Polypore-inhabiting beetles of four protected forests in South Häme, Central Finland

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Schigel, D. S. 2005: Polypore-inhabiting beetles of four protected forests in South Häme, Central Finland. — Sahlbergia 10: 59-62. Helsinki, Finland, ISSN 1237–3273.

Beetles living on polypores show preferences to hardness, moisture and other characteristics of fungal substrates. This topic was studied in four protected forests in South Häme, Central Finland (Lammi Biological Station Reserve, Kotinen Virgin Forest, Metsäksensoidinmaa Nature Reserve, and Vesijako Strict Nature Reserve). On 21 polypore species 30 such beetle species were found. New larval substrates are reported for three beetle species, *Perenniporia subacida* for *Cis nitidus*, *Trametes velutina* for *Cis hispidus,* and *Postia stiptica* for *Hallomenus binotatus. Clambus nigrellus*, a rare beetle species in Finland, is attracted to a near-threatened polypore *Postia guttulata.*

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Introduction

From the 1960's considerable research activity has been focused on polypore-inhabiting beetles. These insects, together with their easily recognisable fungal hosts, have become a favoured study object in forest ecology and studies in biodiversity and population biology in the Nordic countries. Tens of Fennoscandian papers dealing with saproxylic insects have been published during the last 15 years, e.g. Økland (1995), Andersen *et al.* (2000), Thunes *et al*. (2000), Kaila (1993), Komonen *et al.* (2001), Martikainen (2001), Siitonen *et al.* (2001), Ehnström & Axelsson (2002), and Jonsell & Nordlander (2002), each containing extensive reference lists. For further literature sources see Komonen (2003).

The project *Rare and insufficiently known Aphyllophorales fungi in Finland and their beetles* aims to solve certain taxonomical problems in mycology, and to collect ecological and biogeography data on beetle–fungus interactions in boreal forests. This study programme focuses mostly on feeding preferences among uncommon beetle species and on how insufficiently studied polypore fungi (i.e. poroid non-bolete Basidiomycota) attract different species and genera of Coleoptera.

The present study describes the results of a number of collections and rearings of polypore-associated beetles in South Häme Province.

Material and methods

Material was collected during the autumns of 2001–2004 in the surroundings of the Lammi Biological Station (grid 27°E 6773:394) and in some more distant places, such as the Kotinen Virgin Forest (6794:395) and the Metsäksensoidinmaa Nature Reserve (6788:403) in Evo, and the Vesijako Strict Nature Reserve (6807:398) in Padasjoki. Localities are given in the Finnish National Grid Coordinate System. Collecting and

Table 1. Polypores and their beetles. Polypore species are given in an alphabetical order. IUCN threat categories are according to Rassi et al. (2001), specified after polypore names if present. Localities (LOC) are coded as L = Lammi Biological Station Reserve, K = Kotinen Virgin Forest, M = Metsäksensoidinmaa Nature Reserve, V = Vesijako Strict Nature Reserve. Numbers of insect specimens found or reared are given in parentheses after the beetle species name. Imagines collected in nature are indicated in *light face*; insect records of larvae or reared imagines in ***bold face***. Beetle – fungus associations meeting the Lawrence (1973) criterion are marked with "10+" instead of the number of larvae or reared imago specimens.

Fungus species	LOC	Insect records
Amylocystis lapponica (Romell) Singer VU	V	*Ostoma ferruginea* (Linnaeus, 1758) (6), ***Hallomenus binotatus*** (Quensel, 1790) (1), *Acrulia inflata* (Gyllenhal, 1813) (1).
Antrodia serialis (Fr.) Donk	M	*Cis glabratus* Mellié, 1848 (1), ***Cis dentatus*** Mellié, 1848 (2).
Bjerkandera adusta (Willd. : Fr.) P. Karst.	L	*Cis boleti* (Scopoli, 1763) (1), ***Cis hispidus*** (Paykull, 1798) (3), *Rhizophagus dispar* (Paykull, 1800) (7).
Cerrena unicolor (Bull. : Fr.) Murrill	L	***Cis comptus*** Gyllenhal, 1827 (2).
Datronia mollis (Sommerf.) Donk	M	*Scaphisoma boreale* Lundblad, 1952 (1).
Fomitopsis pinicola (Sw. : Fr.) P. Karst.	L, M	***Cis glabratus*** (10+), ***Cis quadridens*** Mellié, 1848 (3), *Sepedophilus testaceus* (Fabricius, 1793) (1 ♀), *Latridius hirtus* Gyllenhal, 1827 (1).
Ganoderma lipsiense (Batsch) G.F. Atk.	L	***Cis jacquemartii*** Mellié, 1848 (9).
Gelatoporia pannocincta (Romell) Niemelä NT	M	*Sepedophilus littoreus* (Linnaeus, 1758) (1 ♂), *Rhizophagus dispar* (5).
Leptoporus mollis (Pers. : Fr.) Quél.	M	*Cerylon histeroides* (Fabricius, 1793) (1).
Inonotus radiatus (Sowerby : Fr.) P. Karst.	V	*Leptusa pulchella* (Mannerheim, 1830) (1).
Ischnoderma benzoinum (Wahlenb. : Fr.) P. Karst.	V	*Sepedophilus testaceus* (1).
Perenniporia subacida (Peck) Donk NT	M	***Cis nitidus*** (Fabricius, 1792) (2).
Phaeolus schweinitzii (Fr.) Pat.	L	*Quedius xanthopus* Erichson, 1839 (1 ♂), *Placusa tachyporoides* (Waltl, 1838) (1 ♂), *Phloeonomus punctipennis* Thomson, 1867 (2 ♂, 1 ♀), *Dinaraea aequata* (Erichson, 1837) (1 ♂, 1 ♀), *Atheta pallidicornis* (Thomson, 1856) (1 ♂, 2 ♀), *Rhizophagus dispar* (12), *Cerylon ferrugineum* Stephens, 1830 (1), *Cryptophagus quercinus* Kraatz, 1852 (1).
Phellinus tremulae (Bondartsev) Bondartsev & Borisov	K	*Orchesia micans* (Panzer, 1794) (1).
Piptoporus betulinus (Bull. : Fr.) P. Karst.	L	***Cis bidentatus*** (Olivier, 1790) (10+), *Dolichocis laricinus* (Mellié, 1848) (1).
Postia guttulata (Peck) Jülich NT	V	*Clambus nigrellus* Rtt. Reitter, 1914 (1).
Postia stiptica (Pers. : Fr.) Jülich	V	***Hallomenus binotatus*** (1).
Trametes hirsuta (Wulfen : Fr.) Pilát	L	***Cis boleti*** (10+), ***Cis hispidus*** (10+), ***Octotemnus glabriculus*** (Gyllenhal, 1827) (10+).
Trametes ochracea (Pers.) Gilb. & Ryvarden	L	***Cis boleti*** (10+), ***Cis hispidus*** (10+), ***Octotemnus glabriculus*** (Gyllenhal, 1827) (10+).
Trametes velutina (Fr.) G. Cunn.	L	***Cis boleti*** (10+), ***Cis hispidus*** (10+), ***Octotemnus glabriculus*** (Gyllenhal, 1827) (10+).
Tyromyces chioneus (Fr.) P. Karst.	M	*Dinaraea aequata* (1 ♂).

rearing was done by standard methods (Nikitsky & Schigel 2004). Specimens are to be preserved in the Finnish Museum of Natural History, University of Helsinki. Polypore nomenclature follows Niemelä (2004), coleopteran names are given according to Silfverberg (2004), with the exception of the Ciidae that are treated following Müller et al. (2001).

Results

From the studied 21 polypore species, 30 beetle species were found, belonging to 10 families. Eleven Coleoptera species were collected as larvae, and others were attracted to polypore fruit bodies as adult beetles. The highest number of beetle species (8, all new for the substrate) was found on *Phaeolus schweinitzii*. Our set of beetle species from common polypores (*Bjerkandera adusta, Cerrena unicolor, Ganoderma lipsiense, Fomitopsis pinicola, Piptoporus betulinus, Trametes* spp.) proved to be typical for European boreal zone in general, and no new beetle associations were found among these fungi. However, for three beetle species new larval substrates were found, *Perenniporia subacida* for *Cis nitidus*, *Trametes velutina* for *Cis hispidus,* and *Postia stiptica* for *Hallomenus binotatus*. Data on the attraction of beetle adults to the fungal fruit bodies are new for the most of beetle species (Table 1).

Discussion

Recording beetles that visit fruit bodies of polypores is a powerful tool for regional studies in beetle species diversity and ecology. It helps to reveal the presence of overlooked beetle species and those avoiding traps, and clarifies poorly known post-pupal dietary habits and life histories of beetles.

Fruit bodies of certain polypores attract beetles, previously unknown from these fungi. The hardness, water contents and other characteristics of the host fungus seem to select which beetle species are attracted and which are not (Schigel et al. 2004). For instance, imagines of *Cerylon histeroides* visit the tyromycetoid (soft and watery) fungus *Leptoporus mollis, Dinaraea aequata* occurs on *Tyromyces chioneus*, and *Ostoma ferruginea*, *Hallomenus binotatus* and *Acrulia inflata* utilize *Amylocystis lapponica* (VU). The xanthochroic, fibrous fruit bodies of *Inonotus radiatus* attract imagines of *Leptusa pulchella*. The young and soft fruit bodies of *Ischnoderma benzionum* are visited by *Sepedophilus testaceus*. Spores of fomitoid, woody *Phellinus tremulae* serve as food substrate to the imagines of *Orchesia micans,* while adult *Latridius hirtus* individuals are attracted by fruit bodies of *Fomitopsis pinicola* (Table 1).

Clambus nigrellus is a rare species in Finland: there are only a few records (Mannerkoski 2000). A single specimen of this beetle was collected on the hymenophore of a red-listed (NT) polypore *Postia guttulata* in the Vesijako Strict Nature Reserve. *Postia guttulata* usually grows on uprooted bases or on cracked stumps of spruce wind-throws in old-growth forests; it has not been found on saw-cut stumps.

Most Ciidae species colonise annual polypores, and they usually develop in recently died fruit bodies, but some utilise perennial fruit bodies. For instance, *Cis nitidus* was reared from fruit bodies of *Perenniporia subacida*, an indicator of old spruce forests in Finland. Fibrous and corky fruit bodies of *Antrodia serialis* are usually eaten up by moth caterpillars, whose excrements are kept together by silky threads. This way of colonisation is characteristic and is used for the field distinguishing of *A. serialis* from the other white resupinate polypores. Some fruit bodies of *A. serialis*, however, stay uncoloni-

sed by moths and are finally consumed by *Cis dentatus*. Imagines of *Cis glabratus* also visit this polypore (Table 1).

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