

Interesting macrofungi from the Eastern Carpathians, Ukraine and their value as bioindicators of primeval and near-natural forests

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Abstract. In 1999 and 2007 mycobiota of several locations in the Eastern Carpathians, Ukraine was studied. The Chornohora, Svydovets and Horhany mountain massifs were visited, especially locations with natural (primeval or near-natural) forests. Records of 32 rare, threatened or overlooked species of macrofungi are published. Ten of them are probably new to Ukraine (*Cordyceps rouxii*, *Gymnopilus josserandii*, *Hydropus atramentosus*, *H. marginellus*, *H. subalpinus*, *Hypholoma subviride*, *Hypoxylon vogesiacum*, *Lopadostoma pouzarii*, *Omphalina cyanophylla*, *Skeletocutis carneogrisea*) and 10 can be considered bioindicators of natural forests (*Cystostereum murrayi*, *Hohenbuehelia auriscalpium*, *Hydropus atramentosus*, *Hypoxylon vogesiacum*, *Multiclavula mucida*, *Omphalina cyanophylla*, *Phellinus nigrolimitatus*, *P. pouzarii*, *Rigidoporus crocatus*, *Skeletocutis stellae*). The records are compared with the mycobiota of the Poloniny National Park, Slovakia and with data on indicator species of fungi from abroad. The Eastern Carpathians (covering parts of Slovakia, Poland, Ukraine and Romania) seem to be the best refuge for rare (especially lignicolous) fungi of mountain beech and mixed forests in Europe.

Key words: biodiversity, bioindication, Carpathian Biosphere Reserve, lignicolous fungi, near-natural forests, primeval forests, Zakarpatska oblast

Introduction

In 1999 and 2007 I visited several locations in the Eastern Carpathians, Ukraine. Most of them are situated in the Chornohora and Svydovets mountain massifs (eastern part of the Zakarpatska oblast region). Exceptionally I also visited the Horhany mountain massif (western part of the Ivano-Frankivska oblast region). The area is exceptional for its rich occurrence of natural habitats like alpine and subalpine communities and well-preserved *Fagus*, *Abies* and *Picea* forests and mixed forests composed of all these trees with admixed *Acer pseudoplatanus*, *Acer platanoides*, *Fraxinus excelsior*, *Ulmus glabra*, etc. Some records of macrofungi from this area are interesting and worth publishing. They represent rare or threatened species or taxa which seem to be new to Ukraine or the Eastern Carpathians. Consequently, this paper contributes to the knowledge of the local mycobiota and discusses the potential value of selected fungal species as bioindicators of natural (primeval and near-natural) forests.

Basic work on the biodiversity of macrofungi in the Eastern Carpathians was carried out by the prominent Czech mycologist Albert Pilát in the period 1928–1938. He collected especially lignicolous fungi growing in mountain forests minimally influenced by man. The results were summarized in a detailed mycofloristic contribution (Pilát 1940: more than 500 species) and the collected material also served as a basis for Pilát's well-known taxonomic monographs of *Polyporaceae* (Pilát 1936–1942) and the genera *Stereum*, *Pleurotus*, *Lentinus*, *Crepidotus*, etc. (for a bibliography of his publications on the Eastern Carpathians and locations of his collecting sites, see Holec 2002). Data published or collected by Russian and Ukrainian mycologists are summarized in check lists (Minter & Dudka 1996; Akulov *et al.* 2003; Andrianova *et al.* 2006) and maps (Minter *et al.* 2008). However, the publications relating directly to macrofungi of Eastern Carpathians are not frequent (e.g. Gorova 1979; Wasser 1992). A recent work on the biodiversity of (mostly corticioid) macrofungi in selected beech forests of the Eastern Carpathians was published by Küffer *et al.* (2004).



Fig. 1. Position of the Zakarpatska oblast region (Ukraine), where most of the studied locations in the Eastern Carpathians are located.

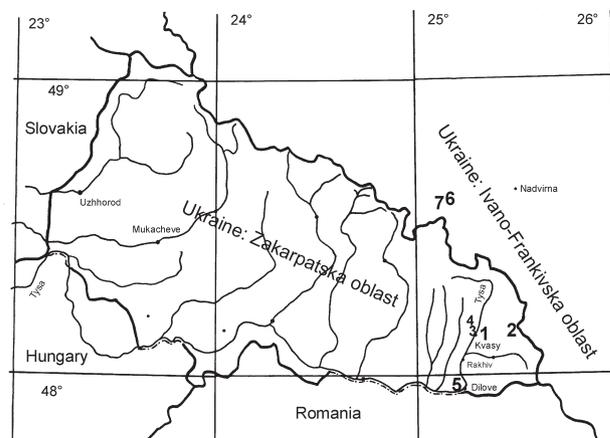


Fig. 2. Position of studied localities in the Zakarpatska and Ivano-Frankivka oblast regions. 1: Mt. Menchul. 2: Mt. Hoverla and Hoverla stream valley. 3: Trostyanets stream valley. 4: Trostyanets stream: spring area. 5: Kuzyi (Kuzy) stream valley. 6: Velykyi Kuzmynets stream valley. 7: Mt. Vysoka. For details on localities see Table 1.

Table 1. Geographic position of studied localities in the Eastern Carpathians. Numbers of localities agree with numbers in Fig. 2.

Mountain massif	Region (oblast) of Ukraine	Location	Studied localities (for details, see Collections studied in Results and Fig. 2)
Chornohora	Zakarpatska oblast	E of Tysa river valley between the towns Yasinya and Rakhiv	1. Mt. Menchul NE of the village of Kvasy 2. Mt. Hoverla and Hoverla stream valley NNE of the village of Luh
Svydovets	Zakarpatska oblast	W of Tysa river valley between the towns Yasinya and Vel. Bychkiv	3. Trostyanets stream valley NW of the village of Kvasy 4. Trostyanets stream: spring area close to Mt. Mala Blyznytisia NNW of the village of Kvasy
Horhany	Ivano-Frankivska oblast	W of the town of Nadvirna	5. Kuzyi (Kuzy) stream valley between the villages Luh and Dilove 6. Velykyi Kuzmynets stream valley W of the village of Stara Huta 7. Mt. Vysoka W of the village of Stara Huta

Material and Methods

The locations studied are situated in three mountain massifs of the Eastern Carpathians (Ukraine), see Table 1 and Figs 1-2. The Chornohora massif was visited in July 1999 and June-July 2007, Svydovets in June-July 2007 and Horhany in July 2007. Mt. Menchul NE of the village of Kvasy was the most intensively studied locality (5 days). The other localities were visited only once. During the fieldwork, all macrofungi were recorded and some of them collected for microscopic study. Only the most noteworthy species (rare, endangered, bioindicators, new to Ukraine) are published here. Voucher specimens are kept in the PRM herbarium (National Museum, Mycological Department, Prague). Some collections were revised by polypore specialist Dr. Zdeněk Pouzar (National Museum, Prague).

The occurrence of the species in Ukraine (see Table 2) was evaluated with respect to Pilát (1940), Ukrainian check lists (Minter & Dudka 1996; Akulov *et al.* 2003; Andrianova *et al.* 2006) and maps (Minter *et al.* 2008). As there is no official red list of Ukrainian fungi (the list of potentially endangered fungi – see Minter *et al.* 2008b – does not have this status), the threat of the species published here was compared with their threat status in some (mostly neighbouring) countries of Central Europe covered by mountains higher than 1000 m a.s.l. and thus possessing comparable habitat conditions (Czech Republic, Poland, Slovakia; for references, see Table 2).

For the purpose of this article, the following terms are used:

■ **natural forests**

primeval forest: possessing a natural tree species composition, multi-aged structure, long continuity (never completely

Table 2. Fungi found in the Eastern Carpathians by J. Holec in comparison with data by Pilát, Ukrainian checklists and fungi known from Poloniny NP. The last three columns represent the threat status of the species in the Czech Republic and two neighbours of Ukraine: Slovakia and Poland (only neighbours with occurrence of mountains above 1000 m above sea level are included (i.e. Hungary is not involved being mostly a lowland country). For explanations see below the table.

Species found by J. Holec (this article) Species new to Ukraine are in bold.	Pilát (1940) or his other works	UKR (CHL96)	UKR (CHL06 + maps)	UKR (CHL Aph)	Poloniny NP (Kuthan <i>et al.</i> 1999)	CZ (RL)	SK (RL)	PO (RL)
<i>Camarops tubulina</i>	+ (as <i>Bolinia t.</i>)				+	NT	VU	V
<i>Cantharellus friesii</i>	+				+	VU		E
<i>Cordyceps rouxii</i>								
<i>Cystostereum murrayi</i>	+ (as <i>Stereum m.</i>)			+	+	NT		V
<i>Entoloma placidum</i>	+ (as <i>Leptonia p.</i>)				+	DD		E
<i>Eocronartium muscicola</i>	+							
<i>Gymnopilus josserandii</i>						DD		
<i>Hohenbuehelia auriscalpium</i>	+ (under <i>H. petaloides</i>)				+ (under <i>H. petaloides</i>)	EN		
<i>Hydropus atramentosus</i>					+	EN	CR	E
<i>Hydropus marginellus</i>					+			E
<i>Hydropus subalpinus</i>					+			R
<i>Hymenochaete carpatica</i>					+		DD	
<i>Hymenochaete cruenta</i>	+ (as <i>H. mougeotii</i>)			+	+	NT		V
<i>Hymenochaete fuliginosa</i>	+			+	+	EN		E
<i>Hypholoma subviride</i>					+			
<i>Hypoxylon vogesiacum</i>								
<i>Lopadostoma pouzarii</i>								
<i>Multiclavula mucida</i> (= <i>Lentaria mucida</i>)	+ (as <i>Clavaria m.</i>)				+ (under <i>Lentaria m.</i>)	EN	EN	
<i>Mycena purpureofusca</i>		+			+			V
<i>Omphalina cyanophylla</i>						CR		
<i>Omphalina hudsoniana</i>		+	+			EN		NT
<i>Omphalina umbellifera</i>	+				+ (as <i>O. ericetorum</i>)			R (NT as lichen)
<i>Panellus violaceofulvus</i>	+ (as <i>Pleurotus v.</i>)				+	CR		R
<i>Phellinus nigrolimitatus</i>	+			+		NT		E
<i>Phellinus pouzarii</i>	+ (identified as <i>P. ferrugineofuscus</i> , see Kotlaba 1968: 27)			+	+	CR	VU	
<i>Pholiota squarrosoides</i>	+ (among collections identified as <i>P. squarrosa</i> , see Holec 2001a: 68)				+	EN		
<i>Pluteus thomsonii</i>			+		+	EN		
<i>Pluteus umbrosus</i>	+		+		+	VU		
<i>Rigidoporus crocatus</i>	+ (Pilát 1936-42: 413, as <i>Poria nigrescens</i>)			+	+	EN		E
<i>Skeletocutis carneogrisea</i>					+			
<i>Skeletocutis stellae</i>	+ (Pilát 1936-42: 465, as <i>Poria s.</i>)	+	+	+	+	CR		V
<i>Trechispora candidissima</i>	? (could be present under collections identified as <i>Poria subtilis</i> , revision needed)			+		DD		

Abbreviations: CHL Aph – check list of *Aphylophorales* by Akulov *et al.* (2003); CHL96 – check list by Minter & Dudka (1996); CHL06 + maps – check list by Andrianova *et al.* (2006) and maps by Minter *et al.* (2008); CR – critically endangered (IUCN red list category); CZ (RL) – Czech Republic, red list by Holec & Beran 2006; DD – data deficient (IUCN red list category); E – declining – critically endangered (category of Polish red list); EN – endangered (IUCN red list category); NT – near threat (IUCN red list category); PO (RL) – Poland, red list by Wojewoda & Ławrynowicz (2006); SK (RL) – Slovakia, red list by Lizoň (2001); R – rare – potentially endangered (category of Polish red list); RL – red list; UKR – Ukraine; V – vulnerable (category of Polish red list); VU – vulnerable (IUCN red list category); +* – omitted in the check lists, but published by Wasser 1992)

cut), rather large area (tens or hundreds of hectares), almost intact (no selective cutting, no clearings, no removal of fallen trunks), surrounded by near-natural forests (see below);

near-natural forest: possessing a natural tree species composition, multi-aged structure, smaller area than a primeval forest, long continuity or having been naturally recovered after cutting, little influenced by man (selective cutting, forest paths, small clearings), surrounded by man-influenced to man-made forests (see below).

■ **cultural forests**

man-influenced forest: possessing a natural tree species composition but homogeneous age structure, managed by man, but some fallen trunks left;

man-made forest: possessing an unnatural tree species composition (mostly homogeneous *Picea* plantations instead of a heterogeneous composition), completely managed by man.

Ukrainian local names have been transliterated into English according to Yurchenko (2001).

Abbreviations: **BR** – Biosphere Reserve; **IUCN** – The World Conservation Union; **JH** – number of collection by Jan Holec; **not.** – from the Latin word *notavit*, i.e. recorded, a find which is only recorded but not documented by a voucher specimen; **NP** – National Park; **PRM** – herbarium of the National Museum, Mycological Department, Prague.

Results and Discussion

In the following survey, interesting records of fungi from the Eastern Carpathians are listed alphabetically (see also Table 2). The phrase “probably new to Ukraine” means that the species is not included in the following comprehensive works on the biodiversity of fungi in the Eastern Carpathians and Ukraine: Pilát (1940), Minter & Dudka (1996), Akulov *et al.* (2003), Andrianova *et al.* (2006), Minter *et al.* (2008). The word “probably” reflects the fact that it cannot be stated with certainty, as it was impossible to check this in Ukrainian herbaria and local journals. The same Ukrainian publications are used for comparison of my records with previous Ukrainian data, and references to them are not included for reasons of space. For threat status in selected (mostly neighbouring) countries see Table 2.

Camarops tubulina (Alb. et Schwein. : Fr.) Shear

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: WNW slope, alt. 650 m, man-influenced mixed forest (*Fagus*, *Abies*), NNE of the village of Kvasy NNE of the town of Rachiv, *Abies alba*: on decaying trunk, 15 Jul 1999, leg. et det. J. Holec, JH 96/1999 (PRM 892904).

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: W slope, ca 2.2 km WNW of the summit, near-natural *Fagus-Abies* forest, multi-aged, with many fallen trunks, NNE of the village of Kvasy NNE of the town of Rachiv, alt. 800 m, *Abies alba*: fallen decaying trunk, 27 Jun 2007, leg. et det. J. Holec, JH 51/2007 (PRM 909453).

A pyrenomycete requiring dead wood of conifers as well as deciduous trees, and stable habitat conditions of natural forests. Although the species was collected in the Eastern Carpathians by Pilát (1940), it is not included in any Ukrainian check list. It is considered an indicator of the conservation value of European beech forests (Christensen *et al.* 2004). In the Czech Republic (Holec 2005a) and Slovakia (Kotlaba 1995) it is mostly found on wood of *Picea* or *Abies*. In these two countries, it clearly prefers natural forests (Holec 2003), beech as well as mixed mountain forests (*Fagus*, *Picea*, *Abies*), mountain spruce forests and bog spruce forests.

Cantharellus friesii Quél.

Trostryanets stream valley, NE slope SW of the stream, ca 6 km SSE of the summit of Mt. Velyka Blyznytisia, man-influenced *Fagus* forest with admixed *Abies* and *Picea*, ca 2 km W of the village of Trostryanets NNE of the town of Rachiv, Svydovets mountain massif, alt. 800 m, in soil, 28 Jun 2007, leg. et det. J. Holec, JH 55/2007 (PRM 909457).

C. friesii is a typical but uncommon species of *Fagus* forests. As a mycorrhizal fungus, it is threatened by changes of soil conditions (acidification, eutrophication). For this reason, it was included into red lists of some countries of Central Europe (Table 2). Although the species was collected in the Eastern Carpathians by Pilát (1940), it is not included in any Ukrainian check list.

Cordyceps rouxii Cand.

Velykyi Kuzmynets stream valley, *Fagus-Abies* forest, Horhany mountain massif, ca 25 km W of the town of Narvirna, ca 4 km W of S margin of the village Stara Huta, alt. 850 m, 1 Jul 2007 leg. Pavlína Brettlová, det. J. Holec, JH 65/2007 (PRM 909466).

Probably new species to Ukraine. It was described as late as in 1976 and most mycologists misidentify it as the better known species *C. capitata*. Recently, the differences between these two species were well described and illustrated by Kautmanová & Kautman (2006). The authors state that most localities of *C. rouxii* are situated near springs or streams at higher altitudes (630–1150 m). The published find is from this kind of habitat.

Cystostereum murrayi (Berk. et M.A. Curtis) Pouzar

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: SW slope, alt. 800 m, near-natural forest composed of *Abies*, *Fagus*, *Picea*, NNE of the village of Kvasy NNE of the town of Rachiv, *Abies alba*: on fallen trunk with bark, 11 Jul 1999, leg. et det. J. Holec, JH 82/1999 (PRM 892890).

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: W slope, alt. 700 m, near-natural forest composed of *Abies* and *Fagus*, NNE of the village of Kvasy NNE of the town of Rachiv, *Abies alba*: on fallen trunk without bark, 15 Jul 1999, leg. et det. J. Holec, JH 98/1999 (PRM 892906).

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: W slope, alt. 800 m, near-natural forest composed of *Fagus*, *Abies*, *Acer pseudoplatanus*, *Fraxinus*, *Picea*, NNE of the village of Kvasy NNE of the town of Rachiv, *Abies alba*: on decaying trunk, 11 Jul 1999, not. J. Holec.

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: WNW slope, ca 2.2 km W of the summit, near-natural *Fagus-Abies* forest, multi-aged, with many fallen trunks, NNE of the village of Kvasy NNE of the town of Rachiv, alt. 720 m, *Abies alba*: fallen trunk without bark, 27 Jun 2007, not. J. Holec.

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: W slope, ca 2.5 km WNW of the summit, primeval *Fagus-Abies* forest, NNE of the village of Kvasy NNE of the town of Rachiv, alt. 800 m, *Abies alba*: fallen trunk with bark, 29 Jun 2007, leg. et det. J. Holec, JH 59/2007 (PRM 909461).

The species is well known from the Eastern Carpathians (e.g. Pilát 1940; Akulov *et al.* 2003) and from most mountainous areas of Central Europe (e.g. Kotlaba 1987). It prefers near-natural to primeval forests with presence of dead wood (mostly fallen trunks) of *Abies* or *Picea*. For this reason, it can be used as a bioindicator of such forests (Holec 2003). However, it certainly does not belong to the rarest fungi of them, which is well documented e.g. by frequent finds on slopes of Mt. Menchul near Kvasy. Tortič (1998) considers the species an indicator of old forests of beech and fir in former Yugoslavia.

Entoloma placidum (Fr. : Fr.) Noordel.

Mt. Menchul (1305 m): slopes oriented towards the Keveliv stream valley, exact site exposition: N slope, alt. 1000 m, near-natural forest composed of *Fraxinus*, *Acer platanoides*, *Fagus*, *Picea*, *Abies*, NNE of the village of Kvasy NNE of the town of Rachiv, *Abies alba*: on strongly decayed trunk, 14 Jul 1999, leg. et det. J. Holec, JH 93/1999 (PRM 892901).

E. placidum is a lignicolous agaric, which is not usual in the genus *Entoloma*. It is considered a rare species (Noordeloos 1992; Gminder & Krieglsteiner 2003) all over Europe. Although it was collected in the Eastern Carpathians by Pilát (1940), it is not included in any Ukrainian checklist. The present record is unique for its substrate (*Abies*), as *E. placidum* grows almost exclusively on wood of *Fagus* (Noordeloos 1992; Gminder & Krieglsteiner 2003). However, such cases are known in lignicolous fungi.

Eocronartium muscicola (Pers. : Fr.) Fitzp.

Hoverla stream valley 4.1 km SW of the summit of Mt. Hoverla, primeval *Abies-Picea-Fagus* forest with many fallen trunks, NE of the town of Rachiv, alt. 1000 m, on moss covering a trunk used for stabilization of the stream bank, 8 Jul 2007, leg. et det. J. Holec, JH 70/2007 (PRM 909471).

Mt. Hoverla, W slope above the Hoverla stream ca 3.9 km SW of the summit of Hoverla, primeval *Abies-Picea-Fagus* forest with many fallen trunks, NE of the town of Rachiv, alt.

1000 m, on moss growing on fallen trunk, 8 Jul 2007, leg. et det. J. Holec, JH 71/2007 (PRM 909472).

Mt. Hoverla, W slope above the Hoverla stream ca 3.9 km SW of the summit of Hoverla, primeval *Abies-Picea-Fagus* forest with many fallen trunks, NE of the town of Rachiv, alt. 1100 m, on moss growing on fallen trunk of *Fagus*, 8 Jul 2007, leg. et det. J. Holec, JH 73/2007 (PRM 909473).

Although the species was collected in the Eastern Carpathians by Pilát (1940), it is not included in any Ukrainian check list. This could be caused by its inconspicuous appearance, unusual habitat and also by the fact that it can be considered a *Typhula* or *Clavaria* species. In fact, the species is not a true macromycete but a primitive rust. In Europe, it is rare everywhere (Wojewoda 2000). In Estonia, the species is used as indicator of primeval forests and old-growth forests deserving protection (Parmasto 2001).

Gymnopilus josserandii Antonín

= *G. subsphaerosporus* (Joss.) Kühner et Romagn. (invalid name)

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: W slope, ca 1.7 km WNW of the summit, primeval *Fagus-Abies* forest, multi-aged, NNE of the village of Kvasy NNE of the town of Rachiv, alt. 920 m, *Abies alba*: fallen decayed trunk covered with mosses, 29 Jun 2007, leg. et det. J. Holec, JH 63/2007 (PRM 909465).

Probably new to Ukraine and the Carpathians. The species is distinctive by its dull colours, fibrillose-tomentose surface, subglobose spores and distinctly tibiiform cheilocystidia (Holec 2001b, 2005b). However, it was overlooked by most mycologists in the past, although it is not so rare (Holec 2005b) as was thought. *G. josserandii* is mostly known from natural forests (Holec 2003). However, it is able to grow in man-made spruce forests, too (data from herbarium PRM). I suppose that the species is scattered in Carpathian forests where strongly decayed wood of conifers is present.

Hohenbuehelia auriscalpium (Maire) Singer

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: SW slope, alt. 800 m, near-natural forest composed of *Abies*, *Fagus*, *Picea*, NNE of the village of Kvasy NNE of the town of Rachiv, *Fagus sylvatica*: on decaying trunk, 11 Jul 1999, leg. et det. J. Holec, JH 86/1999 (PRM 892894).

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: WNW slope, ca 2.5 km W of the summit, near-natural multi-aged *Fagus* forest with admixed *Picea*, NNE of the village of Kvasy NNE of the town of Rachiv, alt. 720 m, *Fagus sylvatica*: decaying fallen trunk covered with mosses, 27 Jun 2007, leg. et det. J. Holec, JH 45/2007 (PRM 909447).

H. auriscalpium is treated here in the sense of Elborne (1995) and Ludwig (2000: Figs. 32.3.A, B, C). Although the species was collected in the Eastern Carpathians by Pilát (1940, as *H. petaloides*), it is not included in any Ukrainian

check list. The species is considered an indicator species “of the nature value” of European beech forests (Christensen *et al.* 2004). Data from the Czech Republic confirm this (Holec & Beran 2006).

Hydropus atramentosus (Kalchbr.) Kotl. et Pouzar

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: WNW slope, ca 2.2 km W of the summit, near-natural *Fagus-Abies* forest, multi-aged, with many fallen trunks, NNE of the village of Kvasy NNE of Rachiv town, alt. 720 m, *Abies alba*: fallen decaying trunk covered with mosses, 27 Jun 2007, leg. et det. J. Holec, JH 49/2007 (PRM 909451).

Probably new to Ukraine. Data from Central Europe (e.g. Kotlaba 1995) show that the species occurs only in the best preserved near-natural to primeval forests with stable habitat conditions and uninterrupted vegetation continuity (no cutting, no clearings, no removal of fallen trunks, etc.). Consequently, it is included in red lists of many countries (for examples, see Table 2) and can be considered a bioindicator of natural forests (Holec 2003).

Hydropus marginellus (Pers. : Fr.) Singer

Mt. Menchul (1305 m): slopes oriented towards the Keveliv stream valley, exact site exposition: N slope, alt. 1000 m, near-natural forest composed of *Fraxinus*, *Acer platanoides*, *Fagus*, *Picea*, *Abies*, NNE of the village of Kvasy NNE of the town of Rachiv, *Abies alba*: on decaying trunk covered with mosses, 14 Jul 1999, not. J. Holec.

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: NW slope, alt. 750 m, near-natural forest composed of *Fagus*, *Abies*, *Acer pseudoplatanus*, NNE of the village of Kvasy NNE of the town of Rachiv, *Abies alba*: on decayed stump among mosses, 11 Jul 1999, not. J. Holec.

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: SW slope, alt. 770 m, near-natural forest composed of *Abies* and *Fagus*, NNE of the village of Kvasy NNE of the town of Rachiv, *Abies alba*: on strongly decayed trunk, 15 Jul 1999, not. J. Holec.

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: WNW slope, ca 2.2 km W of the summit, near-natural *Fagus-Abies* forest, multi-aged, with many fallen trunks, NNE of the village of Kvasy NNE of the town of Rachiv, alt. 720 m, *Abies alba*: fallen decaying stump, 27 Jun 2007, not. J. Holec.

Probably new to Ukraine. It is surprising that *H. marginellus* is not included in any works on biodiversity of fungi of the studied area nor in Ukrainian check lists. In Central Europe, the species is not rare and represents a common and typical inhabitant of old, decaying or fully decayed stumps and trunks of *Abies*, often covered with mosses. Numerous records from Mt. Menchul confirm this. The species occurs both in natural and cultural forests with presence of decaying wood of *Abies*. Thus, it has ideal conditions in the Eastern Carpathians where *Abies* is rather common.

Hydropus subalpinus (Höhn.) Singer

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: W slope, ca 2.5 km WNW of the summit, man-influenced *Fagus* forest with admixed *Carpinus*, NNE of the village of Kvasy NNE of the town of Rachiv, alt. 720 m, wood in soil, 29 Jun 2007, not. J. Holec.

Probably new to Ukraine. *H. subalpinus* is typical by its growth on dead wood of broadleaved trees (especially *Fagus*) hidden in raw humus or soil. It occurs in spring or early summer. Consequently, it often escapes the attention of mycologists. It belongs to the typical fungi of beech forests (both natural and cultural) and grows scattered throughout Europe.

Hymenochaete carpatica Pilát

Several records from the same locality have been published by Tomšovský (2001), who visited Mt. Menchul during the same excursion as J. Holec (in 1999).

Mt. Menchul (1305 m), man-influenced *Fagus* forest, alt. 1300 m, NNE of the village of Kvasy NNE of the town of Rachiv, *Acer pseudoplatanus*: underside of bark chips on lower part of living trunk, 13 Jul 1999, leg. et det. J. Holec, JH 87/1999 (PRM 892895).

Mt. Menchul (1305 m): slopes oriented towards the Keveliv stream valley, exact site exposition: N slope, alt. 1000 m, near-natural forest composed of *Fraxinus*, *Acer platanoides*, *Fagus*, *Picea*, *Abies*, NNE of the village of Kvasy NNE of the town of Rachiv, *Acer pseudoplatanus*: underside of bark chips on lower part of living trunk, 14 Jul 1999, not. J. Holec.

Mt. Menchul (1305 m): slopes oriented towards the Keveliv stream valley, exact site exposition: NNE slope, alt. 900 m, man-influenced mixed forest composed of *Abies*, *Fagus*, *Ulmus*, *Acer pseudoplatanus*, *Fraxinus*, NNE of the village of Kvasy NNE of the town of Rachiv, *Acer pseudoplatanus*: underside of bark chips on lower part of living trunk, 14 Jul 1999, leg. et det. J. Holec, JH 90/1999 (PRM 892898).

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: W slope, ca 2.2 km WNW of the summit, near-natural *Fagus-Abies* forest, multi-aged, with many fallen trunks, NNE of the village of Kvasy NNE of the town of Rachiv, alt. 800 m, *Acer pseudoplatanus*: inner side of bark chips, 27 Jun 2007, leg. et det. J. Holec, JH 53/2007 (PRM 909455).

H. carpatica is common in Central and West Europe (Krieglsteiner 1993, Tomšovský 2001) but it is mostly overlooked by mycologists due to its unusual substrate – underside (rarely also upper side) of bark chips on trunks of older individuals of *Acer pseudoplatanus*. In the Eastern Carpathians, the species has ideal conditions, as old *Acer* trees are common in their mountain forests. This is well illustrated by numerous records originating from one selected locality – Mt. Menchul near the village of Kvasy. Surprisingly, the species is not included in the check list of Ukrainian aphylophoroid fungi (Akulov *et al.* 2003), although it is common in the Eastern Carpathians and records of it from this area have been published (Tomšovský 2001).

Hymenochaete cruenta (Pers. : Fr.) Donk

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: NW slope, alt. 600 m, near-natural forest composed of *Fagus*, *Abies*, *Acer platanoides*, *A. pseudoplatanus*, *Picea*, NNE of the village of Kvasy NNE of the town of Rachiv, *Abies alba*: on fallen log, 11 Jul 1999, not. M. Tomšovský.

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: SW slope, alt. 800 m, near-natural forest composed of *Abies*, *Fagus*, *Picea*, NNE of the village of Kvasy NNE of the town of Rachiv, *Abies alba*: on fallen log, 11 Jul 1999, leg. et det. J. Holec, JH 84/1999 (PRM 892892).

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: W slope, alt. 800 m, near-natural forest composed of *Fagus*, *Abies*, *Acer pseudoplatanus*, *Fraxinus*, *Picea*, NNE of the village of Kvasy NNE of the town of Rachiv, *Abies alba*: on fallen log, 11 Jul 1999, not. J. Holec.

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: W slope, ca 2.2 km WNW of the summit, near-natural *Fagus-Abies* forest, multi-aged, with many fallen trunks, NNE of the village of Kvasy NNE of Rachiv town, alt. 800 m, *Abies alba*: log of a freshly fallen trunk, 27 Jun 2007, leg. et det. J. Holec, JH 52/2007 (PRM 909454).

Typical species on logs or trunks of living or freshly fallen individuals of *Abies*, mostly high in the treetop. It is common in the Carpathians (and was common in other mountain areas of Europe with presence of *Abies*, too), however in past decades it has become threatened by *Abies* decline in some polluted areas (see e.g. Krieglsteiner 2000). Consequently, it is included in red lists of some European countries (for examples, see Table 2). As *Abies* seems to be very vital in the Eastern Carpathians, *H. carpatica* is rather common there, which is well illustrated by numerous records from one locality – Mt. Menchul near Kvasy.

Hymenochaete fuliginosa (Pers. : Fr.) Bres.

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: NW slope, alt. 600 m, near-natural forest composed of *Fagus*, *Abies*, *Acer platanoides*, *A. pseudoplatanus*, *Picea*, NNE of the village of Kvasy NNE of the town of Rachiv, *Abies alba*: on fallen log, 11 Jul 1999, not. M. Tomšovský.

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: SW slope, alt. 800 m, near-natural forest composed of *Abies*, *Fagus*, *Picea*, NNE of the village of Kvasy NNE of the town of Rachiv, *Abies alba*: on decaying log, 11 Jul 1999, not. J. Holec.

Mt. Menchul (1305 m): small side summit NW of the main summit, alt. 1000 m, man-influenced mixed forest (*Acer pseudoplatanus*, *Fagus*, *Abies*), NNE of the village of Kvasy NNE of the town of Rachiv, *Abies alba*: on log, 11 Jul 1999, not. J. Holec.

H. fuliginosa is a typical mountainous species growing on fallen trunks or logs of *Picea* and *Abies* (I consider *Hymenochete subfuliginosa* Bourdot et Galzin growing on deciduous trees like *Quercus* a separate species). In the Czech Republic and Poland (and several other European countries), the species is included in red lists (see Table 2). I know the species both from cultural and natural forests. Thus, it is not suitable for indication of natural habitats, although I first published that it is a bioindicator (Holec 2003). I suppose that the species is scattered to common at higher altitudes of the Eastern Carpathians – see numerous records from Mt. Menchul.

Hypholoma subviride (Berk. et M.A. Curtis) Dennis
= *Hypholoma fasciculare* var. *subviride* (Berk. & M.A. Curtis) Krieglst. = *Hypholoma fasciculare* var. *pusillum* J.E. Lange

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: WNW slope, ca 2.2 km W of the summit, near-natural *Fagus-Abies* forest, multi-aged, with many fallen trunks, NNE of the village of Kvasy NNE of the town of Rachiv, alt. 720 m, *Abies alba*: fallen trunk without bark, 27 Jun 2007, not. J. Holec.

Probably new to Ukraine. As discussed by Noordeloos (1999), some authors consider this taxon only a smaller variety of *H. fasciculare* with densely crowded lamellae. For the purpose of this article, the fungus is treated here as separate taxon to assess the biodiversity of Eastern Carpathians in all its aspects including taxonomy. Further studies are necessary to judge the identity of *H. subviride* (species?, variety of *H. fasciculare*?, identical with *H. fasciculare*?). I know *H. subviride* well from the Czech Republic, where it differs from *H. fasciculare* not only by its appearance, but also by its ecology. It obviously prefers natural forests (floodplain forests, ravine forests, mixed mountain forests), whereas the true *H. fasciculare* grows in all forests including the cultural ones.

Hypoxyton vogesiacum (Currey) Sacc.

Mt. Menchul (1305 m): slopes oriented towards the Keveliv stream valley, exact site exposition: NE slope, alt. 1050 m, near-natural ravine forest composed of *Acer platanoides*, *A. pseudoplatanus*, *Fagus*, *Fraxinus*, NNE of the village of Kvasy NNE of the town of Rachiv, on fallen trunk of deciduous tree, 14 Jul 1999, leg. et det. J. Holec, JH 94/1999 (PRM 892902).

Probably new to Ukraine. Although very distinctive by its purplish red brown stromata, this pyrenomycete is rarely reported by mycologists. It seems to be rare and restricted to mountainous or Nordic areas (Granmo 1999). In the Czech Republic, where I know it well (voucher specimens in herbarium PRM), it grows on wood of *Ulmus glabra* and *Fraxinus excelsior* exclusively in natural habitats like mixed mountain forests or ravine forests (see e.g. Holec 2003). The present find from the Eastern Carpathians originates from such a habitat. *H. vogesiacum* is a potential bioindicator of natural forests (but more records are necessary to confirm this hypothesis).

Lopadostoma pouzarii Granmo et L.E. Petrini

Mt. Menchul (1305 m): slopes oriented towards the Keveliv stream valley, exact site exposition: NE slope, alt. 1050 m, near-natural ravine forest composed of *Acer platanoides*, *A. pseudoplatanus*, *Fagus*, *Fraxinus*, NNE of the village of Kvasy NNE of the town of Rachiv, on fallen trunk of deciduous tree, 14 Jul 1999, leg. et det. J. Holec, JH 95/1999 (PRM 892903).

Probably new to Ukraine. This is a recently described species little known among mycologists. In Europe, *L. pouzarii* is known above all from Nordic countries (Denmark, Norway, Finland; see Granmo & Petrini 1996; Hansen & Knudsen 2000). I know it from natural mountain ravine forests in the Czech Republic (Bohemian Forest: specimens in PRM). The record from the Eastern Carpathians is from this kind of habitat (and from the same site where *Hypoxylon vogesiacum* was found, see above). *L. pouzarii* seems to be a potential bioindicator of natural forests.

Multiclavula mucida (Pers. : Fr.) R.H. Petersen
= *Lentaria mucida* (Pers. : Fr.) Corner

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: SW slope, alt. 800 m, near-natural forest composed of *Abies*, *Fagus*, *Picea*, NNE of the village of Kvasy NNE of the town of Rachiv, *Abies alba*: on decaying trunk, 11 Jul 1999, leg. K. Prášil, det. J. Holec, JH 85/1999 (PRM 892893).

Although this lichenized fungus was collected in the Eastern Carpathians by Pilát (1940, as *Lentaria mucida*), it is not included in any Ukrainian check list. Data on its ecology from the Czech Republic (Holec 1997, 2003; herbarium collections in PRM) and Slovakia (Škubla 2003) show that *M. mucida* occurs there almost exclusively in primeval or near-natural forests (composed of *Fagus*, *Picea*, *Abies*, *Acer*, *Ulmus*, etc.). Its substrate is represented by decaying fallen trunks of both conifers and broadleaved trees. As its habitat on Mt. Menchul is similar, the species can be considered a bioindicator of natural forests in this part of Europe. This is supported by data from Estonia where the species is used as indicator of primeval forests and old-growth forests deserving protection (Parmasto 2001). I suppose that further localities will be found in local primeval forests of the Eastern Carpathians.

Mycena purpureofusca (Peck) Sacc.

Mt. Menchul (1305 m): slopes oriented towards the Keveliv stream valley, exact site exposition: NNE slope, alt. 900 m, man-influenced mixed forest composed of *Abies*, *Fagus*, *Ulmus*, *Acer pseudoplatanus*, *Fraxinus*, NNE of the village of Kvasy NNE of the town of Rachiv, *Abies alba*: on decaying trunk covered with mosses, 14 Jul 1999, leg. et det. J. Holec, JH 89/1999 (PRM 892897).

This *Mycena* species is not so rare (but included in the red list of Poland, see Table 2). As it is mentioned only from the Chernihiv region in the first Ukrainian check list (Minter & Dudka 1996), this record is published here. I know the species both from natural and cultural forests (experience from the Czech Republic and Slovakia and collections in PRM).

Omphalina cyanophylla (Fr.) Courtec. et Bon

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: NW slope, alt. 750 m, near-natural forest composed of *Fagus*, *Abies*, *Acer pseudoplatanus*, NNE of the village of Kvasy NNE of the town of Rachiv, *Abies alba*: on decaying trunk covered with mosses, 11 Jul 1999, leg. et det. J. Holec, JH 80/1999 (PRM 892888).

Probably new to Ukraine. *Omphalina cyanophylla* is an extremely rare lignicolous fungus growing on dead wood of conifers (*Picea*, *Abies*). It is not known from neighbouring countries like Poland (Wojewoda 2003) and Slovakia (Škubla 2003). In the Czech Republic, it has only one locality (Holec & Beran 2006) in the Žofinský prales primeval forest, which is one of the best preserved mixed mountain forest in Central Europe (see e.g. Christensen *et al.* 2004). According to Ludwig (2001), it is also known from Sweden, France, Switzerland, Germany and Hungary, but it is rare elsewhere.

Omphalina hudsoniana (H.S. Jenn.) H.E. Bigelow

Mt. Vysoka (1803.6 m), N slope, *Pinus mugo* stand on bouldery slope covered by *Sphagnum* and *Vaccinium myrtillus*, Horhany mountain massif, ca 25 km W of the town of Narvirna, ca 8.5 km W of the village of Stara Huta (Stara Guta), alt. 1580 m, on decaying *Sphagnum*, 2 Jul 2007, leg. et det. J. Holec, JH 67/2007 (PRM 909468).

This lichenized fungus is known from the Eastern Carpathians (Andrianova *et al.* 2006; Minter & Dudka 1996). However, as it is a rare species included in red list of some European countries (e.g. Czech Republic, Poland, etc., see Table 2), the find from Mt. Vysoka in the Horhany mountain massif is published here.

Omphalina umbellifera (L. : Fr.) Quél.

= *Omphalina ericetorum* (Pers. : Fr.) M. Lange

Mt. Vysoka (1803.6 m), N slope, *Pinus mugo* stand on bouldery slope covered by *Sphagnum* and *Vaccinium myrtillus*, Horhany mountain massif, ca 25 km W of the town of Narvirna, ca 8.5 km W of the village of Stara Huta, alt. 1580 m, on old *Sphagnum*, 2 Jul 2007, leg. et det. J. Holec, JH 66/2007 (PRM 909467).

Although this lichenized fungus was collected in the Eastern Carpathians by Pilát (1940), it is not included in any Ukrainian check list. Pilát characterized it as a frequent species of alpine habitats. I herewith confirm it at least from Mt. Vysoka in the Horhany mountain massif where I saw it several times on one day.

Panellus violaceofulvus (Batsch : Fr.) Singer

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: SW slope, alt. 800 m, near-natural forest composed of *Abies*, *Fagus*, *Picea*, NNE of the village of Kvasy NNE of the town of Rachiv, *Abies alba*: on twig, 11 Jul 1999, leg. et det. J. Holec, JH 83/1999 (PRM 892891).

Although this fungus was collected in the Eastern Carpathians by Pilát (1940), it is not mentioned in any Ukrainian check list. It is a rare species included in the red lists of some European countries (e.g. Czech Republic, Poland, Austria, etc., see Ripková *et al.* 2007). However, in some regions with higher presence of its preferable substrate (dead wood of *Abies*, mostly twigs, logs and thin stems) it is more frequent (e.g. Baden-Württemberg in Germany, see Krieglsteiner 2001). Rarely it also grows on wood of *Picea*, *Pinus sylvestris* (Krieglsteiner 2001) and even *Salix* (Ripková *et al.* 2007). In Slovakia, which is also a "Carpathian" country neighbouring with Ukraine, only twelve localities are known. Published data (see references above) do not show that the species is exclusively found in natural forests, but preference of such habitats is evident. Further records in the Eastern Carpathians are expected due to rich occurrence of *Abies* in local forests.

Pbellinus nigrolimitatus (Romell) Bourdot et Galzin

Mt. Hoverla, SW slope ca 3.5 km SSW of the summit, primeval *Abies-Picea-Fagus* forest with many fallen trunks, NE of the town of Rachiv, alt. 1200 m, *Picea abies*: fallen decaying trunk, 7 Jul 2007, leg. et det. J. Holec, JH 68/2007 (PRM 909469).

In Central Europe, *P. nigrolimitatus* is an uncommon but typical polypore of near-natural to primeval mountain forests where it lives on fallen decaying trunks of *Picea abies* and *Abies alba* (Kotlaba 1984; Holec & Beran 2006). It is much commoner in Scandinavia (Hansen & Knudsen 1997). It could be used as a bioindicator of natural habitats and long ecological continuity, which was discussed e.g. in the Czech Republic (Holec 2003) and Norway (Bredesen *et al.* 1997; Sverdrup-Thygeson & Lindenmayer 2003; Stokland & Kauserud 2004). In Estonia, the species is used as indicator of primeval forests and old-growth forests deserving protection (Parmasto 2001). Tortič (1998) considers the species an indicator of old forests of beech and fir in former Yugoslavia. The species is considered a potential indicator of climatic changes in Bavaria, Germany (Hahn & Bässler 2005).

Pbellinus pouzarii Kotlaba

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: WNW slope, ca 2.2 km W of the summit, near-natural *Fagus-Abies* forest, multi-aged, with many fallen trunks, NNE of the village of Kvasy NNE of the town of Rachiv, alt. 720 m, *Abies alba*: fallen decaying trunk, 27 Jun 2007, leg. J. Holec, det. J. Holec & Z. Pouzar, JH 46/2007 (PRM 909448).

The first record of this rare polypore in the Eastern Carpathians was made by Pilát (PRM20724), however, it was identified by him as *P. ferrugineofuscus* (Pilát 1936-1942: 549, 1940). When Kotlaba (1968) described *P. pouzarii* as new species, he cited this record in his protologue. *P. pouzarii* grows exclusively on wood of *Abies* and is known in Europe only from Germany, the Czech Republic, Slovakia,

Ukraine, Russia and former Yugoslavia (Ryvarden & Gilbertson 1994). All its localities in Germany (Nuss 1999), the Czech Republic (Kotlaba 1968, 1984) and Slovakia (Kotlaba 1984; Škubla 2003) represent the best preserved primeval forests (composed of *Fagus*, *Abies* and *Picea*) of these countries. The record published here is from the same habitat. Consequently, at least in Central Europe, *P. pouzarii* can be considered a bioindicator of natural forests possessing long-term ecological continuity. Tortič (1998) considers the species an indicator of old forests of beech and fir in former Yugoslavia.

Pholiota squarrosoides Peck

Kuzyi (Kuzy) stream valley on SW slope of Mt. Menchul (1242 m), mixed forest along the stream (*Fagus*, *Acer pseudoplatanus*, *A. campestre*, *Carpinus*), between the villages of Luh and Dilove S of the town of Rachiv town, S part of the Sydvovets mountain massif, alt. 560 m, *Fagus sylvatica*: fallen trunk close to the stream, open place covered by *Petasites*, 9 Jul 2007, leg. et det. J. Holec, JH 74/2007 (PRM 909475).

This rare species is not included in Ukrainian check lists. Its occurrence in the Ukrainian Eastern Carpathians was first published by Holec (2001a: 68), who revised Pilát's collections of *P. squarrosa* from this area (herbarium PRM) and showed that some of them represent in fact *P. squarrosoides*. Most European records of this fungus originate from natural forests, however finds from man-made landscapes are also known (data from herb. PRM). Christensen *et al.* (2004) consider *P. squarrosoides* an indicator of so called natural value of beech forests in Europe. This is true for beech forests but the species is also known from other substrates, e.g. *Betula*, *Carpinus*, *Populus*, *Salix*, *Sorbus* and *Quercus* (Holec 2001a). In natural forests of the Eastern Carpathians, the species has ideal conditions. Thus, further records are to be expected.

Pluteus thomsonii (Berk. et Broome) Dennis

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: WNW slope, ca 2 km WNW of the summit, near-natural *Fagus* forest with admixed *Acer pseudoplatanus*, *Fraxinus*, *Abies alba*, NNE of the village of Kvasy NNE of the town of Rachiv, alt. 850 m, *Acer pseudoplatanus*: fallen decaying trunk covered with mosses, 29 Jun 2007, leg. et det. J. Holec, JH 60/2007 (PRM 909462).

The species grows on decaying trunks of broadleaved trees. It is reported from Ukraine by Wasser (1992). It is scattered to rare in Europe. Consequently, in some countries it is included in red lists (e.g. Czech Republic: Holec & Beran 2006; Norway: Brandrud *et al.* 2006). In natural forests of the Eastern Carpathians, the species has ideal conditions due to their high amount of dead wood. Thus, further records are to be expected.

Pluteus umbrosus (Pers. : Fr.) P. Kumm.

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: WNW slope, ca 2 km

WNW of the summit, near-natural *Fagus* forest with admixed *Acer pseudoplatanus*, *Fraxinus*, *Abies alba*, NNE of the village of Kvasy NNE of the town of Rachiv, alt. 850 m, *Acer pseudoplatanus*: fallen decaying trunk covered with mosses, 29 Jun 2007, not. J. Holec.

Although the species was collected in the Eastern Carpathians by Pilát (1940) and reported by Wasser (1992), it is not included in any Ukrainian check list. It grows on decaying trunks of deciduous trees, preferably *Fagus* (Gminder & Kriegelsteiner 2003). It is widespread but scattered in Europe. Data from the Czech Republic show that it has a distinct preference for natural forests with a high amount of dead wood (Holec & Beran 2006). It is considered an indicator of so called nature value of European beech forests (Christensen *et al.* 2004). In natural forests of the Eastern Carpathians, the species has ideal conditions. Thus, further records are to be expected.

Rigidoporus crocatus (Pat.) Ryvarden

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: WNW slope, ca 2.2 km W of the summit, near-natural *Fagus-Abies* forest, multi-aged, with many fallen trunks, NNE of the village of Kvasy NNE of the town of Rachiv, alt. 720 m, *Abies alba*: fallen decaying trunk covered with mosses, 27 Jun 2007, leg. et det. J. Holec, JH 50/2007 (PRM 909452).

Trostanets stream valley, NE slope SW of the stream, ca 6 km SSE of the summit of Mt. Velyka Blyznytisia, man-influenced *Fagus* forest with admixed *Abies* and *Picea*, ca 2 km W of the village of Trostanets NNE of the town of Rachiv, Svydovets mountain massif, alt. 800 m, *Abies alba*: fallen decaying trunk covered with mosses, 28 Jun 2007, leg. et det. J. Holec, JH 54/2007 (PRM 909456).

The species has been known from the Eastern Carpathians for a long time (Table 2). In Europe, it is a rare species (Ryvarden & Gilbertson 1994), it is however commoner in some mountainous areas (Kotlaba 1984). It is included in red lists of many European countries, of the countries near Ukraine e.g. Poland (Wojewoda & Ławrynowicz 2006) and the Czech Republic (Holec & Beran 2006). Consequently, its records are published here. The species occurs almost exclusively in near-natural to primeval forests (Holec & Beran 2006). It was assessed as a potential indicator of “stands with old-growth characteristics” (Lindner & Burdsall 2006) in northern Wisconsin, USA. Similarly, Kotiranta *et al.* (2005) mention it as a typical “old-growth forest species” from South Ural. Tortič (1998) considers the species an indicator of old forests of beech and fir in former Yugoslavia. In Estonia, the species is used as indicator of primeval forests and old-growth forests deserving protection (Parmasto 2001).

Skeletocutis carneogrisea A. David

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: WNW slope, ca 2.2 km W of the summit, near-natural *Fagus-Abies* forest, multi-aged,

with many fallen trunks, NNE of the village of Kvasy NNE of the town of Rachiv, alt. 720 m, *Abies alba*: fallen decaying trunk, 27 Jun 2007, leg. J. Holec, det. Z. Pouzar, JH 47/2007 (PRM 909449).

Probably new to Ukraine. The species was reported from the country neither by Ryvarden & Gilbertson (1994) in their book on European polypores nor by Akulov *et al.* (2003) in their check list of Ukrainian aphyllorphoroid fungi. In the past it was confused with *S. amorpha*.

Skeletocutis stellae (Pilát) Jean Keller

Mt. Hoverla, W slope above the Hoverla stream ca 3.9 km SW of the summit of Hoverla, primeval *Abies-Picea-Fagus* forest with many fallen trunks, NE of the town of Rachiv, alt. 1050 m, *Picea abies*: fallen decaying trunk, 7 Jul 2007, leg. et det. J. Holec, JH 69/2007 (PRM 909470).

Spring area of the Trostanets stream, ca 1.9 km SSE of the summit of Mt. Mala Blyznytisia, SE slope, primeval *Fagus-Abies-Picea* forest with many fallen trunks, NW of the village of Trostanets NNE of the town of Rachiv, Svydovets mountain massif, alt. 1050 m, *Picea abies*: fallen decaying trunk, 28 Jun 2007, leg. et det. J. Holec, JH 56/2007 (PRM 909458).

The species is well documented from the Ukrainian Eastern Carpathians. In many European countries it is included in red lists, e.g. in Poland (Wojewoda & Ławrynowicz 2006), the Czech Republic (Holec & Beran 2006), Norway (Brandrud *et al.* 2006), Sweden (Gärdenfors 2005) and Finland (Rassi *et al.* 2001). Consequently, its records are published here. In the Czech Republic *S. stellae* occurs exclusively in near-natural to primeval forests (Kotlaba 1984; Holec & Beran 2006). The records published here are from such a habitat. The fungus can be considered an indicator of natural forests possessing long-term ecological continuity (see Holec 2003; Penttilä *et al.* 2004; Trass *et al.* 1999; etc.). Tortič (1998) considers the species an indicator of old forests of beech and fir in former Yugoslavia. In Estonia, the species is used as indicator of primeval forests and old-growth forests deserving protection (Parmasto 2001).

Trechispora candidissima (Schwein.) Bondartsev et Singer

Mt. Menchul (1305 m): slopes oriented towards the Tisa river valley, exact site exposition: W slope, ca 1.9 km WNW of the summit, primeval *Fagus-Abies* forest, multi-aged, NNE of the village of Kvasy NNE of the town of Rachiv, alt. 900 m, *Abies alba*: fallen decaying trunk, 29 Jun 2007, leg. J. Holec, det. Z. Pouzar, JH 62/2007 (PRM 909464).

Although the species is mentioned in the Ukrainian check list of aphyllorphoroid fungi (Akulov *et al.* 2003), the record from Mt. Menchul is published here. It was identified according to the key published by Larsson (1994), who carefully studied the group of *Trechispora candidissima* – *mollusca* – *hymenocystis*. The species were confused in the past and revision of older finds and published data is necessary.

Evaluation of the recorded species of fungi

Species probably new to Ukraine

Of the species published here, 11 are most probably reported from Ukraine for the first time. Some of them are species described in the past three decades which are not well known among mycologists (*Cordyceps rouxii*, *Lopadostoma pouzarii*, *Skeletocutis carneogrisea*) or species well delimited only recently (*Gymnopilus josserandii*, *Hypholoma subviride*). Some of the „new“ species have been evidently omitted during past research in the Ukrainian Carpathians, as they are not rare (*Hydropus marginellus*, *H. subalpinus*). A last group consists of very rare fungi, mostly preferring near-natural to primeval forests (*Hydropus atramentosus*, *Hypoxylon vogesiacum*, *Omphalina cyanophylla*, *Pluteus thomsonii*).

Fungi preferring near-natural to primeval forests

The Eastern Carpathians are well-known for their rather high percentage of natural forests. Fungi living in such habitats represent the most valuable part of the local mycobiota. As for the species published here, two groups can be recognized: 1. fungi clearly preferring natural forests but growing also outside of them (e.g. *Camarops tubulina*, *Hypholoma subviride*, *Panellus violaceofulvus*, *Pholiota squarrosoides*, *Pluteus thomsonii*, *P. umbrosus*; for details, see the annotations to the species), 2. fungi living exclusively in natural (near-natural or primeval) forests. Members of the second group can be considered bioindicators of natural forests. From the recorded species this status is applicable to *Cystostereum murrayi*, *Hohenbuehelia auriscalpium*, *Hydropus atramentosus*, *Hypoxylon vogesiacum*, *Multiclavula mucida*, *Omphalina cyanophylla*, *Phellinus nigrolimitatus*, *P. pouzarii*, *Rigidoporus crocatus*, *Skeletocutis stellae*. „Top“ species of this group are *Omphalina cyanophylla* and *Phellinus pouzarii*, which are known only from the best-preserved primeval forests in this part of Central Europe (Czech Republic, Slovakia, Poland, western Ukraine).

The bioindicators selected here can be used for habitat evaluation in the Carpathian Biosphere Reserve, which protects among others the most valuable parts of the Chornohora and Sydvovets massifs where some of the studied localities are situated.

Comparison with the mycobiota of Poloniny National Park, Slovakia

Poloniny National Park is situated in the westernmost part of the Eastern Carpathians in the NE part of Slovakia, at the border between Slovakia, Poland and Ukraine. It covers the Slovak part of the Bukovské vrchy Mts. (orographic subunit of the Eastern Carpathians). The Polish side is protected as the Bieszczady National Park. The mycobiota of Poloniny

National Park were recently elaborated in detail by Kuthan *et al.* (1999), and some additional records of rare and threatened macrofungi were published e.g. by Adamčík *et al.* (2007). About 1200 species of macrofungi are recently known from the Poloniny NP.

The localities studied in the Ukrainian Eastern Carpathians are only about 150 km ESE of Poloniny National Park. As both areas have similar conditions (mountainous areas with flysh as the geological background, almost identical forest vegetation, high percentage of natural forests), their mycobiota is comparable well. The data from Table 2 show that most species found in the Ukrainian Eastern Carpathians and published here are also present in Poloniny National Park, Slovakia, which is quite understandable owing to the similarity of both areas. However, some species from the Ukrainian Carpathians are not known from the Slovak part (Table 2), mostly species described or delimited recently. Consequently, this paper contributes not only to the knowledge of the Ukrainian mycobiota, but also to the mycobiota of the Eastern Carpathians as a whole.

Value of the mycobiota of the Ukrainian Eastern Carpathians

The Eastern Carpathians, located in eastern Slovakia, south-eastern Poland, south-western Ukraine and northern Romania, belong to the areas with the highest percentage of well-preserved natural mountain forests in Europe, especially some national parks and biosphere reserves (Poloniny NP, Bieszczady NP, Carpathian BR, etc.). They are represented by *Fagus*, *Abies* or *Picea* forests or mixed forests composed of these tree species and admixed *Acer pseudoplatanus*, *A. platanoides*, *Ulmus glabra*, *Tilia cordata*, *Fraxinus excelsior*, etc. Due to the high amount of dead wood in various stages of decay, the forests are rich in lignicolous fungi. This is well documented by numerous records of extremely rare and threatened species or fungi occurring almost exclusively in primeval and near-natural forests (see e.g. Pilát 1940; Gorova 1979; Akulov *et al.* 2003; this paper). For example, the polypore *Amylocystis lapponica* grows in the Ukrainian part of the Eastern Carpathians (Pilát 1936-42: 179-180; Bondartsev 1971: 229). The species is considered one of the rarest European polypores (Dahlberg & Croneborg 2003) – outside of the taiga forests of North Europe – and represents one of the best indicators of primeval or near-natural forests (e.g. Røsok 1998; Piątek 2005; Holec 2007).

Christensen *et al.* (2005) studied dead wood in European beech forest reserves (in 13 countries; however, Ukraine and Romania were omitted) and the occurrence of 21 species of fungi selected as indicators of „nature value“ (Christensen *et al.* 2004) in these reserves. They insisted that the highest number of these fungal indicators in Europe is present in Stužica and Rožok nature reserves in the Slovakian Eastern Carpathians (another reserve from this area, Havešová, was in 6th position). The high value of primeval forests of the

Slovakian Eastern Carpathians was further emphasized by Adamčík *et al.* (2007), who found other indicator and rare species of fungi there. To the detriment of the cause, Ukrainian and Romanian primeval forests were omitted. As they are very similar to the Slovak ones (and sometimes even larger), I suppose that the species richness of lignicolous fungi will be similar (or maybe even higher) than in the Slovak part of the Eastern Carpathians (see also Comparison with the mycobiota of Poloniny NP, or conclusions published by Küffer *et al.* 2004). The richness concerns not only pure beech forests, but also mixed forests composed of mainly *Fagus*, *Abies*, *Picea* etc. (see above).

It is a great challenge for mycologists to assess the current diversity of lignicolous fungi in protected primeval forests of the Ukrainian and Romanian Carpathians in detail.

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