with a tough and moist structure grow in groups mostly on deciduous trees. *Bjerkandera adusta* was common in parks and mixed deciduous forests. *B. fumosa* was studied only in the capital region. Similarly to *Trametes*, rearings from *Bjerkandera adusta* yielded ***Cis boleti***, *C. hispidus* and *C. nitidus*. ***Dacne bipustulata*** was reared from *B. fumosa*. The hymenophore of mature *B. adusta* attracted *Cis jacquemartii*, *Dinaraea aequata*, *Latridius hirtus*, *Lordithon lunulatus*, *Rhizophagus depressus*, *R. dispar* and *Scaphisoma inopinatum*. Guevara *et al*. (2000b) and Möller (2005) studied Ciidae attracted by *Bjerkandera adusta*, and Reibnitz (1999) by both *Bjerkandera* species.

Gloeoporus dichrous (Fr. : Fr.) Bres.

Tough and fibrous patches of the effused-reflexed fruit bodies of this polypore appear on birches decayed by *Inonotus obliquus* through its entire distribution in Finland (Niemelä & Kotiranta 1983, Niemelä 2005). ***Cis comptus*** was reared from old and dry fruit bodies, while *Scaphisoma agaricinum* and *S. subalpinum* were collected from the hymenophore of live fruit bodies.

Datronia and *Diplomitoporus*

Datronia mollis (Sommerf.) Donk
Diplomitoporus flavescens (Bres.) Domański

Thin and dry fruit bodies of these fungi are characterized by thin context and relatively thick and large-pored hymenophore (Niemelä 2005). The near-threatened *Diplomitoporus flavescens* (Rassi *et al*. 2010) was found only once during my fieldwork in Repovesi. ***Ennearthron cornutum*** was the only beetle reared from old and exceptionally large fruit bodies of *Datronia mollis*. Adult *Dinaraea aequata* and *Scaphisoma boreale* were observed on the live pilei of *D. mollis*. A single *Cis comptus* was collected from *Diplomitoporus flavescens*. Reibnitz (1999) studied the Ciidae of *Datronia mollis*.

Dichomitus

Dichomitus campestris (Quél.) Domański & Orlicz
Dichomitus squalens (P. Karst.) D.A. Reid

Thick and fleshy effused-reflexed fruit bodies of these termophilic species have homogenous white context. Both species are rare and have narrow host and biotope preferences: near-threatened *Dichomitus campestris* appears mostly on *Corylus* in hemiboreal Finland, and vulnerable *Dichomitus squalens,* an indicator species of old pine forests (Kotiranta & Niemelä 1996, Rassi *et al*. 2010), is a rare species growing on coniferous trees in sunny windfall areas (Niemelä 2005). Fruit bodies dry soon and often remain on the wood for one season after their death. Dry and recently dead *Dichomitus campestris* fruit bodies reared numerous ***Ennearthron cornutum***. In the two collections of old fruit bodies of *Dichomitus squalens*, adults of *E. cornutum* were present, in one case together with *Scaphisoma boreale*.

Antrodiella and *Gloeoporus pannocinctus*

Antrodiella canadensis (Overh.) Niemelä
Antrodiella faginea Vampola & Pouzar
Antrodiella pallescens (Pilát) Niemelä & Miettinen (= *Antrodiella semisupina* (Berk. & M.A. Curtis) Ryvarden)
Antrodiella serpula (P. Karst.) Spirin & Niemelä
Gloeoporus pannocinctus (Romell) J. Erikss.

This group includes annual species with small-sized, very small-pored, and thin fruit bodies. In some species, they are very tough

(*Antrodiella faginea*, *A. pallescens*, *A. serpula*) while soft in others (*A. canadensis*, *Gloeoporus pannocinctus*). All except the endangered *Antrodiella canadensis* (Rassi *et al*. 2010) have at least a slight tendency to appear on a tree after another, common polypore has decayed it. The annual, thin resupinate, effused-reflexed, or pileate fruit bodies of *Antrodiella* are cartilaginous and thin-contexted (Niemelä 2005). Dead fruit bodies disintegrate late in the autumn, but sometimes, during dry conditions, persist on the wood until the next season. Rearings on large and dead fruit bodies of *A. pallescens* contained *Cis jacquemartii*, ***Cis hispidus*** and ***Cis boleti***, and *Cis nitidus* was reared from *A. serpula*. Smaller and resupinate fruit bodies of *Gloeoporus pannocinctus* and *Antrodiella* were intact in all cases. Adult beetles were attracted by fully-grown fruit bodies, such as *Leptusa pulchella* on *Antrodiella canadensis*, *Acrulia inflata* on *A. faginea*, *Acrulia inflata*, *Atheta pilicornis*, *Leptusa pulchella*, *Octotemnus glabriculus*, *Oxypoda brevicornis*, *Rhizophagus dispar* and *Cis glabratus* on *A. pallescens*, and *Atheta fungi*, *Dinaraea aequata*, and *Ennearthron cornutum* on *A. serpula*. Adult *Acrulia inflata*, *Rhizophagus dispar*, *Sepedophilus littoreus* and *S. testaceus* visited decomposing fruit bodies of *Gloeoporus pannocinctus*, and sometimes co-occurred with moth caterpillars.

Rigidoporus corticola (Fr.) Pouzar

Annual fruit bodies of this resupinate species of *Rigidoporus* are larger and softer than other species of this genus (Niemelä 2005). Large, moist resupinate fruit bodies of *R. corticola* often occupy entire aspen logs from below, while other *Rigidoporus* species with tough resupinate perennial fruit bodies grow in a more compact fashion. Dead fruit bodies of *R. corticola* typically decay very fast and disintegrate into slimy goo. Only rarely did dead fruit bodies of *Rigidoporus corticola* remain dry on the host log, and in such cases ***Abdera affinis***, *Cis bidentatus* and *C. nitidus* were reared. Live and mature fruit bodies attract masses of adult *Scaphisoma boreale* and larvae of unidentified Staphylinidae, while dead, moist, decomposing fruit bodies hosted *Acrulia inflata*, *Agathidium pisanum*, *Anomognathus cuspidatus*, *Gyrophaena angustata* and *Rhizophagus dispar*. Inside, often some unidentified black-headed maggots utilize the subcortical mycelial layers. Siitonen *et al*. (1996) reported *Rigidoporus corticola* as a possible host of *Sulcacis bidentulus*.

Antrodia

Antrodia albobrunnea (Romell) Ryvarden
Antrodia infirma Renvall & Niemelä
Antrodia pulvinascens (Pilát) Niemelä
Antrodia serialis (Fr.) Donk
Antrodia sinuosa (Fr.) P. Karst.
Antrodia xantha (Fr. : Fr.) Ryvarden

This genus is polyphyletic and will probably be divided into more uniform groups. Yet the species share many common morphological and physical characteristics, which justify their treatment together, especially in terms of their links to beetles. Dimitic, mostly annual fruit bodies are usually resupinate and located on logs. Among resupinate polypores, these difficult-to-identify species are characterized by tough and up to 1-cm-thick fruit bodies (Niemelä 2005). Hymenophore and subiculum contribute more or less equally to the volume of the fruit body. Dead fruit bodies are decomposed during the year following the growth period, but at favourable sites near-threatened *A. albobrunnea* and vulnerable *A. pulvinascens* (Rassi *et al*. 2010) may be perennial for 2–3 years. *Antrodia* includes many common and widely distributed species, such as *A. serialis* and *A. sinuosa*. *Antrodia albobrunnea*, an indicator of virgin pine forests, is very rare in the south (Kotiranta & Niemelä 1996). Dead fruit bodies of *Antrodia serialis* were often occupied by moth caterpillars, and in such cases only few, if any, beetles were reared. Moth-free fruit bodies that had dried in sheltered conditions mostly hosted ***Cis dentatus***, but also ***Cis glabratus***. ***Ennearthron laricinum*** developed in *Antrodia serialis* and *A. pulvinascens*. *Cis micans* was reared from dead *Antrodia infirma*. Adult, mostly fungivorous beetles breeding in other fungi were collected only from the hymenophore of live *Antrodia serialis*; these were *Cis boleti*, *Octotemnus glabriculus*, *Ostoma ferruginea*, *Rhizo-*

phagus dispar and *Sulcacis fronticornis*. *Antrodia sinuosa* and vulnerable *A. infirma* (Rassi *et al*. 2010) were visited by *Phyllodrepa linearis* and *Rhyncolus ater*. Single adults of *Orthoperus rogeri* and *Ostoma ferruginea* visited fruit bodies of *Antrodia sinuosa*, *Acrulia inflata* was collected from *Antrodia infirma*, *Stenus carbonarius* on *A. pulvinascens*, *Orchesia micans* on *A. albobrunnea* and *Orthoperus rogeri* on *A. xantha*. These seem to be among the first records of beetles on *Antrodia infirma*, *A. albobrunnea* and *A. pulvinascens*. Ollila (2005) reared larvae of *Ennearthron cornutum* and collected adults of *E. laricinum* from *Antrodia albobrunnea*, reared *Cis dentatus* and *Montescardia tessulatellus* (Zeller 1846), and collected adult *Ostoma ferruginea* from *Antrodia infirma*. In her dataset, fruit bodies of *Antrodia serialis* hosted larvae of *Cis dentatus*, *Ennearthron laricinum*, *E. cornutum*, *Ischnoglossa elegantula* and *Montescardia tessulatellus* (Lepidoptera), and attracted adults of *Orthoperus punctatus* and *Ostoma ferruginea*. *Agrotrichis intermedia* was reared from *Antrodia sinuosa*, and this polypore was visited by adult *Ostoma ferruginea*, *Hapalarea linearis* and *Ischnoglossa elegantula*. *Antrodia xantha*, neglected by insect larvae (except single records of unidentified Diptera and Coleoptera), attracted adult *Octotemnus glabriculus*, *Ostoma ferruginea*, *Calitys scabra*, *Scaphisoma agaricinum*, *Hapalarea clavigera*, *H. linearis*, *Ennearthron laricinum* and *Rhizophagus* sp. Reibnitz (1999) reports Ciidae from *Antrodia serialis*, and Ehnström and Axelsson (2002) beetles from *A. sinuosa*.

Trichaptum

Trichaptum abietinum (Pers. : Fr.) Ryvarden
Trichaptum fuscoviolaceum (Ehrenb. : Fr.) Ryvarden
Trichaptum pargamenum (Fr.) G. Cunn.

Thin and nail-shaped, pileate to resupinate, but mostly effused-reflexed fruit bodies form large groups and are among the first species to occupy recently dead coniferous trees (*Trichaptum abietinum* and *T. fuscoviolaceum*) or birch (*T. pargamenum*). They produce soft white rot throughout outer wood layers of the tree trunk. Both the context and hymenophore of annual or biennial fruit bodies are thin, but their bases merge together and form thicker mycelial pads, often connected with the subcortical mycelial layer (Niemelä 2005). *Trichaptum abietinum* and *T. fuscoviolaceum* were common in the whole area, while near-threatened *T. pargamenum* (Rassi *et al*. 2010) was recorded only at the two easternmost study sites (Fig. 1, Kt and KK). ***Cis punctulatus*** was reared from all three *Trichaptum* species. Most of the rearings on *T. pargamenum* contained ***Cis comptus*** while *Cis lineatocribratus* was reared only once. The few adult beetle visitors of *Trichaptum* included *Leptusa pulchella* on *T. fuscoviolaceum* and *Cis jacquemartii*, *Ennearthron cornutum*, *Acrulia inflata*, *Leptusa pulchella* and *Rhizophagus dispar* on *T. pargamenum*. Beetles attracted by *Trichaptum* spp. are reported by Fossli and Andersen (1998), Reibnitz (1999), Ehnström and Axelsson (2002), Jonsell *et al*. (2005) and Möller (2005).

Phellinus subg. *Fuscoporia*

Phellinus ferruginosus (Schrad. : Fr.) Pat.
Phellinus viticola (Schwein. *ex* Fr.) Donk

Fruit bodies of Finnish *Fuscoporia* group are annual or live for a few years. Fruit bodies are brown-pigmented, mostly resupinate, but *P. viticola* forms groups of effused-reflexed or small pileate fruit bodies. These are species fruiting in shelter, most commonly under logs (Niemelä 2005). Dead fruit bodies often stay on the substrate. *Phellinus viticola* is a widely distributed indicator species of old spruce-dominated forests (Kotiranta & Niemelä 1996). Vulnerable (Rassi *et al*. 2010) and a strictly southern species (Niemelä & Kotiranta 1982), *P. ferruginosus* was recorded only in southwestern hemiboreal Finland and on the Åland Islands. These polypores were usually intact when alive and dead, and adult beetles visited them only occasionally. *Ennearthron cornutum* was the sole reared species obtained from large dried but not heavily decomposed fruit bodies of both these polypore species. Hymenophore of live *P. viticola* hosted *Cis boleti*, *C. glabratus*, *Octotemnus glabriculus* and *Reesa vespulae*.

Ischnoderma benzoinum (Wahlenb. : Fr.) P. Karst.

Annual, effused-reflexed or pileate fruit bodies of this species are moist, tough and cheesy or rubbery when alive and actively growing, but dry, hard and corky stiff when dead (Niemelä 2005). Homogenous context occupies most of the fruit body. The pilei decays and quickly disintegrates when wet. ***Cis nitidus*** and *C. bidentatus* were reared from dead and dry fruit bodies, collected in sheltered places of rootstocks in wind-fallen spruce trees. *Cis glabratus* and *Sepedophilus testaceus* were collected from the hymenophore of mature live fruit bodies. Coleoptera of *I. benzoinum* were reported by Reibnitz (1999) and Möller (2005).

Inonotus, resupinate subcortical species

Inonotus obliquus (Pers. : Fr.) Pilát
Inonotus ulmicola Corfixen

Resupinate brown-pigmented fruit bodies of these two species are 1–2 cm thick, up to several metres long and only partly visible beneath broken bark. They are annual and short-lived (a few weeks) and produce masses of yellow spores. Tough when alive, the fruit body loses plenty of water after death, and brittle cracked remnants fall from the wood already during the following summer season. Growing mostly on birch, *Inonotus obliquus* was one of the most common species in the study, as not only fruit bodies, but also sterile black *chaga* conks were recorded. Fruit bodies were rare even in forests with plenty of sterile conks. *Inonotus ulmicola* was collected from *Ulmus* park trees in the Helsinki area. Unlike the majority of polypores with annual fruit bodies, the mycelium of *Inonotus obliquus* develops sterile conks on live birches, and the fruit body emerges on the tree trunk only once after the tree's death. For *I. ulmicola* such conk formations are not known, and its fruit bodies may develop on branches high up in the crown repeatedly in consecutive years (Niemelä 2005). Sterile black conks of *Inonotus obliquus* seem to be unsuitable for Coleoptera and were never observed to be visited or colonized. Even though the fruit bodies of *I. obliquus* were infrequently seen in the forest, this polypore is widely distributed and was common enough to support larvae of the monophagous ***Triplax russica***. Other reared beetles were ***Abdera affinis***, *Dorcatoma dresdensis* and *Ennearthron laricinum*. ***Orchesia micans*** was numerous in rearing from these two *Inonotus* species. All adult beetles were found on live and sporulating fruit bodies. Masses of yellow spores and the hymenophore surface provide food resources for adults of various beetles, many of which develop in other habitats: *Agathidium pisanum*, *Atheta boletophila*, *A. picipes*, *Cis bidentatus*, *C. hispidus*, *Endomychus coccineus*, *Ennearthron cornutum*, *Lordithon speciosus*, *Mycetophagus quadripustulatus*, *Oxypoda hansseni* and *Rhizophagus bipustulatus*. *Diaperis boleti*, *Bolitochara pulchra* and *Rhizophagus dispar* were most frequent and abundant visitors on *Inonotus obliquus*. *Inonotus ulmicola* attracted *Abdera affinis*. Ehnström and Axelsson (2002) and Möller (2005) reported Coleoptera on *I. obliquus*.

Inonotus, pileate species

Inonotus dryophilus (Berk.) Murr.
Inonotus radiatus (Sowerby : Fr.) P. Karst.
Inonotus rheades (Pers.) P. Karst.

These bracket-shaped, more or less triquetrous *Inonotus* species grow on different deciduous trees, and often form clusters of heavily brown-pigmented pilei, that may merge at their bases. The numbers of fruit bodies in these clusters, their sizes and host trees vary according to species: large, up to 15 cm thick and often solitary fruit bodies of *Inonotus dryophilus* grow high up on oak trunks or on large branches in lower crowns. Medium-sized *I. rheades* prefers aspen, and smaller and thinner *I. radiatus* grows mostly on alder and hazel, where it forms groups of effused-reflexed fruit bodies (Niemelä 2005). In these species, the context forms a substantial part of the fruit body. Dead fruit bodies often dry and disintegrate soon thereafter. The vulnerable *Inonotus dryophilus* (Rassi *et al.* 2010) was very rare, and was sampled only from Ruissalo in Turku. ***Abdera affinis*** and ***Dorcatoma***

dresdensis were reared from all three species, ***Orchesia micans*** from both *Inonotus dryophilus* and *I. rheades*, *Cis nitidus* only from *Inonotus dryophilus*, and *Abdera flexuosa* and *Cis lineatocribratus* only from *I. rheades*. It is noteworthy that among all the polypores, the larvae of Melandryidae were mostly discovered in live fruit bodies of Hymenochaetaceae, while Ciidae and *Dorcatoma* mostly used dying or dead ones. Occasional visitors collected from the hymenophore of live fruit bodies were *Cis jacquemartii* and *Rhizophagus dispar* on *Inonotus dryophilus*, *Atheta orphana*, *Corticaria rubripes*, *Epuraea variegata* and *Rhizophagus dispar* on *I. rheades* and *Atheta boleticola*, *Cis bidentatus*, *Leptusa pulchella*, *Megarthrus depressus*, *Orthoperus corticalis*, *Oxypoda alternans* and *Rhizophagus dispar* on *I. radiatus*. Beetles from *Inonotus radiatus* were reared by Økland (1995) and Jonsell and Nordlander (2004). Beetles reared from pileate *Inonotus* spp. are reported by Reibnitz (1999), Ehnström and Axelsson (2002), Süda and Nagirniy (2002) and Möller (2005).

Onnia and *Phaeolus*

Onnia leporina (Fr.) H. Jahn
Phaeolus schweinitzii (Fr.) Pat.

These species have soft and, when alive, watery fruit bodies. Dry and light-weight, dead fruit bodies often remain on the substrate for the following season. Bracket-shaped and strongly projecting fruit bodies of *Onnia* appear in groups at the bases of spruce trees, and stipitate, solitary or dense-clustered fruit bodies of *Phaeolus* arise from the roots of pine and larch (Niemelä 2005). Even though dead fruit bodies of *Onnia leporina*, an indicator of old spruce-dominated forests (Kotiranta & Niemelä 1996), often bore marks of insect activity, rearings from live and dead fruit bodies did not harvest any beetles. Live fruit bodies of *Onnia* attracted adults of *Cis bidentatus*, *Ostoma ferruginea*, *Lordithon speciosus* and *Phloeonomus pusillus*. Only fully grown living fruit bodies of *Phaeolus* were attractive to *Atheta boleticola*, *A. pallidicornis*, *Cerylon ferrugineum*, *Cryptophagus quercinus*, *Dinaraea aequata*, *Phloeonomus punctipennis*, *Placusa tachyporoides*, *Quedius xanthopus* and *Rhizophagus bipustulatus*.

Polyporus

Polyporus brumalis (Pers. : Fr.) Fr.
Polyporus ciliatus Fr. : Fr.
Polyporus leptocephalus (Jacq. : Fr.) Fr.
Polyporus squamosus (Huds. : Fr.) Fr.
Polyporus pseudobetulinus (Pilát) Thorn, Kotir. & Niemelä

The genus *Polyporus* includes species with annual, tough and corky, stipitate or sessile fruit bodies with a thick homogenous context (Niemelä 2005). Dead fruit bodies lose water and become light-weight, but not brittle. The very rare and vulnerable *Polyporus pseudobetulinus* (Schigel & Toresson 2005, Rassi *et al*. 2010) was found only in Pisavaara. *Polyporus brumalis*, *P. ciliatus* and *P. leptocephalus* were collected from various deciduous trees across Finland, while *P. squamosus* was sampled only in the capital region. Ciidae reared from *Polyporus leptocephalus* were not numerous, and included *Cis bidentatus*, *C. lineatocribratus*, *C. jacquemartii*, *Ennearthron laricinum* and *Sulcacis affinis*. Rearings from *Polyporus pseudobetulinus* included ***Cis comptus*** and ***Dacne bipustulata***, both beetles particularly abundant in dry fruit bodies collected high up above the ground, and *Cis bidentatus*. Moist, decayed and mouldy fruit bodies found on the ground were visited by adult *Cis boleti*, *Orthoperus corticalis*, *O. rogeri*, *Corticarina lambiana*, *Cerylon ferrugineum* and *Atheta picipes* (Schigel & Toresson 2005). *Ennearthron cornutum* was the commonest visitor of *Polyporus squamosus*, followed by *Scaphisoma boreale*, *Abdera affinis* and *Dorcatoma dresdensis*. Fruit bodies of the smaller *Polyporus* species attracted few adult beetles only: *Scaphisoma agaricinum* on *P. brumalis*, *Rhizophagus dispar* on *P. ciliatus* and *Orthoperus corticalis* on *P. leptocephalus*. Fossli and Andersen (1998) and Reibnitz (1999) studied beetles of *Polyporus* spp. and *Polyporus squamosus* was investigated by Klimaszewski and Peck (1987), Guevara *et al*. (2000b), Ehnström and Axelsson (2002) and Möller (2005).

Piptoporus betulinus **(Bull. : Fr.) P. Karst.**

Young and mature fruit bodies of this annual, thick-contexted birch specialist are rubbery, elastic and moist (Niemelä 2005). Fully grown pilei are corky, and dead fruit bodies often remain on the wood for a couple of years, to become dry and chalky, or flabby and mouldy. ***Diaperis boleti***, ***Dacne bipustulata***, ***Cis bidentatus*** and *Ennearthron laricinum* were reared from dead fruit bodies at different stages of decomposition. *Cis bidentatus* was also recorded from *P. betulinus* in Cumbria (UK) where this fungus also hosts *Cis bilamellatus* Wood, 1884, *Cis nitidus*, *Ennearthron cornutum*, *Oligota* (*Holobus*) *apicata* Erichson, 1837 and *Tetratoma fungorum* (David B. Atty pers. comm.). Studies of Thunes (1994), Økland (1995), Thunes and Willasten (1997), Fossli and Andersen (1998), Reibnitz (1999), Guevara *et al*. (2000b), Ehnström and Axelsson (2002) and Jonsell and Nordlander (2004) provide more information on beetles breeding in *P. betulinus*. The majority of adult visitors were collected from moist and decomposed fruit bodies: *Atheta crassicornis*, *A. gagatina*, *A. nigricornis*, *Autalia longicornis*, *Atomaria affinis*, *Epuraea boreella*, *Glischrochilus hortensis*, *Orthoperus corticalis*, *Proteinus brachypterus*, *Rhizophagus dispar* (common and abundant, including teneral adults collected on several occasions), *Scaphisoma agaricinum*, *S. boreale*, *S. subalpinum* and *Tetratoma fungorum*. *Cis glabratus* was collected from dry fruit bodies.

Laetiporus sulphureus **(Bull. : Fr.) Murrill, collective name**

Large, soft and brittle watery fruit bodies of this species form voluminous clusters on deciduous trees, in particular on willows and oaks (Niemelä 2005). The species was missing from the inventoried nature reserves, but was common in southern Finland, especially in Ruissalo, the Åland Islands and the Helsinki metropolitan area. Some of these individuals formed fruit body clusters of over 1 m in their vertical dimension. All my records are from oak trees. Dead fruit bodies remain on the trees for some time, but thereafter fall to the ground and disintegrate. Their bases, or sometimes the entire fruit body in sheltered places, may dry up and stay attached to the wood for a season or two. Formerly considered as a single species, *Laetiporus* "*sulphureus*" turned out to include five species in North America (Linder & Banik 2008), three in Japan (Ota & Hattori 2008), and three in Europe (Rogers *et al*. 1999). Two species may occur in Finland (Tuomo Niemelä pers. comm.), one on oak and another on *Salix alba*, but their taxonomy and the dissimilarity of the beetle fauna are still unclear. Larvae of ***Eledona agricola*** and ***Diaperis boleti*** mostly utilise live mature fruit bodies, but are also able to develop in the dry remnants of older fruit bodies. Adult visitors occur mostly between densely growing lobes of mature fruit bodies, on the hymenophore, or, in the case of *Rhizophagus dispar*, under detached fruit bodies on the ground. Among these visitors the most common and abundant were *Megarthrus depressus*, *Atheta subtilis*, *A. crassicornis*, *Cis bidentatus* and *Glischrochilus hortensis*. The following species were recorded as adults: *Acrotona aterrima*, *A. exigua*, *Atheta amicula*, *A. boletophila*, *A. celata*, *A. dadopora*, *A. fungi*, *A. gagatina*, *A. macrocera*, *A. nigricornis*, *A. nigritula*, *A. picipes*, *A. sodalis*, *Bisnius subuliformis*, *Cadaverota cadaverina*, *Cercyon analis*, *Cis bidentatus*, *C. nitidus*, *Cryptophagus distinguendus*, *C. saginatus*, *Dacne bipustulata*, *Epuraea variegata*, *Gyrohypnus angustatus*, *Gyrophaena affinis*, *G. angustata*, *Hallomenus axillaris*, *H. binotatus*, *Lordithon lunulatus*, *Megasternum concinnum*, *Mycetophagus decempunctatus*, *Oxypoda opaca*, *Philonthus fumarius*, *Plegaderus caesus*, *Quedius brevicornis*, *Q. maurus*, *Q. xanthopus*, *Scaphisoma boreale*, *Sepedophilus testaceus* and *Triplax rufipes*. Many of these records of adult beetles are new. Reibnitz (1999), Ehnström and Axelsson (2002), Süda and Nagirniy (2002) and Möller (2005) reported beetle rearings from this fungus.

Climacocystis borealis **(Fr.) Kotl. & Pouzar**

Annual, very fibrous and tough fruit bodies contain plenty of water and under favourable conditions the species can produce tens of large fruit bodies in a few weeks (Niemelä 2005). Dead fruit bodies get mouldy quickly and disintegrate in wet conditions, but may stay on the wood for the following season, if dried. *Climacocystis borealis* may be one of the few polypores of the North that almost always, if found with dead fruit bodies, contained Coleoptera material. In all cases, rearings from dry dead fruit bodies from the previous season yielded numerous ***Cis bidentatus***. Also single individuals of *Cis quadridens*, *Ennearthron laricinum* and *Dorcatoma dresdensis* were reared. Moist and sometimes mouldy pilei attracted adult *Atheta* fungi, *A. paracrassicornis*, *A. picipes*, *A. pilicornis*, *A. subtilis*, *Atomaria affinis*, *Cis jacquemartii*, *Deliphrum tectum*, *Epuraea variegata*, *Latridius consimilis*, *Leptusa pulchella*, *Oxypoda alternans*, *Rhizophagus dispar*, *Rugilus rufipes* and *Tachinus laticollis*.

Ceriporiopsis, *Hyphodontia*, *Meruliopsis*

Ceriporiopsis pseudogilvescens (Pilát) Niemelä
Hyphodontia paradoxa (Schrad. : Fr.) E. Langer & Vesterholt
Meruliopsis taxicola (Pers. : Fr.) Bondartsev

Few-millimetre-thin patches of resupinate fruit bodies are mostly located on fallen trunks, and are relatively dry both when alive and dead. Even when abundant in certain areas and present at all growth and decomposition stages, these polypores were mostly intact and were rarely visited by adult beetles. Only one rearing from *Ceriporiopsis pseudogilvescens* yielded ***Cis hispidus*** and *Octotemnus glabriculus*, and a single adult *Scaphisoma agaricinum* was collected. Adult *Ennearthron cornutum* visited *Meruliopsis taxicola*, and, along with *Phloeocharis subtilissima,* also *Hyphodontia paradoxa*.

Skeletocutis and *Cinereomyces*

Skeletocutis nivea (Jungh.) Jean Keller
Skeletocutis odora (Sacc.) Ginns
Skeletocutis stellae (Pilát) Jean Keller
Cinereomyces lindbladii (Berk.) Jülich

Annual and resupinate fruit bodies of *Skeletocutis* and *Cinereomyces* emit bug-reminiscent smells when alive (Niemelä 2005). Patches of fruit bodies are thin and difficult to identify, except for the larger and juicier *S. odora*. Dead fruit bodies almost always turn slimy, mouldy and quickly disintegrate. Threatened indicators of spruce-dominated forests (Kotiranta & Niemelä 1996), e.g., *Skeletocutis odora*, *S. stellae* and *Cinereomyces lindbladii* were found on logs of coniferous trees. In a few cases when dead fruit bodies of *Skeletocutis odora* dried in sheltered conditions, ***Cis bidentatus*** was reared. Adults of *Orthoperus corticalis* and *Orthoperus rogeri* were the most abundant and regular visitors of *Skeletocutis odora* fruit bodies during early stages of decomposition. The actual food source of *Orthoperus* spp. may not be *S. odora*, but the polyporicolous fungus *Sistotrema brinkmannii* (Bres.) J. Erikss. This species seems to colonize the substrate held by *Skeletocutis odora* (Veera Norros pers. comm.) easily. Other visitors of *S. odora* were *Ennearthron cornutum*, *Octotemnus glabriculus*, *Acrulia inflata*, *Gyrophaena angustata, Leptusa pulchella* and *Phyllodrepa linearis*. A single *Scaphisoma boreale* was collected from a live *S. odora*. *Skeletocutis nivea* was visited by a single adult *Cyphon laevipennis, S. stellae* by a single *Acrulia inflata*, and *Cinereomyces lindbladii* by *Bolitochara mulsanti* and *Ennearthron cornutum*. These are new beetles reported for *Skeletocutis* and *Cinereomyces*.

Ceriporia, *Junghuhnia*, *Protomerulius*

Ceriporia purpurea (Fr.) Donk
Junghuhnia luteoalba (P. Karst.) Ryvarden
Junghuhnia nitida (Pers. : Fr.) Ryvarden
Protomerulius caryae (Schwein.) Ryvarden

Annual, thin, resupinate and, when alive, moist fruit bodies of these rare polypores are difficult to separate from many other, similar-looking species and occupy logs of coniferous (*Junghuhnia luteoalba*) and deciduous trees (Niemelä 2005). Ephemeral fruit bodies quickly turn slimy and decompose, only rarely drying and turning lose and brittle. An indicator of old pine forests (Kotiranta & Niemelä 1996), *Junghuhnia luteoalba* was recorded more frequently in the

Southeast than in the North. *Ceriporia purpurea* is near-threatened (Rassi *et al*. 2010), and was mostly collected from the Åland Islands, and *Junghuhnia nitida* in southern Finland. No insect larvae or their traces were observed on the fruit bodies of these polypores. Live fruit bodies of *Ceriporia purpurea* were visited by a single *Dinaraea aequata* and *Scaphisoma agaricinum*; *Junghuhnia luteoalba* hosted adult *Sepedophilus testaceus* and *Stenus clavicornis*, and a single *Agathidum pisanum* was collected from *J. nitida*. The near-threatened *Protomerulius caryae* (Rassi *et al*. 2010) attracted numerous *Rhizophagus dispar* and *Scaphisoma subalpinum*. No beetles were earlier reported from these fungi.

Hapalopilus and *Erastia*

Hapalopilus aurantiacus (Rostk.) Bondartsev & Singer
Hapalopilus croceus (Pers. : Fr.) Bondartsev & Singer
Hapalopilus rutilans (Pers. : Fr.) P. Karst.
Erastia salmonicolor (Berk. & M.A. Curtis) Niemelä & Kinnunen (= *Sarcoporia salmonicolor* (Berk. & M.A. Curtis) Teixeira

Annual, thick, brightly-coloured fruit bodies are shaped from resupinate or effused-reflexed like in *Hapalopilus croceus*, to pileate like in *H. rutilans*. The context and hymenophore are watery and brittle (Niemelä 2005). Dead fruit bodies usually disintegrate when wet, but a few may dry in sheltered places. The vulnerable *Erastia salmonicolor* and near-threatened *Hapalopilus aurantiacus* were found in a few, mostly northern, localities, while the critically endangered *Hapalopilus croceus* (Rassi *et al*. 2010) was studied in its sole location in Helsinki. Rearings of ***Cis dentatus*** were successful only from dead and dry fruit bodies of *Erastia salmonicolor*. Few adult visitors were spotted on live fruit bodies, such as *Cis bidentatus* on *Erastia salmonicolor* and *Scaphisoma inopinatum* on *Hapalopilus rutilans* and *H. aurantiacus*. A single *Cis boleti* individual was collected from *Hapalopilus rutilans*. Live fruit bodies of *Hapalopilus croceus*, growing in a hollow tree-trunk next to remnants of *Laetiporus sulphureus* attracted *Dacne bipustulata*, *Myrmecocephalus concinnus* and *Scaphisoma agaricinum*. I am not aware of earlier records on these fungus–beetle associations.

Amylocystis, *Leptoporus* and *Pycnoporellus*

Amylocystis lapponica (Romell) Singer
Leptoporus mollis (Pers. : Fr.) Quél.
Pycnoporellus fulgens (Fr.) Donk

Annual, thick pileate fruit bodies of these polypores are soft and rich in water. These species grow on coniferous trees, but *Pycnoporellus fulgens*, a successor species, may follow *Fomitopsis pinicola* also to deciduous hosts (Niemelä 2005). *Amylocystis lapponica* often co-occurred with *Fomitopsis rosea*. Dead fruit bodies quickly decompose and soften when moist, but sometimes dry up at least from the surface. *Amylocystis lapponica* is rare in the south, an indicator of spruce-dominated old-growth forests (Kotiranta & Niemelä 1996), and is classified as near-threatened in Finland (Rassi *et al*. 2010). Indicators of old spruce forests, *Leptoporus mollis* and *Pycnoporellus fulgens* (Kotiranta & Niemelä 1996) were found in various habitats. Mature live and moist dead fruit bodies were frequently occupied by Diptera larvae, but rearings from drier specimens yielded ***Hallomenus binotatus*** from *Amylocystis lapponica* and *Ennearthron laricinum* from *Pycnoporellus fulgens*. Most frequent and abundant visitors of fully-grown and recently dead fruit bodies of *Amylocystis lapponica* were *Phyllodrepa linearis* and *Ostoma ferruginea*, but *Acrulia inflata*, *Atomaria affinis*, *Cis bidentatus*, *Cis comptus*, *Corticaria longicollis*, *Dendrophagus crenatus*, *Orthoperus rogeri*, *Phymatura brevicollis*, *Quedius plagiatus*, *Quedius xanthopus*, *Rhizophagus bipustulatus*, *R. dispar*, *Sepedophilus littoreus* and *Sulcacis fronticornis* were also recorded. *Leptoporus mollis* were visited by adults of *Cerylon histeroides*, *Ennearthron laricinum*, *Hallomenus axillaris* and *Cis jacquemartii*. The most numerous visitors of *Pycnoporellus fulgens* were *Ostoma ferruginea* (Schigel *et al*. 2004) while *Atheta sodalis*, *Atomaria affinis*, *Cryptophagus scanicus* and *Henoticus serratus* were recorded on single occasions. Beetles breeding in *Amylocystis lapponica* were earlier reported by Komonen (2001) and Komonen *et al*. (2001), and in *Pycnoporellus fulgens* by Reibnitz (1999).

Postia and *Oligoporus*

Oligoporus balsameus (Peck) Gilb. & Ryvarden
Oligoporus fragilis (Fr.) Gilb. & Ryvarden
Oligoporus guttulatus (Peck) Gilb. & Ryvarden
Oligoporus immitis (Peck) Niemelä
Oligoporus lateritius (Renvall) Ryvarden & Gilb.
Oligoporus sericeomollis (Romell) M. Bondartseva
Oligoporus stipticus (Pers. : Fr.) Gilb. & Ryvarden
Postia alni Niemelä & Vampola
Postia caesia (Schrad. : Fr.) P. Karst.
Postia lactea (Fr.) P. Karst.
Postia leucomallella (Murrill) Jülich
Postia luteocaesia (A. David) Jülich
Postia tephroleuca (Fr.) Jülich

This group of related polypores shares many fruit body characteristics, such as a lack of pigments, a soft, watery and fragile architecture with homogenous and relatively thick context/subiculum, fast growth (from days to a few weeks) and rapid decomposition. Species are difficult to determine, and their host preferences vary, even though the majority of species utilize wood of coniferous trees (Niemelä 2005). New to Finland and extremely rare were *Postia luteocaesia* (found in Repovesi and Kolovesi National Parks) and *Oligoporus immitis* (Helsinki). Rare *Oligoporus balsameus* and *Postia lactea* were examined for beetles in a few localities in southern Finland. The majority of species in between these extremes were uncommon, but widespread and regularly found, especially in old-growth forests. *Postia* and *Oligoporus* include several red-listed and indicator species: the near-threatened *Oligoporus guttulatus* and *Oligoporus lateritius*, and *Postia leucomallella* (Kotiranta & Niemelä 1996, Rassi *et al*. 2010). *Ennearthron cornutum* was reared from dry fruit bodies of *Oligoporus balsameus*. ***Hallomenus binotatus*** was reared from superficially dry but still moist inside fruit bodies of *Oligoporus lateritius*, and, together with *Cis hispidus*, from *Postia tephroleuca*. ***Hallomenus axillaris*** was reared under similar conditions from fruit bodies of *Postia leucomallella*. Larvae of *Hallomenus* sp. were observed in the context of *Oligoporus fragilis*, *O. stipticus* and *Postia alni*, but their rearings failed. *Dacne bipustulata* visited *Oligoporus balsameus*, *Gyrophaena bihamata* and *Phyllodrepa linearis*, *Phymatura brevicollis* visited *Oligoporus fragilis*, *Clambus nigrellus* and *Hallomenus binotatus*, *Rhizophagus dispar* visited *Oligoporus guttulatus*, *Scaphisoma boreale* visited *Oligoporus immitis*, *Acrulia inflata*, *Atheta graminicola*, *Dinaraea aequata*, *Lordithon lunulatus*, *Omalium caesum* and *Phyllodrepa linearis*, *Rhizophagus dispar* visited *Oligoporus lateritius* and *Cis hispidus*, *Sepedophilus littoreus* visited *Oligoporus sericeomollis*, *Agathidium confusum*, *Autalia impressa* and *Gyrophaena joyi*, *Rhizophagus dispar* visited *Oligoporus stipticus*, *Colenis immunda* visited *Postia alni*, *Lordithon bimaculatus* and *Rhizophagus dispar*, *Scaphisoma agaricinum* visited *Postia caesia*, *Dinaraea aequata* visited *Postia lactea*, *Agathidium confusum*, *Cis punctulatus*, *Leptusa pulchella* and *Phyllodrepa linearis*, *Rhizophagus dispar* visited *Postia leucomallella*, *Othius lapidicola* visited *Postia luteocaesia*, *Acrulia inflata* and *Atrecus pilicornis*, and *Rhizophagus dispar* visited *Postia tephroleuca*. Most of these beetle species were collected from fully grown, live or recently dead fruit bodies.

Rhodonia placenta (Fr.) Niemelä, K.H. Larsson & Schigel

Resupinate and annual fruit bodies of *Rhodonia placenta* are watery and up to 1–2 cm thick (Niemelä 2005). Similarly to the *Postia–Oligoporus* group above, high water content and fragility result in a short lifetime of the fruit body. The species typically grows on the undersides of logs in moist forests. After their death fruit bodies become slimy at moist shady sites, but sometimes dry up and become fragile on exposed tree trunks, and deteriorate before the next season. This species is an indicator of old spruce-dominated forests (Kotiranta & Niemelä 1996). A single rearing record of *Rhizohpagus dispar*, with no larvae observed, is the only dubious evidence of this beetle breeding in *Rhodonia placenta*. Records of adult *Hallomenus axillaris* and numerous *Hallomenus* sp. larvae (failed in my rearings) indicate potential suitability of *Rhodonia placenta* as a larval host. Unidentified black-headed ~1-cm-long Diptera larvae were observed on several occasions. *Phymatura breviollis* was the most common and abundant species, collected as adults. Other visitors were observed only once (*Phyllodrepa linearis*, *Acrulia inflata*, *Bolitochara pulchra*, *Ishnoglossa polixa*) or twice (*Rhizophagus dispar*, *Epuraea variegata*). *Scaphisoma inopinatum*, *Ostoma ferruginea* and *Gyrophaena strictula* were collected on several occasions.

Tyromyces chioneus (Fr.) P. Karst.

Similarly to *Postia*, *Oligoporus* and *Rhodonia*, this species produces short-lasting, watery and fragile fruit bodies, growing on dead wood of deciduous trees (Niemelä 2005), but it often dries on the wood before disintegration at the end of the growing season. Fruit bodies of *Tyromyces chioneus* were visited by single adults of *Acrulia inflata*, *Atheta sodalis*, *Dinaraea aequata*, *Orthoperus corticalis* and *Rhizophagus bipustulatus*.

Spongipellis

Spongipellis fissilis (Berk. & M.A. Curtis) Murrill
Spongipellis spumea (Sowerby : Fr.) Pat.

Annual, fibrous, oily and watery voluminous fruit bodies are thick both in context and hymenophore parts, and often grow in hollows of deciduous trees (Niemelä 2005). A tough and fibrous structure seems to delay the decomposition of *Spongipellis* fruit bodies, in comparison with other voluminous and watery polypores, but eventually they also disintegrate in the autumn. These near-threatened (Rassi *et al*. 2010) and southern (Kotiranta & Niemelä 1996) species were collected only from the Helsinki metropolitan area and the Åland Islands. *Dacne bipustulata*, *Gyrophaena angustata*, *Mycetophagus salicis* and *Scaphisoma agaricinum* visited *Spongipellis fissilis* and *Scaphisoma agaricinum* visited *Spongipellis spumea*. Möller (2005) recorded two beetle species in *Spongipellis* spp.

Fistulina hepatica Schaeff. : Fr.

Large and thick annual pilei of this oak fungus are fast-growing, very moist, soaked with red liquid, and usually located close to the ground (Niemelä 2005). Ephemeral mature fruit bodies rapidly decompose into a black slime. All specimens of this near-threatened (Rassi *et al*. 2010) and southern (Kotiranta & Niemelä 1986) fungus were collected in southwestern continental Finland and the Åland Islands. The fully grown, dying and dead fruit bodies of *Fistulina hepatica* hosted numerous Diptera larvae. These maggots often stay in the black slimy remnants of decomposed fruit bodies that have fallen to the ground, or are still attached to the wood. *Atheta crassicornis* and *A. gagatina* were the most numerous adult beetle visitors of *Fistulina hepatica* fruit bodies, followed by *Aleochara stichai*, *Atheta paracrassicornis*, *A. picipes*, *Cis nitidus*, *Deliphrum tectum*, *Ennearthron cornutum*, *Epuraea unicolor*, *Glischrochilus quadripunctatus* and *Phyllodrepa nigra*. Many of these beetle associations to *Fistulina* are new.

Grifola frondosa (J. Dicks. : Fr.) Gray

Numerous fibrous lobes make up the large ball- or rosette-shaped fruit bodies, which arise at the bases of old standing live and dead oaks (Niemelä 2005). Dead fruit bodies usually decompose in the autumn and, like wood-decaying mushrooms, may sometimes dry and shrink due to considerable loss of water, and persist throughout the winter. This near-threatened (Rassi *et al*. 2010) and southern (Kotiranta & Niemelä 1996) polypore species was studied only on the Ruissalo Island, Turku. Among the numerous adult beetles collected from the mature fruit bodies of *Grifola frondosa*, staphylinid *Atheta paracrassicornis* and *A. crassicornis* were most numerous, followed by *Atheta nigritula*, *Lordithon lunulatus*, *Deliphrum tectum* and *Proteinus brachypterus*. Besides, *Aleochara stichai*, *Atheta aeneipennis*, *A. castanoptera*, *A. gagatina*, *A. marcida*, *A. picipes*, *A. pilicornis*, *A. sodalis*, *Autalia longicornis*, *Catops coracinus*, *Lordithon bimaculatus*, *Lordithon thoracicus*, *Omalium rivulare*, *Philhygra malleus*, *Philon-*

thus fumarius, *Philorhizus sigma*, *Sepedophilus testaceus* and *Tachinus proximus* were less abundant. Dead fruit bodies from the previous year are ignored by beetles.

Albatrellus ovinus (Schaeff. : Fr.) Kotl. & Pouzar

This soft, annual, stipitate and mushroom-looking polypore has a thick stipe. Its moist fruit bodies appear on the ground in late summer and autumn in spruce forests (Niemelä 2005). Dead fruit bodies decompose rapidly. *Bolitochara pulchra* and *Proteinus brachypterus* were collected from decomposed and slimy fruit bodies.

Polyporicolous Coleoptera in Finland: concluding remarks

In this study, 176 species of Coleoptera were recorded on 116 species of polypores, including 21 (12%) beetle species with fungivorous larvae. Altogether there are at least 200 such species (including ~20% with fungivorous larvae), if beetles of *Fomes*, *Fomitopsis* and *Amylocysitis* (rearings from those were beyond the scope of this study, *see* Material and methods) are included. Based on the Finnish checklist of Coleoptera (Silfverberg 2004), foreign literature on fungivorous beetles (*see* Introduction) and my collecting and rearing abroad, the total number of polyporicolous beetles in Finland is expected to reach 250–300 species. Of these, the proportion of beetle species with fungivorous larvae may constitute some 25%, as all doubtful rearing records in this study were treated as records of adult visitors. Thus, an estimated 30% of polypore–beetle links in Finland are unknown and are yet to be discovered. The fraction of Fennoscandian polypore species studied for beetles in any detail has grown from 7% (Komonen 2003a) to 60%–70%.

In a similar study in the Moscow region, 261 beetle species, including 87 as larvae, have been linked with 61 species of polypores (Nikitsky & Schigel 2004), and in European Russia at least 307 beetles have been linked to 92 polypores (Schigel 2003). In the present study, I was able to recognise and examine 198 (86%) Finnish species of polypores with a fungus–beetle association matrix comprised of 116 polypore *vs.* 176 beetle species. In general, both the species diversity of polypore-utilizing beetles and the numbers of individuals per fruit body decreases towards the North. Some 300–400 species of polyporicolous beetles may be expected to be found in European boreal forests. Hemiboreal and nemoral polypores like *Polyporus squamosus* (Klimaszewski & Peck 1987) *Laetiporus sulphureus*, *Grifola frondosa*, *Fistulina hepatica* and *Meripilus giganteus* alone contribute tens, if not hundreds, of species of Coleoptera. Only a few studies have scrutinized the species-rich assemblages of adult Coleoptera attracted by polypore fruit bodies (Klimaszewski & Peck 1987, Thunes 1994, Hågvar 1999, Økland 2002).

In spite of the relatively robust taxonomic knowledge of both fungi and beetles, their interspecific relations, especially concerning threatened species, has remained largely unknown. Collecting such data is slow and laborious, and the present study is a qualitative report, and the food web patterns are revealed in a separate paper (Schigel 2011). In earlier publications, I discussed the role fungal substrates play in determing the associated beetle communities. In those studies, I dealt with two fundamental properties of the fungal fruit body, its architecture (including consistency, Schigel *et al*. 2004, 2006, Schigel 2007) and seasonality (Schigel *et al*. 2006). The 43 groups of species described in this study fall into these categories as shown in Table 3.

Fungus habitat groups for the Ciidae were described by Paviour-Smith (1960) in the UK: *Polyporus* (= *Piptoporus*) *betulinus–Cis bidentatus* group, which included also *Ganoderma applanatum* and the *Polysticus* (= *Trametes*) *versicolor–Octotemnus glabriculus* group. Four groups were outlined by Lawrence (1973) in the USA: *Coriolus* (= Trametes), *Hirshioporus* (= *Trichaptum*), *Phellinus* and *Ganoderma*. Fossli and Andersen (1998) observed three host preference groups among the Ciidae of northern Norway, however commenting that most of the ciids prefer single genera or species. Orledge and Reynolds (2005) supported Lawrence's (1973) four groups of Ciidae in the Holarctic region by using cluster analysis, and identified two more non-polypore *Auricularia* and *Stereum* host-use

Table 3. Genera and species groups of Finnish polypores and the beetle host-use groups. Polypore taxa in this table and in the text are arranged from the hardest perennial to the softest ephemeral annual ones. Fruit body architecture (Schigel *et al.* 2004, Schigel 2007) and seasonality (Schigel *et al.* 2006) in these studies are compared with Reibnitz (1999) and Orledge and Reynolds (2005) and are abbreviated as follows: AB = annual or biennial; AE = annual ephemeral; AH = annual hibernating; AS = annual sturdy; ASD = annual, quickly turns slimy and disintegrate when dead; B = brown-pigmented, fibrous, brittle when dead; CP = corky or leathery, pileate; CR = corky or leathery, resupinate; CVK = corky or fleshy, voluminous, thick homogenous context; DD = quickly drying and disintegrating when dead; HD = hardening when dead; HVK = hard, voluminous, robust, with thick context and layered hymenophore; HVN = as previous, but thin-contexted; P = perennial; RDD = remains dead and dry on the substrate; SD = slow to decompose; SW = soft and watery; TC = thin, with numerous pilei in dense clusters.

Group of polypore species in this study	Reibnitz 1999	Orledge & Reynolds 2005	Schigel 2007, Schigel *et al.* 2004		Schigel *et al.* 2006	
			Consistency class	Architectural characteristics	Growth and decomposition	Seasonality
Phellinus subg. *Fomitiporia*	*Phellinus*	*Phellinus*	Fomitoid	HVK	SD	P
Phellinus s. str.	*Phellinus*	*Phellinus*	Fomitoid	HVK	SD	P
Phellinus conchatus	*Phellinus*	*Phellinus*	Fomitoid	HVK	SD	P
Phellinus subg. *Porodaedalea*	*Phellinus*	*Phellinus*	Fomitoid	HVK	SD	P
Fomes and *Fomitopsis*	*Fomes*	*Ganoderma*	Fomitoid	HVK	SD	P
Fomes and *Fomitopsis*	*Fomitopsis*	*Ganoderma*	Fomitoid	HVK	SD	P
Ganoderma applanatum	*Ganoderma*	*Ganoderma*	Fomitoid	HVK	SD	P
Heterobasidion parviporum	*Heterobasidion*	*Ganoderma*	Fomitoid	HVK	SD	P
Haploporus odorus	–	–	Fomitoid	HVK	SD	P
Gloeophyllum	*Gloeophyllum*	–	Fomitoid	HVN	SD	P
Perenniporia and *Daedalea*	–	–	Fomitoid	HVN	SD	P
Ganoderma lucidum	*Ganoderma*	*Ganoderma*	Trametoid	CP	DD	AH
Trametes	*Trametes*	*Trametes*	Trametoid	CP	DD	AH
Cerrena	*Cerrena*	*Trametes*	Trametoid	CP	DD	AH
Funalia	*Funalia*	*Trametes*	Trametoid	CP	DD	AH
Lenzites	*Lenzites*	*Trametes*	Trametoid	CP	DD	AH
Pycnoporus cinnabarinus	–	*Trametes*	Trametoid	CP	DD	AH
Daedaleopsis	–	*Ganoderma*	Trametoid	CP	DD	AH
Bjerkandera	*Bjerkandera*	*Ganoderma*	Trametoid	CP	DD	AH
Gloeoporus dichrous	–	–	Trametoid	CP	DD	AH
Datronia and *Diplomitoporus*	–	*Ganoderma*	Trametoid	CP	DD	AH
Dichomitus	–		Trametoid	CP	DD	AH
Antrodiella and *Gloeoporus pannocinctus*	–	–	Trametoid	CP	DD	AH
Rigidoporus corticola	–	*Ganoderma*	Trametoid	CR	DD	AH
Antrodia	*Antrodia*	*Ganoderma*	Trametoid	CR	AB	AH
Trichaptum	*Trichaptum*	*Trichaptum*	Trichaptoid	TC	AB	AH

continued

Table 3. Continued.

Group of polypore species in this study	Reibnitz 1999	Orledge & Reynolds 2005	Schigel 2007, Schigel *et al.* 2004		Schigel *et al.* 2006	
			Consistency class	Architectural characteristics	Growth and decomposition	Seasonality
Phellinus subg. *Fuscoporia*	*Phellinus*	*Phellinus*	Xanthocroic	HD	AB	AH
Ischnoderma benzoinum	*Ischnoderma*	*Ganoderma*	Xanthocroic	HD	RDD	AS
Resupinate subcortical *Inonotus*	*Phellinus*	*Phellinus*	Xanthocroic	B	RDD	AS
Pileate *Inonotus*	*Phellinus*	*Phellinus*	Xanthocroic	B	RDD	AS
Onnia and *Phaeolus*	–	–	Xanthocroic	B	RDD	AS
Polyporus	*Polyporus*	*Ganoderma*	Piptoporoid	CVK	RDD	AS
Piptoporus betulinus	*Piptoporus*	*Ganoderma*	Piptoporoid	CVK	RDD	AS
Laetiporus sulphureus	*Laetiporus*	*Ganoderma*	Piptoporoid	CVK	ASD	AS
Climacocystis borealis	–	–	Tyromycetoid	SW	ASD	AS
Ceriporiopsis, Hyphodontia and *Meruliopsis*	–	–	Tyromycetoid	SW	ASD	AE
Skeletocutis and *Cinereomyces*	–	–	Tyromycetoid	SW	ASD	AE
Ceriporia, *Junghuhnia* and *Protomerulius*	–	–	Tyromycetoid	SW	ASD	AE
Hapalopilus and *Erastia*	–	–	Tyromycetoid	SW	ASD	AE
Amylocystis, *Leptoporus* and *Pycnoporellus*	*Laetiporus*	*Ganoderma*	Tyromycetoid	SW	ASD	AE
Postia and *Oligoporus*	–	–	Tyromycetoid	SW	ASD	AE
Rhodonia placenta	–	–	Tyromycetoid	SW	ASD	AE
Tyromyces chioneus	–	–	Tyromycetoid	SW	ASD	AE
Spongipellis	–	–	Tyromycetoid	SW	ASD	AE
Fistulina hepatica	–	–	Tyromycetoid	SW	ASD	AE
Grifola frondosa	–	–	Armillarioid	SW	ASD	AE
Albatrellus ovinus	–	–	Agaricoid	SW	ASD	AE

groups. Following Thunes (1994), who pointed out that such classes may be too large to give meaningful ecological information, in this study I did not attempt to overcomplicate the existing ecological classifications, but plainly reported my collections and rearings along the gradient of hardness of polypore fruit bodies. In relation to Ciidae, this gradient mainly agrees with Reibnitz's (1999) demarcation of 13 main groups of beetle species linked to 19 hosts. In his study fungal hosts were generally treated at genus level, including 12 genera of polypores (Table 3).

Nordic polypores demonstrate a large variety of life and, in particular, fruiting strategies, from a "hit and run" ephemeral fruiting to the production of perennial basidiocarps (Ryvarden 1991). Fruit bodies vary in hardness and elasticity, size, hyphal structure, location on the substrate and resistance against desiccation, seasonality and longevity, sporulation dynamics, ways of decomposition and chemical characteristics. Therefore polyporicolous Coleoptera, both visitors and colonizers, are faced with very diverse habitats and food sources.

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