

SOME RECORDS OF WOOD-INHABITING FUNGI ON *FAGUS SYLVATICA* IN NORTHERN SPAIN

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ABSTRACT. Some records of wood-inhabiting fungi on *Fagus sylvatica* in northern Spain. A list is given of some interesting records of lignicolous macrofungi found on *Fagus* during some excursions in Asturias and Navarra in November 2005. At least *Antrodiella fissiliformis*, *Nemania carbonacea* and *Phellinus cavicola* represent first records for the country. In a conservation perspective, the strict forest reserves Lizarzoia and Aztaparreta in Navarra are considered to be important for the conservation of saproxylic fungi on beech in south western Europe. It is our hope that the paper will inspire to continued studies of wood-inhabiting fungi in beech forests in Spain.

Key words: wood-inhabiting fungi, *Fagus sylvatica*, natural forest, indicator species, chorology.

RESUMEN. Algunas citas de hongos lignícolas sobre *Fagus sylvatica* en España septentrional. Se presenta una lista de algunos allazgos interesantes de macromicetes lignícolas sobre *Fagus*, realizados durante las prospecciones en Asturias y Navarra, en noviembre de 2005. Por lo menos *Antrodiella fissiliformis*, *Nemania carbonacea* y *Phellinus cavicola* representan primeras citas para España. desde una perspectiva de la conservación de la biodiversidad fúngica, las reservas integrales de Lizarzoia i Aztaparreta, en Navarra, se consideran de especial importancia para la conservación de los hongos saproxílicos fagícolas en el sudoeste de Europa. Este trabajo esta orientado también a fomentar el estudio continuado de los hongos lignícolas en los hayedos de España.

Palabras clave: hongos lignícolas, *Fagus sylvatica*, especies indicadoras, corología.

RESUM. Algunes citacions de fongs lignícoles sobre *Fagus sylvatica* a Espanya septentrional. Es presenta una llista d'algunes recol·leccions interessants de macromicets sobre *Fagus*, fetes en algunes prospeccions a Astúries i Navarra, en novembre de 2005. Pel cap baix, *Antrodiella fissiliformis*, *Nemania carbonacea* y *Phellinus cavicola* representen les primeres citacions per a l'estat espanyol. Des del punt de vista de l'interès per a la conservació de la biodiversitat fúngica, les reserves integrals de Lizarzoia i Aztaparreta, a Navarra, es consideren d'especial importància per a la conservació dels fongs saproxílics fagícoles del sud-oest d'Europa. Aquest treball vol estimular també l'estudi continuat dels fongs lignícoles a les fagedes de l'estat espanyol.

Paraules clau: fongs lignícoles, *Fagus sylvatica*, espècies indicadores, corologia.

INTRODUCTION

The beech forests of northern Spain (Pyrenees, Cantabrian region) form the south western limit of the natural distribution area of European beech (*Fagus sylvatica*). They originate from a southwesterly migration of an expanding population in central France, around 1000 to 3000 years ago (BRADSHAW & MOUNTFORD 2002). Characteristics of Spanish beech forests are summarised by COSTA TENORIO *et al.* (2005). They are mostly found in mountain areas, between 300-1500 (1800) m altitude, with high precipitation values (more than 900 mm per year). Natural or near natural stands are very scarce.

Early studies of wood inhabiting fungi on beech in Europe mainly focused on species communities (mycocoenoses) on stumps or small wooden fragments (Table 1). LANGE (1992) was one of the first to focus on the diversity and succession of species on naturally decaying entire logs. More recently, lignicolous fungi of beech forests have received considerable interest with respect also to

habitat quality and conservation issues (Table 1). During a European project on nature-based management of beech forests (Nat-Man, www.flec.kvl.dk/natman/), macrofungi were investigated on about 1000 beech logs in western and central Europe (ODOR *et al.* 2004a, 2004b, 2006), followed by a study of 200 beech logs in southern Sweden (HEILMANN-CLAUSEN 2005, 2006). Publications dealing with fungi occurring on beech wood fungi in southern Europe, are comparably scarce. Therefore, we visited shortly some Spanish beech forests reserves to get an overview of the diversity of wood inhabiting fungi in comparison with other European regions.

MATERIAL AND METHODS

The following sites have been visited.

14 Nov. Asturias, Natural Park of Redes, Brañagallones, UTM $\pm 30T$ 0312049 4775538, ca. 1100 m alt. An extensively managed, formerly grazed beech forest (with some trees probably pollarded in the past) on calcareous soil (with large hawthorn (*Craetagus*) trees, *Ilex*, *Helleborus*, *Galium odoratum*). In the visited part, quite a good number of fallen logs, and good variation in decay stages. *Fomitopsis pinicola* is the dominant species in the fungal communities on decaying beech wood, sometimes forming very big carpophores.

15 Nov. Navarra, Arantza, Artikutza, UTM $\pm 30T$ 0359757 4787906, ca. 800 m alt. Area with very high rainfall (about 2000 mm per year). A young beech forest on granitic soil, with scattered, sometimes dense groups of very old pollards of beech, oak (*Quercus*) and chestnut (*Castanea sativa*). Not or extensively managed since some years. Most likely an open and grazed park-like forest 50-100 years ago. Moderate amounts of dead wood, especially dying or dead pollards. *Kretzschmaria deusta* dominant on the available dead wood and many logs completely black due to pseudosclerotial plates formed by this species.

15 Nov. Navarra, Bertizarana, parque natural de Señorío de Bértiz, northern part on hill, UTM $\pm 30T$ 0615446 4779976, alt. 900 m. A mixed atlantic forest with a.o. *Ruscus aculeatus* on acid soil and old pasture woodlands with very large numbers of very big pollards of chestnut (mostly already dead because of competition with beech) and beech (not pollarded for a very long time, and many looking like huge candelabras, likely to collapse in the coming decades). All pastures heavily invaded by more or less even aged beech (natural regeneration). At present only a rather low amount of dead *Fagus* wood is present, but many old pollards have dead parts or heart rot.

16 Nov. Navarra, selva de Irati, Spain's largest beech forest, never clearcut in the past. Lizaroia, area close to reserva integral, UTM $\pm 30T$ 0653573 4761853, ca. 1100 m alt. A young managed beech forest with several even aged, rather old logs which are mostly black due to pseudosclerotial plates by *Kretzschmaria deusta* (probably from storm in the early '1990), and adjacent to this a rather open grassy hill slope with many large and old trees of beech, some silver fir (*Abies alba*), and in higher parts oak and hawthorn on calcareous soil. Quite a good number of logs are present, often sun-exposed, and lots of old trees with cavities or heart rot.

17 Nov. Navarra, selva de Irati, Lizaroia reserva integral (since 1987), UTM $\pm 30T$ 0653713 4763206, ca. 1100 m alt. An old grown *Abieto-Fagetum* with distinct virgin forest attributes (soil heaps from old uprooted trees, large structural variation, very old and large trees). Core-area not or hardly managed for several centuries, forming a dense and dark stand with few sun-exposed trees and logs. Presence of lots of logs in all decay phases, many covered with *Eutypa spinosa*. *Fomitopsis pinicola* is also very common here.

18 Nov. Navarra, Isaba, reserva integral de Aztaparreta, UTM $\pm 30T$ 0678417 4753140, ca. 1500 m alt. An old grown *Abieto-Fagetum* on calcareous soil, with a standing volume of 700 m³/ha and 127 m³/ha dead wood according to recent measurements (Schwendtner García, pers. comm.). Mostly situated on a north facing slope. Probably some management in the past. Thus the oldest tree cohort appear to be fairly even-aged, and there are rather few soil heaps pointing to old uprooted trees. Most of the reserve consists of high forest with smaller gaps and rather few large *Abies*. Presence of a very big storm gap (because of a big storm during winter 1992-1993) with plenty of even aged logs, now bushy by natural regeneration of beech. Only few black logs (*Eutypa*

spinosa and *Kretzschmaria deusta* rather sparsely represented). *Fomes fomentarius* is well represented, as well as *Ischnoderma resinosum*. Presence of at least 2 strict epixylic mosses (VAN DORT & AUDE in prep.).

In each site fungal sporocarps were noted or collected during 2-4 hours, focusing on larger, strictly lignicolous macrofungi on coarse woody debris (> 10 cm diámetro). Fully resupinate corticioid fungi were not studied in any detail, but occasional collections were made. Our observations were done during heavy rains that followed a rather long dry period. In general agarics were sparsely represented due to the preceding dry period and the late time of the year.

RESULTS

In total about 153 larger macrofungi have been identified. A selection of the list, focussing on the most interesting records, is given below, with information on voucher material preserved in Ghent University (GENT) or Copenhagen (C). A full list can be obtained from the authors.

Aleurodiscus wakefieldiae Boidin & Beller

Found in Artikutza (herb. JHC05-138, C; Walley 4159, GENT). Apparently a strictly atlantic species in Europe, known from Britain, France and Spain (DUHEM 1994; LEGON & HENRICI 2005).

Antrodiella fissiliformis (Pilát) Gilb. & Ryvarden

This rare and poorly known polypore was collected on a beech log in Aztaparreta (JHC05-158, C), the first record for Spain. Previously only known from central Europe, but it has been found also in northern Italy (BERNICCHIA, 2005) and at several localities in Halland, Sweden (HEILMANN-CLAUSEN 2006). It seems to be restricted to mountainous regions with high precipitation, and within these to be more or less confined to sites with high conservation value.

Camarops polysperma (Mont.) Miller

Observed on a snag in Lizardoia (Walley 4173, GENT), and on old pollard in Artikutza. This presumed heart rot agent is usually found on large snags and fallen logs of *Alnus glutinosa*, but is even considered to be an indicator species of habitat quality of beech forests and woodlands in Denmark and Britain.

Ceriporiopsis gilvescens (Bres.) Dom.

Observed in all visited sites (Brañagallones: JHC05-115, 116, C; Artikutza JHC05-127, C). Apparently not rare in the area. Considered as an indicator of valuable beech forests at the European scale (CHRISTENSEN *et al.* 2004), and often a common species in old beech forest reserves throughout Central Europe. Apparently increasing in Great Britain (AINSWORTH 2004).

Crustomyces subabruptus (Bourdot & Galzin) Jülich

Found on fallen logs and large branches in Artikutza (JHC07-129, C) and nearby Lizardoia (Walley 4165, GENT).

Dentipellis fragilis (Pers.: Fr.) Donk

Found on beech logs in Redes, Lizardoia (Walley 4163, GENT), Brañagallones (JHC05-109, C) and Aztaparreta. Considered a good indicator for sites with high conservation value, especially in northern and Western Europe. In Central Europe, e.g. Poland and Slovakia, it is more common (ADAMČÍK *et al.* 2007) and found also in managed beech forests.

Entoloma pluteisimilis Noordel. & C.E. Hermos.

Found on brown rotted beech logs in Redes (Walley 4150, GENT) and Aztaparreta (a single carpophore). This species has only been described very recently from northern Spain (NOORDELOOS 2004) and has, according to our knowledge, not been reported since. The type was growing on rotten wood of *Pinus*. The lignicolous habitat (always associated with brown rot?) and the small, weakly angled spores that remind of the genus *Rhodocybe*, are characteristic for this species.

Ganoderma pfeifferi Bres.

Found nearby Lizardoia, on old living beech. Considered as an indicator for sites with high conservation value for wood inhabiting fungi on beech. Mostly recorded in open forest types, as was the case in Lizardoia. In many parts of Europe it is mainly confined to partly managed habitats such as old parks, hunting estates etc.

Gloeophycium analogum (Bourd. & Galz.) Hjortst.

Found on decaying beech logs in Bertiz (JHC05-136, C; Walley 4171, GENT), Lizardoia and Aztaparreta. Easily identified in the field by its particular smell. Considered as an indicator of valuable beech forests at the European scale (CHRISTENSEN *et al.* 2004), in Denmark (HEILMANN-CLAUSEN & CHRISTENSEN) and Britain (AINSWORTH 2004, 2005).

Gloeoporus (Ceriporiopsis) pannocincta (Romell.) J. Erikss.

Only observed in Aztaparreta (JHC05-164). In some European countries, such as Britain (AINSWORTH, pers. comm.) and Belgium (WALLEYN, 2004) the species has been increasing significantly during the last decade.

Hericium coralloides (Scop.: Fr.) Pers.

Only observed on one decaying snag nearby Lizardoia. In the core area of Lizardoia *Hericium flagellum*, growing on *Abies*, was observed as well.

Hohenbuehelia auriscalpium (Maire) Singer

Found on decaying logs in Artikutza, Lizardoia (JHC05-153, C) and Aztaparreta (JHC05-162, C). Considered as an indicator of valuable beech forests at the European scale (CHRISTENSEN *et al.* 2004), but apparently not too rare even in young beech forest reserves in areas of Europe with an Atlantic climate.

Hohenbuehelia petalodes (Bull.: Fr.) Schulzer

Found on a log in Aztaparreta (Walley 4177, GENT).

Inonotus obliquus (Pers.: Fr.) Pilat

Remnants of old carpophores of this heart rot agent were observed on a fallen log nearby Lizardoia. Further studies are needed to clarify if the taxon observed is beech is different from the one observed on *Betula* (HEILMANN-CLAUSEN 2005).

Ischnoderma resinosum (Schrad.: Fr.) P. Karst.

Rather common in Lizardoia (JHC05-149, 160, C; Walley 4172, GENT) and Aztaparreta, often forming large, more or less resupinate fruitbodies. Considered as an indicator of valuable beech

Table 1. Guide to literature on wood inhabiting fungi on *Fagus sylvatica* in Europe.

- Diversity and ecology (species communities, succession) of species on logs.
ADAMČÍK (1996: Slovakia), HEILMANN-CLAUSEN J. (2001: Denmark; 2003: Denmark; 2005, 2006: Sweden); HEILMANN-CLAUSEN & CHRISTENSEN (2000a: Denmark), KÜFFER *et al.* (2004: Ukraine); LANGE (1992: Denmark); ÓDOR *et al.* (2004a, 2004b, 2006: Europe); PILTAVER *et al.* (2002: Slovenia); PIRLOT J.-M. (1994: Belgium); WALLEYN & VANDEKERKHOVE (2002: Belgium); WILLIG & SCHLECHTE (1995: Germany).
- Diversity and species communities on branches.
CHAPELA & BODDY (1988a, 1988b, 1988c: Britain); DARIMONT (1975: Belgium).
- Diversity/species communities on stumps/cut log pieces.
ANDERSSON (1995, 1997: Germany); BODDY *et al.* (1989: UK, fundamental research); CHAPELA *et al.* (1988: UK, fundamental research); COATES & RAYNER (1985a, 1985b, 1985c: UK, fundamental research); JAHN (1968); KREISEL (1961); PIRK & TÜXEN (1957: Germany); RICEK (1967, 1968: Austria); RUNGE (1975, 1980, 1990: Germany).
- Diversity and conservation, diversity and forest management, indicator species.
ADAMČÍK *et al.* (2007), AINSWORTH (2004, 2005: UK); CHRISTENSEN & HEILMANN-CLAUSEN (2002: Denmark); CHRISTENSEN *et al.* (2004: Europe); HEILMANN-CLAUSEN (2003: Denmark); HEILMANN-CLAUSEN & CHRISTENSEN (2000, 2003a, 2003b, 2004a, 2005: Denmark; 2004b: Europe); HEILMANN-CLAUSEN *et al.* (2005); ŁUSZCZYŃSKI (2003: Poland); MÜLLER *et al.* (2007a, 2007b); NITARE (2000: Sweden); NUSS (1999: Germany), (PARMASTO & PARMASTO (1997: Estonia); SCHMID & HELFER (1999); TORTIĆ (1998: Yugoslavia); VEERKAMP (2003: Netherlands); WALLEYN & VEERKAMP (2005: Netherlands, Belgium); WINTER *et al.* (2005: Germany).
- Case studies of particular species on *Fagus*.
BAUM *et al.* (2003: *Fomes fomentarius*); CHRISTENSEN (2001: *Fomes fomentarius*); LÆSSØE *et al.* (2000: *Nemania*); SKOV (2002: *Fomes fomentarius*); WALD *et al.* (2004: *Hericium*).
- Records of *Fagus* inhabiting species:
ADAMČÍK *et al.* (2007: Slovakia); BERNICCHIA *et al.* (2007: Italy); CAVET J. (2000: France); SIEPMANN (1973: Germany); WALLEYN (2004, 2006: Belgium); WALLEYN *et al.* (2004: Belgium).

forests at the European scale (CHRISTENSEN *et al.* 2004), and rather common species in old beech forest reserves throughout Central Europe. Much rarer in the strongly human influenced landscapes of NW Europe.

***Junghuhnia lacera* (P. Karst.) Niemelä & Kinnunen**

Recorded on a large beech log in Aztaparreta (JHC05-163, C). Rather poorly known in Europe, due to confusion with similar species, but apparently rare.

***Lentaria epichnoa* (Fr.) Corner**

Found on a rotten beech log in Aztaparreta (JHC05-173). A rare or overlooked species throughout Europe associated with rotten wood in old forests, but also occasionally observed on sawdust (e.g. HEILMANN-CLAUSEN 1996).

Lentinellus ursinus (Fr.: Fr.) Kühner ss. Moreau *et al.* (1999).

Found on decaying log nearby Lizardoia (Walley 4164, GENT). Considered as an indicator of valuable beech forests at the European scale (CHRISTENSEN *et al.* 2004).

Lentinellus vulpinus (Sowerby: Fr.) Kühner & Maire ss. Moreau *et al.* (1999).

Found on a log in Aztaparreta JHC05-166, C). Considered as an indicator of valuable beech forests at the European scale (CHRISTENSEN *et al.* 2004).

Melanotus horizontalis (Bull.) P.D. Orton

Found in Brañagallones. Rarely recorded species in Europe, but probably overlooked. Mainly found late autumn and winter, during mild but wet periods.

Nemania atropurpurea (Fr.: Fr.) Pouzar

Only collected in Redes (Walley 4151, GENT), but *Xylariaceae* received little attention during the excursion. In Denmark this species is considered an indicator of habitat quality for beech forests.

Nemania carbonacea Pouzar

Found nearby Lizardoia (JHC05-148, C). Presumably not recorded before from Spain. The species seems to have a clear preference for sunexposed wood, and is typically found on larger branches fallen from standing dead trees, or on the log of fallen, previously standing dead trees. Apparently a rare species in Europe, reported from Denmark, Sweden and the Czech Republic (GRANMO *et al.* 1999), but also occurring in France (Fontainebleau) and N. Germany (HEILMANN-CLAUSEN pers. obs).

Perenniporia fraxinea (Bull.: Fr.) Ryvarden

Found in Bertiz (JHC05-140, C) on a living veteran beech pollard. A cosmopolitan species, widely distributed in Europe. Infrequent to very rare in northern Europe.

Phellinus cavicola Kotl. & Pouzar

This very rare polypore was found on a recently fallen old beech pollard in Bertiz (JHC05-139, C). Presumably not recorded before from Spain. In England, this species is considered a good indicator for identifying sites with a high conservation value for beech inhabiting fungi (AINSWORTH 2004, 2005). The species has reflective pore-mouths as typical in *Inonotus* spp., but is completely resupinate and with a perfectly smooth pore-surface.

Phlebia (Mycoacia) nothofagi (G. Cunn.) Nakasone

Found in Redes and nearby Lizardoia (Walley 4153, GENT). Considered as an indicator of valuable beech forests at the European scale (CHRISTENSEN *et al.* 2004). Recorded as new to Europe based on records from Spain by HJORTSTAM *et al.* (1981), but since then recorded from several countries throughout Europe (e.g. CHRISTENSEN *et al.* 2004).

Phleogena faginea (Fr.: Fr.) Link

Although we are quite familiar with this species, mostly fruiting during late autumn and winter, we only observed it once, in Bertiz. It is considered an indicator of habitat quality in Denmark (HEILMANN-CLAUSEN & CHRISTENSEN 2000b), England (AINSWORTH 2004, 2005),

Table 2. Indicator species of conservation value of beech forests proposed by CHRISTENSEN *et al.* (2004), HEILMANN-CLAUSEN & CHRISTENSEN (2002) and AINSWORTH (2004, 2005) observed in during single visits of some sites in Northern Spain.

Indicator species	Indicator European system	Indicator Danish system	Indicator English system	Redes PN, Brañagallones	Artikutza	Bertiz	Near Lizardoia	Lizardoia R.I.	Aztaparreta R.I.
<i>Camarops polysperma</i>		i	i		x			x	
<i>Ceriporiopsis gilvescens</i>	i	i	i	x	x	x	x	x	x
<i>Ceriporiopsis pannocincta</i>	i		i						x
<i>Eutypa spinosa</i>		i	i	x	x	x	x	x	x
<i>Ganoderma pfeifferi</i>	i	i	i				x		
<i>Gloeohyphochnium analogum</i>		i	i			x		x	x
<i>Henningsomyces candidus</i>		i			x				
<i>Hericium coralloides</i>	i	i					x		
<i>Hohenbuehelia auriscalpium</i>	i	i	i		x		x	x	x
<i>Hohenbuehelia mastrucata</i>			i						x
<i>Hypoxylon cohaerens</i>		i		x	x	x	x	x	x
<i>Inonotus nodulosus</i>		i	i		x				x
<i>Inonotus obliquus</i>		i					x		
<i>Ischnoderma resinoseum</i>	i	i					x	x	x
<i>Lentinellus ursinus</i>	i		i				x		
<i>Lentinellus vulpinus</i>	i	i	i						x
<i>Mycoacia nothofagi</i>	i		i	x			x		
<i>Nemania atropurpurea</i>		i		x					
<i>Ossicaulis lignatilis</i>	i	i	i	x					
<i>Phellinus cavicola</i>			i			x			
<i>Phleogena faginea</i>		i	i			x			
<i>Pholiota squarrosoides</i>	i							x	x
<i>Phyllotopsis nidulans</i>			i					x	x
<i>Polyporus badius</i>		i		x			x	x	
<i>Scytinostroma portentosum</i>			i	x					
<i>Spongipellis delectans</i>	i	i	i				x		
<i>Stereum subtomentosum</i>		i			x	x			
Total number of larger species observed:				77	56	35	67	65	69
- Indicator species Danish system				6	8	6	10	8	8
- Indicator species English system				5	5	5	7	6	9
- Indicator species European system				3	2	1	8	4	6

Belgium and The Netherlands (WALLEYN & VEERKAMP 2005), but in The Netherlands and Belgium it seems now spreading rapidly, on *Fagus* but also on many others deciduous trees (WALLEYN 2004, VEERKAMP 2007).

***Pholiota squarrosoides* (Peck) Sacc.**

A rare species, causing heart rot, considered a good indicator for sites with conservation value at the European scale (CHRISTENSEN *et al.* 2004). Very old carpophores, still recognizable by their characteristic sweetish smell were found on logs in Lizardoia (JHC05-151, C) and Aztaparreta.

***Protomerulius caryae* (Schwein.) Ryvarden**

This species seems rare all over Europe, and is most often found at localities with high conservation value. Found in Redes, Bertiz and Lizardoia (Walley 4152 & 4168, GENT).

***Pycnoporellus fulgens* (Fr.) Donk**

Observed in Lizardoia, fruiting high up on a dead standing beech, with the associated predecessor *Fomitopsis pinicola*. This might be the second record of this species in Spain. The first record was discovered on *Pinus halepensis* earlier in the same year (SIQUIER *et al.* 2006). It seems that this species is increasing in Europe, in particular spreading from east to west (e.g. WALLEYN & PIRLOT 2002, HOLEC 2004, RÖLLIN 2007).

***Skeletocutis vulgaris* (Fr.) Niemelä & Y.C. Dai**

Presumably common, and found in all sites (JHC05-111, 121, 130, 131, 134, 137, C; Walley 4158, 4170, GENT), except for Aztaparreta, usually at the underside of branches and logs of average decay phase. Only recently effectively delimited from the very similar *Skeletocutis lenis* (NIEMELÄ & DAI 1997) and hence rather poorly known.

***Spongipellis delectans* (Peck) Murrill**

Observed nearby Lizardoia strict reserve, associated with a cavity on a living tree. A rare but widely distributed species in Europe, preferently occurring in sunexposed environments.

***Stereum insignitum* Qué.**

This species was very common in all visited sites, especially on weakly decayed larger branches, whereas it is absent or very rare in northwestern Europe. In Redes, it was parasitized by *Tremella aurantia* Weinm. (Walley 4155, GENT).

***Trametes cervina* (Schwein.) Bres.**

Found in Redes (JHC05-108, C) and nearby Lizardoia. Widely distributed and locally common in Central and Eastern Europe.

***Tyromyces kmetii* (Bres.) Bondartsev & Singer**

Found in Artikutza (JHC05-107, C) on a rather thin, sunexposed beech log. A rare polypore all over Europe, recognisable in the field by its orange coloured basidiocarps.

DISCUSSION

During the last decade several lists of fungal indicator species have been proposed as means to evaluate the conservation value of beech forests in Europe. The most comprehensive scheme published to date is that by CHRISTENSEN *et al.* (2004), based on experience from several

European countries. Other sets of indicator species have been developed based on experiences from more restricted areas, typically single countries [e.g. HEILMANN-CLAUSEN & CHRISTENSEN (2000), HOLEC (2003), AINSWORTH (2004, 2005), WALLEYN & VEERKAMP (2005), NUSS (1999), ŁUSZCZYŃSKI (2003), TORTIĆ (1998)] In the evaluation of visited sites in Spain, we find the European system and those developed for Denmark, Belgium and Great Britain most useful, keeping in mind that the indicator schemes are still in progress, and needs further evaluation and statistical testing to be really trust worthy. The total records of European Indicator species suggested by CHRISTENSEN *et al.* (2004) during our five excursion days clearly indicate that important fungal diversity associated with decaying beech wood is present in Northern Spain (Table 2). This is especially the case for the two reserves visited in the Pyrenees (Lizardoia, Atztaparreta). It is however also evident that the visited areas does not host as many indicator species as recorded in many reserves in eastern Europe and in the best sites known in Denmark and Great Britain. Totally, only 12 of the European indicator species were recorded, while the best known sites outside Spain host as many as 14 species (CHRISTENSEN *et al.* 2004). There are several potential explanations for this: 1) the season was very late for agarics, which might be the reason for the lack of species such as *Flammulaster limulatus*, *F. muricatus* and *Pluteus umbrosus*, and it is quite possible that the number of indicators species in the visited sites may be increased by continued investigations of the areas; b) some indicator species may for climatical reasons be absent for the area, e.g. *Aurantioporus alborubescens* which seems absent outside the subatlantic part of northwest Europe, c) finally some species may be so demanding in their ecological requirements that they might be regionally extend from the region or have never been able to spread to the region, due to early human influence on the dispersing beech population in the Iberian region, 1-3000 years ago. This might be the reason for the lack of or very low number of records of species such as *Hericium coralloides* or *H. erinaceus*.

In a recent paper based on our experiences from eastern Slovakia (ADAMCIK *et al.* 2007) we discussed the reliability of the European indicator scheme in a bigger perspective, and we find it relevant to continue his discussion also in the present paper, based on new experiences from Spain. In Eastern Europe some of the suggested indicator species appear to be more common and abundant than previously thought, and are regularly found even in managed forests with low amounts of dead wood. However, we are not certain that this actually disqualifies these species as indicators of valuable fungal habitats. Rather we believe that they are pointing to the presence of a sustainable amount of dead wood present at the at the landscape scale, allowing the survival of healthy populations of even the more demanding wood-inhabiting fungi. In relation to the present study, we find it especially important to discuss the conservation value of more synanthropic habitats such as parks, formerly grazed and coppiced forests and hunting reserves. In its our experience from Northwest Europe that such habitats are very important for rare heart rotters such as *Aurantioporus alborubescens*, *Ganoderma pfeifferi* and *Inonotus cuticularis*, and this appeared to be the case also in some of the visited reserves in Spain, especially the area nearby the strict reserve in Lizardoia and Artikutza, where the records of *Ganoderma pfeifferi*, *Phellinus cavicola*, *Spongipellis delectans*, *Inonotus obliquus* and *Hericium coralloides* were all obtained in semiopen, partly synanthropic habitats. Even though, such habitats are not very natural in a strict sense they clearly indicate important habitats for biodiversity dependent on veteran trees, including dead wood, and we certainly believe such habitats deserve conservation. In a European perspective the large tracts of coppiced beech forests in Northern Spain are outstanding and further studies to evaluate their value for fungal biodiversity would be highly welcome.

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Phellinus cavicola (JHC05-139).



Junghuhnia lacera (JHC05-163).



Entoloma pluteisimilis (Walley 4150).



Dentipellis fragilis (Walley 4163).