CZECH MYCOL. 63(2): 215–241, 2011

# The ecological knowledge on *Crepidotus kubickae* – a case study from central Slovakia

SOŇA JANČOVIČOVÁ[1], KATARÍNA MIŠÍKOVÁ[1], ANNA GUTTOVÁ[2], DRAHOŠ BLANÁR[3]

[1]Comenius University in Bratislava, Faculty of Natural Sciences, Department of Botany, Révová 39, SK-811 02 Bratislava, Slovakia;
jancovicova@fns.uniba.sk
[3]Institute of Botany SAS, Dúbravská cesta 9, SK-845 23 Bratislava, Slovakia
[3]Administration of Muránska planina National Park, J. Kráľa 12, SK-050 01 Revúca, Slovakia

Jančovičová S., Mišíková K., Guttová A., Blanár D. (2011): The ecological knowledge on *Crepidotus kubickae* – a case study from central Slovakia. – Czech Mycol. 63(2): 215–241.

The ecological knowledge on *Crepidotus kubickae* is not only insufficient in Slovakia but also in the rest of Europe. In the years 2008–2011, a case study was therefore carried out in central Slovakia to find out more data on its habitats and substrate preferences. During the research, 30 collections were gathered at seven localities of the Veporské vrchy Mts., Stolické vrchy Mts. and Muránska planina Plateau. The substrates of the collections were precisely described and collecting sites characterised and documented by phytocoenological relevés. In the selected area, *C. kubickae* occurred in several types of spruce or mixed forests (with dominance of *Picea abies*); namely in six associations of forest communities: *Vaccinio myrtilli-Piceetum*, *Athyrio alpestris-Piceetum*, *Calamagrostio variae-Abietetum*, cf. *Cortuso-Fagetum*, cf. *Poo chaixii-Fagetum*, and *Dentario enneaphylli-Fagetum*. The altitude of most collecting sites was above 1100 m a. s. l. The species preferred dead corticated fallen and standing stems of *Picea abies* of approx. 15–100 cm in diameter, aged about 70–180 years. In this paper, also the ecological knowledge on *C. kubickae* in Europe is summarised.

**Key words:** *Inocybaceae*, *C. cesatii* var. *subsphaerosporus*, Norway spruce forests, ecology, syntaxonomy.

Jančovičová S., Mišíková K., Guttová A., Blanár D. (2011): Ekologické poznatky o druhu *Crepidotus kubickae* – modelová štúdia zo stredného Slovenska. – Czech Mycol. 63(2): 215–241.

Ekologické poznatky o *Crepidotus kubickae* sú nedostatočné na Slovensku aj v Európe. V rokoch 2008–2011 sme preto uskutočnili modelovú štúdiu na strednom Slovensku, aby sme zistili viac údajov o jeho biotopoch a substrátových nárokoch. Počas výskumu sme zhromaždili 30 zberov na siedmich lokalitách vo Veporských vrchoch, Stolických vrchoch a na Muránskej planine; čo najpodrobnejšie sme opísali substráty zberov; tiež charakterizovali zberové stanovištia, ktoré sme zdokumentovali aj fytocenologickými zápismi. Na vybranom území sa *C. kubickae* vyskytoval vo viacerých typoch smrekových a zmiešaných porastov (s dominantnou drevinou *Picea abies*); a to v lesných spoločenstvách šiestich asociácií: *Vaccinio myrtilli-Piceetum*, *Athyrio alpestris-Piceetum*, *Calamagrostio variae-Abietetum*, cf. *Cortuso-Fagetum*, cf. *Poo chaixii-Fagetum* a *Dentario enneaphylli-Fagetum*. Nadmorská výška väčšiny zberových stanovíšť bola nad 1100 m n. m. Druh uprednostňoval mŕtve ležiace a stojace kmene *Picea abies* so zachovanou borkou, s priemerom približne 15–100 cm a vo veku 70–180 rokov. V článku tiež sumarizujeme ekologické poznatky o *C. kubickae* v Európe.

## INTRODUCTION

Known as saprotrophic fungi, *Crepidotus* species colonise various substrates. They grow on stems, branches and twigs of deciduous and/or coniferous trees, as well as their leaves/needles, cones and other fruits, e.g. *Fagus* cupules. They fructify also on stalks, leaves and roots of shrubs and herbaceous plants; some of them also on thalli of mosses or on soil.

Within the genus, a few species colonise several types of substrates, e.g. *C. caspari* Velen. and *C. epibryus* (Fr.) Quél., while other ones are more or less restricted to specific substrates, e.g. *C. autochthonus* J.E. Lange and *C. stenocystis* Pouzar (Senn-Irlet 1995, Ripková & Blanár 2004, Gonou-Zagou & Delivorias 2005, Ripková et al. 2007). *C. kubickae* Pilát seems to belong to the group of species preferring a specific type of substrate; it is known from twigs, branches and stems of coniferous trees such as *Picea*, *Abies* and *Pinus*, rarely of hardwood (Senn-Irlet 1995, Pouzar 2005, Ripková 2009). However, literature on the ecology and sociology of *C. kubickae* is very scarce in Europe and the knowledge is usually generalised (e.g. Roux 2006, Senn-Irlet 2008).

In Slovakia, we knew only one collection of *C. kubickae* before our study. It was a collection from Fabova Hoľa Nature Reserve (Veporské vrchy Mts.), where D. Blanár (co-author of this paper) and I. Mihál collected it in 2002. In our efforts to obtain more ecological and chorological data on this species, we carried out a case study in central Slovakia (Veporské vrchy Mts., Stolické vrchy Mts. and Muránska planina Plateau) in 2008–2011. We focused our study on: 1) describing macro– and micromorphological characters of *C. kubickae* based on our own material; 2) finding out its substrate preferences; 3) characterising the forest communities in which it occurs; 4) comparing ecological data on the species within Europe; and 5) searching for other published/deposed material of it from Slovakia.

## MATERIAL AND METHODS

The case study area included the Veporské vrchy Mts., Stolické vrchy Mts. and Muránska planina Plateau in central Slovakia (Fig. 1). Under the geomorphological classification (used in this paper), Veporské vrchy Mts. and Stolické vrchy Mts. are districts and Muránska planina Plateau a subdistrict of the Spišsko-gemerský kras district, all related to the Slovenské rudohorie Mts. region, the Inner Western Carpathians subprovince and the Western Carpathians province (Mazúr & Lukniš 1980). Within this area, we collected *Crepidotus kubickae* at seven localities: Fabova hoľa Nature Reserve (NR), Klenovský Vepor National Nature Reserve (NNR), Čertova dolina Valley, the massif of Mt. Tŕstie (including Tŕstie NR), the massif of Mt. Stolica, Šarkanica NNR and Veľká Stožka NNR (Fig. 1).

Period of research. (2002, 2008) 2009–2010 (2011). Our research started in 2008 (1 collection) and continued most intensively in 2009 (9 collections) and 2010 (18 collections); we also included the first known collection from the case study area from 2002 and one collection from 2011 into the results.

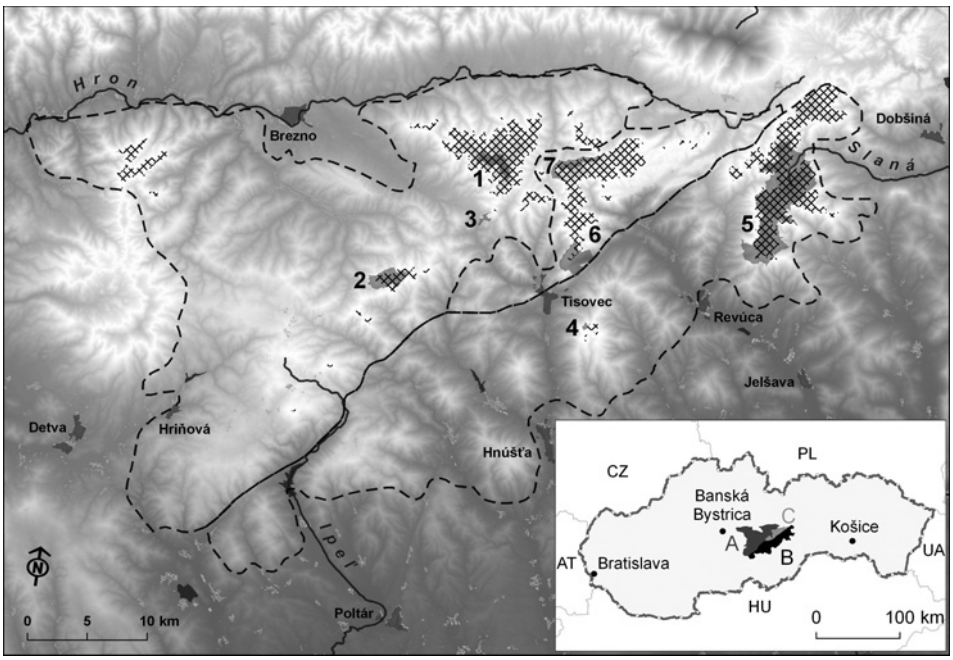


**Fig. 1.** The occurrence of *Crepidotus kubickae* in seven localities of three geomorphological units of Slovakia. Geomorphological units: **A** – Veporské vrchy Mts., **B** – Stolické vrchy Mts., **C** – Muránska planina Plateau. Localities: **1** – Fabova hoľa Nature Reserve (NR), **2** – Klenovský Vepor National Nature Reserve (NNR), **3** – Čertova dolina Valley, **4** – the massif of Mt. Tŕstie, **5** – the massif of Mt. Stolica, **6** – Šarkanica NNR, **7** – Veľká Stožka NNR. The area above 1100 m a. s. l. is hachured.

Collections. The study is based on 30 collections of *C. kubickae*; the specimens are kept in the SLO herbarium. Also some other collections of macromycetes and myxomycetes mentioned in this paper are deposited in herbaria, some of them new or less known in Slovakia: *Pseudographis pinicola* (private herbarium of S. Glejdura), *Phlebiopsis gigantea* (private herbarium of L. Hagara), *Hamatocanthoscypha laricionis*, *Lachnellula occidentalis*, *L. subtilissima* and *Phialina separabilis* (PRM). The herbarium abbreviations are cited in accordance with the Index Herbariorum (Holmgren et al. 1990).

Description of *C. kubickae*. Fresh basidiocarps were observed for description of macromorphological characters; references to colours follow Kornerup & Wanscher (1974); descriptive terminology follows Vellinga (1988). Description of the micromorphological characters is adopted from Ripková (2009), who prepared it based on specimens included in this paper. For the microcharacters (spores, cheilocystidia and basidia) minimum, maximum (in parentheses) and average ± standard deviation values are presented. Q is the ratio of length and width of spores.

Nomenclature and taxonomy. The taxonomy of *C. kubickae* Pilát follows Pouzar (2005) and Ripková (2009), who accept it at the species rank. Some authors treat it as a variety according to Senn-Irlet (1995) – *C. cesatii* var. *subsphaerosporus* (J.E. Lange) Senn-Irlet – (e.g. Roux 2006, Walleyn & Vandeven 2006, Łuszczyński 2007); others synonymise it with *C. cesatii* (Rabenh.) Sacc. (Consiglio & Setti 2008, Hausknecht & Krisai-Greilhuber 2010). The nomenclature and taxonomy of other macromycetes and myxomycetes are based on the work by Bacigálová & Lizoň (1998); for taxa not included we used "CABI Bioscience Databases: Index Fungorum" (Cooper & Kirk 2011). For lichens we

follow Bielczyk et al. (2004), for bryophytes Kubinská & Janovicová (1998), and for vascular plants Marhold (1998). The nomenclature and syntaxonomy of forest communities is based on Jarolímek et al. (2008).

Phytocoenological relevés. Altogether ten phytocoenological relevés were made in the forest communities with occurrence of *C. kubickae*, following Braun-Blanquet (1964) and Westhoff & Van der Maarel (1978).

Syntaxonomical classification. The forest communities were classified using the publications by Sillinger (1933), Šoltés (1976), Fajmonová (1978a, 1978b, 1982), Uhlířová-Šimeková (1978), Šomšák (1979), Fajmonová & Uhlířová-Šimeková (1981), Kubíček & Šomšák (1982), Jirásek (2001a, 2001b, 2002), Vykouková & Hrubá (2009), Kliment et al. (2010), and Kučera (2010).

Groups of forest types. The names of groups of forest types (forest communities/units) follow the system of geobiocoenological typology (forest typology) by Hančinský (1972). Also the works by Zlatník (1959), Hančinský (1972, 1977), Križová & Nič (1991), Križová (1995), and Križová et al. (2010) were considered for their classification.

Forest (altitudinal) vegetation zones are based on Zlatník (1976). In the paper, the 5$^{th}$ to 7$^{th}$ forest vegetation zones are mentioned: 5$^{th}$ = beech-fir zone, 6$^{th}$ = fir-beech-spruce zone, 7$^{th}$ = spruce zone. In the forests where the phytocoenological relevés were made, the zones are according to our own identification of the forest type group. In other cases, the zones are based on unpublished GIS data of the National Forest Centre – Institute for Forest Resources and Information, Zvolen.

Vegetation belts. Data on the vertical occurrence of *C. kubickae* follow Neuhäuslová-Novotná (1994).

Location. Latitudinal and longitudinal coordinates were read from the GPS – Garmin GPSmap 60CS (in system WGS 84). The altitudinal values of collections sites were read from the Basic map of the Slovak Republic 1 : 10,000 – raster form (created by the Geodetic and Cartographic Institute, Bratislava) in ArcView GIS Version 3.3 application. The elevation points of hills/mountains were read from 1 : 50,000 tourist maps of Veporské vrchy and Stolické vrchy (Kordováner 2003, 2006).

## RESULTS AND DISCUSSION

### Description of *Crepidotus kubickae*

Macrocharacters. Basidiocarps (Figs. 2–3) grew singly or in small to tiered groups (about 10–50 basidiocarps per group). Pileus 5–55 × 5–30 mm, irregularly circular, rounded flabelliform, flabelliform, reniform or spathuliform, convex, plano-convex to applanate, slightly hygrophanous; margin inflexed to straight, flat to wavy, entire, undate to lobed, not striate; pure white when young, yellowish white (4A2) to pale yellow (4A3) when mature and dried; surface at first velutinous, later glabrous, at the point of attachment villose. Stipe only visible when young, 1 × 0.5 mm, lateral, cylindrical, white to yellowish white (4A2), velutinous, later vanishing and basidiocarps laterally or dorsally attached to the substratum. Context up to 3 mm thick, whitish to yellowish white (4A2); taste mild; smell indistinct. Lamellae L = 10–32, l = 3–9, up to 5 mm wide, ventricose, adnexed, white, yellowish white (4A2) to greyish yellow (4B4) when young, at maturity greyish orange (5B4), greyish brown (5D5) to coffee brown (5E7), always with pink tint, edge fimbriate and whitish. Spore print reddish cacao brown (6E7).



**Figs. 2–3.** *Crepidotus kubickae*: juvenile (Fig. 2) and adult (Fig. 3) basidiocarps from the Fabova hoľa Nature Reserve (Veporské vrchy Mts., Slovakia), 7 July 2009 (SLO 710). Photo by D. Blanár.

Microcharacters. Basidiospores (5.5)6.8–8.3(10) × (4.2)5–6(7) µm, Q = (1.2)1.3–1.5(1.6), broadly ellipsoid to ellipsoid, brownish-yellowish to yellowish in 5% KOH, under a light microscope echinulate, in a scanning electron microscope distinctly echinulate with isolated spines. Basidia (21)22–27(31) × (6)6.8–8.4(9) µm, 4-spored, cylindrical, hyaline, thin-walled. Cheilocystidia (24)37.9–52(64) × (6)6.3–10.1(17) µm, narrowly utriform, clavate or cylindrical, in the upper part mostly branched, often antler-like, sometimes flexuous or angled, hyaline, thin-walled. Pileipellis a transition between a cutis and a trichoderm composed of cylindrical, hyaline, thin-walled, non-gelatinised and up to 6 µm thick hyphae without differentiated terminal cells, hyphae mostly straight. Clamp connections present in all tissues.

Images of microcharacters. Pilát (1949), Senn-Irlet (1995, as *C. cesatii* var. *subsphaerosporus*), Ripková (2009).

**Substrate preferences of *Crepidotus kubickae***

Summing up the ecological data on all (30) collections from our case study area (Tab. 1), *Crepidotus kubickae* is a saprotroph. We collected basidiocarps only on dead *Picea abies* trees – mostly on fallen stems (22 records), less frequently on standing stems (5 records) and branches protruding from fallen stems (4 records). Only once we found them also on a fallen branch and a root swelling.

The fallen stems were uprooted or broken and the basidiocarps grew out at their bottom (14 records) and/or side (15 records). Only once we recorded basidiocarps also at the top of a stem. The diameter of the stems (measured at the part where the basidiocarps grew) was ca 15–40 cm, the height of the basidiocarps above the ground ca 10–200 cm. No part of the stems with *C. kubickae* basidiocarps touched the ground.

The standing stems were dry, ca 25–100 cm in diameter and the basidiocarps usually occurred all round the stems, from the base up to ca 10 m above the ground (the maximum height from which we collected material was ca 350 cm). It is interesting to mention that we noticed a massive production of basidiocarps on standing trees in October and November 2010 for the first time (only in Fabova hoľa NR).

The branches with *C. kubickae* basidiocarps protruding from fallen stems were ca 3–10 cm thick and at the height of ca 30–170 cm above the ground. Basidiocarps fructified all round the branches, but mostly near the attachment to the stem.

The fallen branch was 0.5 cm thick and the basidiocarps grew out at its top.

The root swelling was ca 50 cm in diameter and the basidiocarps grew out at a height of ca 20 cm above the ground.

**Tab. 1. *Crepidotus kubickae* collections from central Slovakia.**

Within each locality, the collections are arranged according to the collection dates. Each collection is supplemented with following information: **column I** – SLO herbarium number / relevé number ("no" means that no relevé was made; for relevés, see Tab. 2.), village (i.e. cadastre), location; **column II** – latitude, longitude (with an inaccuracy of ± 6–15 m), SUF (see below), Q (see below), altitude; **column III** – habitat, age of the stand; **column IV** – substrate (**bark** of stem, branch or root swelling of dead *Picea abies* trees; year when the tree fell down in brackets), part of the substrate at which the basidiocarps grew, height above the ground at which the basidiocarps grew, substrate diameter (Ø, see below), other myxomycetes and macromycetes that colonised the same substrate as *C. kubickae*; **column V** – collection date (day.month.year), collector(s).

Abbreviations and symbols: **v.** – village, **ca** – circa, **NR** – Nature Reserve, **NNR** – National Nature Reserve, **N** – north, **S** – south, **E** – east, **W** – west, **SUF** – spatial unit of forest arrangement (number of forest stand), **Q** –Central European mapping grid quadrant, **Ø** – substrate diameter (measured at the part of stem, branch or root swelling where the basidiocarps grew), **DB** – Drahoš Blanár, **IM** – Ivan Mihál, **SB** – Slávka Belánová, **SJ** – Soňa Jančovičová.

| I | II | III | IV | V |
|---|---|---|---|---|
| **Fabova hoľa NR** | | | | |
| **SLO 701 / no relevé**<br>v. Polomka, NNW of the elevation point Fabova hoľa (1438.8), SSE of the saddle of the ridge | 48.776690° N<br>19.882353° E<br>SUF 407<br>Q 7285a<br>alt. 1400 m | spruce forest<br>ca 120 years | fallen stem<br>side<br>ca 10 cm<br>Ø not measured | 7.X.2002<br>IM, DB |
| **SLO 702 / no relevé**<br>v. Pohronská Polhora, NNW of the elevation point Fabova hoľa (1438.8) | 48.77328° N<br>19.88525° E<br>SUF 87<br>Q 7285a<br>alt. 1435–1445 m | spruce forest<br>ca 90 years | fallen stem (2007)<br>side, bottom<br>ca 150 cm<br>Ø = ca 35 cm | 25.IX.2008<br>DB |
| **SLO 704 / no relevé**<br>v. Pohronská Polhora, ENE of the elevation point Javorinka (1434.8), on the ridge | 48.78325° N<br>19.87647° E<br>SUF 135a<br>Q 7285a<br>alt. 1420 m | spruce forest<br>ca 150 years | fallen stem (2007)<br>bottom<br>ca 10–30 cm<br>Ø = ca 30 cm | 19.V.2009<br>DB |
| **SLO 705 / no relevé**<br>v. Polomka, ENE of the elevation point Javorinka (1434.8) | 48.78348° N<br>19.87632° E<br>SUF 408b<br>Q 7285a<br>alt. 1422 m | spruce forest<br>ca 145 years | fallen stem (2007)<br>bottom<br>ca 10–30 cm<br>Ø = ca 40 cm | 19.V.2009<br>DB |
| **SLO 706 / relevé no. 1**<br>v. Pohronská Polhora, NNW of the Fabova hoľa saddle | 48.78028° N<br>19.87995° E<br>SUF 134a<br>Q 7285a<br>alt. 1360 m | spruce forest with open canopy with *Sorbus aucuparia* in underlayer<br>ca 150 years | fallen stem (2007)<br>side<br>ca 15–20 cm<br>Ø = ca 20 cm | 7.VII.2009<br>DB, SJ |
| **SLO 709 / relevé no. 1**<br>as SLO 706 | as SLO 706 | as SLO 706 | as SLO 706 | 9.VII.2009<br>DB |
| **SLO 708 / no relevé**<br>v. Pohronská Polhora, ESE of the elevation point Javorinka (1434.8), on the ridge | 48.78199° N<br>19.87829° E<br>SUF 135a<br>Q 7285a<br>alt. 1400 m | spruce forest with open canopy with *Sorbus aucuparia* in underlayer<br>ca 150 years | fallen stem (ca 2008)<br>side, bottom<br>ca 150 cm<br>Ø = ca 30 cm | 7.VII.2009<br>DB, SJ |

| I | II | III | IV | V |
|---|---|---|---|---|
| **SLO 710 / relevé no. 2**<br>v. Polomka, ENE of the elevation point Javorinka (1434.8) | 48.78336° N<br>19.87671° E<br>SUF 408b<br>Q 7285a<br>alt. 1416 m | spruce forest with open canopy, partially dead after *Ips typographus* outbreaks<br>ca 150 years | fallen stem<br>side, bottom<br>ca 100–150 cm<br>Ø = ca 40 cm<br>*Hamatocanthoscypha laricionis*, *Pleurotus dryinus* | 27.VII.2009<br>DB |
| **SLO 711 / relevé no. 3**<br>v. Polomka, NW of the elevation point Javorinka (1434.8) | 48.78341° N<br>19.87185° E<br>SUF 436e<br>Q 7285a<br>alt. 1420 m | spruce forest with open canopy<br>ca 170 years | fallen stem<br>bottom<br>ca 50–100 cm<br>Ø = ca 40 cm<br>*Gloeophyllum sepiarium*, *Pleurotus dryinus*, *Trichaptum abietinum* | 27.VII.2009<br>DB |
| **SLO 712 / relevé no. 4**<br>v. Pohronská Polhora, SSE of the elevation point Psica (1396.9) | 48.78416° N<br>19.85628° E<br>SUF 154<br>Q 7285a<br>alt. 1335–1340 m | spruce forest<br>ca 150 years | fallen stem<br>side, bottom<br>ca 15–25 cm<br>Ø = ca 20 cm | 5.V.2010<br>DB |
| **SLO 713 / no relevé**<br>v. Polomka, NW of the elevation point Javorinka (1434.8) | 48.78592° N<br>19.88164° E<br>SUF 408b<br>Q 7285a<br>alt. 1340 m | spruce forest<br>ca 150 years | fallen stem<br>bottom<br>ca 50 cm<br>Ø = ca 25 cm<br>*Pseudographis pinicola* | 11.V.2010<br>DB |
| **SLO 714 / no relevé**<br>v. Pohronská Polhora, W of the elevation point Javorinka (1434.8), on the ridge | 48.78273° N<br>19.87253° E<br>SUF 136b<br>Q 7285a<br>alt. 1430 m | spruce forest<br>ca 150 years | fallen stem<br>bottom<br>ca 100 cm<br>Ø = ca 30 cm | 11.V.2010<br>DB |
| **SLO 715 / relevé no. 5**<br>v. Pohronská Polhora, ENE of the elevation point Javorinka (1434.8) | 48.78563° N<br>19.87830° E<br>SUF 408b<br>Q 7285a<br>alt. 1385–1390 m | spruce forest with open canopy<br>ca 150 years | fallen stem<br>bottom<br>ca 140 cm<br>Ø = ca 35 cm<br>*Exidia pythia*, *Stereum sanguinolentum*, *Trichaptum abietinum* | 11.V.2010<br>DB |
| **SLO 716 / no relevé**<br>v. Pohronská Polhora, between the elevation points Javorinka (1434.8) and Psica (1396.9), SE slope | 48.779717° N<br>19.864150° E<br>SUF 150<br>Q 7285a<br>alt. 1345–1350 m | spruce forest uprooted by windstorm in August 2007<br>ca 140 years | fallen stem<br>side, bottom<br>ca 140–200 cm<br>Ø = ca 40 cm<br>branch growing from the fallen stem<br>side, bottom<br>ca 170 cm<br>Ø = ca 10 cm<br>*Lachnellula subtilissima* | 19.V.2010<br>DB |
| **SLO 723 / no relevé**<br>v. Pohronská Polhora, S-SSE of the Fabova hoľa saddle, NNW-facing slope | 48.77836° N<br>19.88098° E<br>SUF 132a/134a<br>Q 7285a<br>alt. 1375 m | spruce forest<br>ca 140 years | standing stem<br>up to ca 120 cm from the base<br>Ø = ca 30–35 cm | 7.X.2010<br>DB |

| I | II | III | IV | V |
|---|---|---|---|---|
| **SLO 724 / no relevé**<br>v. Pohronská Polhora, the Fabova hoľa saddle, N–NNW-facing slope | 48.77964° N<br>19.88062° E<br>SUF 134a<br>Q 7285a<br>alt. 1357 m | spruce forest<br>ca 145 years | standing stem<br>ca 150 cm<br>Ø = ca 25 cm | 7.X.2010<br>DB |
| **SLO 725 / no relevé**<br>v. Pohronská Polhora, between the Fabova hoľa saddle and the elevation point Fabova hoľa (1438.8), NNW-facing slope | 48.775615° N<br>19.882813° E<br>SUF 131<br>Q 7285a<br>alt. 1410–1415 m | spruce forest<br>ca 75 years | branch growing from the fallen stem<br>ca 50 cm<br>Ø = 3 cm<br>*Trichaptum abietinum* (on bark of the branch and fallen stem), *Lycogala epidendrum*, *Ascocoryne* sp. (on wood of the fallen stem) | 7.X.2010<br>DB |
| **SLO 726 / no relevé**<br>v. Polomka, NNW of the elevation point Fabova hoľa (1438.8), NNW-facing slope | 48.773123° N<br>19.885484° E<br>SUF 407<br>Q 7285a<br>alt. 1437 m | spruce forest<br>ca 60 years | standing stem<br>almost all around the stem<br>up to ca 10 m from the base<br>Ø = ca 25–30 cm<br>*Exidia saccharina* | 7.X.2010<br>DB |
| **SLO 727 / no relevé**<br>v. Pohronská Polhora, Fabova hoľa saddle, NNW-facing slope | 48.779242° N<br>19.880615° E<br>SUF 134a<br>Q 7285a<br>alt. 1360 m | spruce forest<br>ca 145 years | branch growing from the fallen stem<br>ca 30–70 cm<br>Ø = 3.5–5.5 cm<br>*Trichaptum abietinum* (on bark of the branch and fallen stem), *Ascocoryne* sp., *Dacrymyces stillatus* (on wood of the fallen stem) | 7.X.2010<br>DB |
| **SLO 728 / no relevé**<br>v. Pohronská Polhora, WSW of the Fabova hoľa saddle, WSW-facing slope | 48.77847° N<br>19.87802° E<br>SUF 134a<br>Q 7285a<br>alt. 1280 m | spruce forest<br>ca 145 years | standing stem<br>ca 120 cm<br>Ø = ca 70 cm | 9.XI.2010<br>DB |
| **SLO 731 / no relevé**<br>v. Pohronská Polhora, SSW of the Fabova hoľa saddle, W-facing slope | 48.77837° N<br>19.87986° E<br>SUF 134a<br>Q 7285a<br>alt. 1340–1345 m | spruce forest with dry standing and fallen trees after the windstorm in 2004<br>ca 150 years | standing stem<br>from the base up to 150 cm<br>Ø = ca 65–100 cm<br>*Fomitopsis pinicola*, *Phlebiopsis gigantea*<br>root swelling of dry standing tree<br>ca 20 cm<br>Ø = ca 50 cm | 26.I.2011<br>DB, SB |

| I | II | III | IV | V |
|---|---|---|---|---|
| **Klenovský Vepor NNR** | | | | |
| **SLO 717 / relevé no. 6**<br>v. Klenovec, ca 270 m SW of the elevation point Klenovský Vepor (1338.8) | 48.68737° N<br>19.76720° E<br>SUF 396a<br>Q 7384b<br>alt. 1315–1320 m | spruce forest<br>ca 70 years | fallen stem (ca 2004)<br>bottom<br>ca 50 cm<br>Ø = ca 30 cm | 23.X.2009<br>DB |
| **Čertova dolina Valley** | | | | |
| **SLO 730 / no relevé**<br>v. Tisovec, ENE of the elevation point Remetisko (886.2), W of the viaduct, NE-facing slope | 48.733000° N<br>19.855254° E<br>SUF 388<br>Q 7285c<br>alt. 665–670 m | beech-spruce forest with admixed *Acer pseudoplatanus* and *Fraxinus excelsior*<br>ca 60 years | fallen branch<br>top<br>Ø = 0.5 cm | 29.VII.2010<br>DB |
| **Tŕstie Mt. massif** | | | | |
| **SLO 703 / no relevé**<br>v. Krokava, Tŕstie NR, ESE of the elevation point Holcková (1101.8) | 48.65732° N<br>19.98984° E<br>SUF 515b<br>Q 7385b<br>alt. 1100 m | secondary spruce forest with admixture of old *Fagus sylvatica* individuals<br>ca 50 years | fallen stem<br>side<br>ca 15 cm<br>Ø = ca 20–25 cm | 16.X.2010<br>DB |
| **SLO 729 / no relevé**<br>v. Tisovec, Holcková, the valley of no-named streamlet that is an affluent of Stratená Stream, NNW of the elevation point Salašiská (1132.4), N–NNW-facing slope | 48.664627° N<br>19.993983° E<br>SUF 1255a<br>Q 7386a<br>alt. 1000 m | beech forest with admixed *Abies alba* and *Picea abies*<br>ca 90 years | fallen stem<br>side<br>ca 15 cm<br>Ø = ca 15 cm | 11.X.2010<br>DB |
| **Stolica Mt. massif** | | | | |
| **SLO 718 / no relevé**<br>v. Muránska Zdychava, Stolica, W of the elevation point Stolica (1476.4), NNW-facing slope | 48.773833° N<br>20.206028° E<br>SUF 235a<br>Q 7287a<br>alt. 1465–1470 m | spruce forest with open canopy<br>ca 170 years | fallen stem<br>side, bottom, top<br>ca 100–130 cm<br>Ø = ca 20–25 cm<br>*Pleurotus dryinus*, *Trichaptum abietinum*<br>branch growing from the fallen stem<br>almost all around the branch<br>ca 150 cm<br>Ø = ca 10 cm | 13.VIII.2009<br>DB |
| **Šarkanica NNR** | | | | |
| **SLO 719 / relevé no. 10**<br>v. Muráň, ENE-NE of the elevation point Šarkanica (1151.2) | 48.71448° N<br>19.96847° E<br>SUF 536<br>Q 7285c<br>alt. 1140 m | mixed forest of *Picea abies*, *Larix decidua*, *Fagus sylvatica*, *Abies alba* and *Acer pseudoplatanus*<br>ca 80–120 years | fallen stem<br>side, bottom<br>ca 20 cm<br>Ø = ca 40 cm | 26.I.2010<br>DB |

| I | II | III | IV | V |
|---|---|---|---|---|
| **Veľká Stožka NNR** | | | | |
| **SLO 720 / relevé no. 8**<br>v. Muráň, Veľká Stožka NNR, N of the elevation point Kľak (1408.7), E-facing slope | 48.782583° N<br>19.965350° E<br>SUF 98<br>Q 7285b<br>alt. 1320–1325 m | *Picea abies* and *Larix decidua* forest with admixed *Abies alba* and *Acer pseudoplatanus*<br>ca 170–180 years | fallen stem<br>side<br>ca 50–80 cm<br>Ø = ca 25–30 cm | 21.V.2010<br>DB |
| **SLO 721 / no relevé**<br>v. Muráň, N of the elevation point Kľak (1408.7), NE-facing slope | 48.782067° N<br>19.965333° E<br>SUF 378<br>Q 7285b<br>alt. 1330 m | *Picea abies* and *Larix decidua* forest with admixed *Sorbus aucuparia*<br>ca 170–180 years | fallen stem<br>side<br>ca 70 cm<br>Ø = ca 35–40 cm<br>*Trichaptum abietinum* | 21.V.2010<br>DB |
| **SLO 722 / relevé no. 9**<br>v. Muráň, Zadné Hory, NE-ENE of the elevation point Veľká Stožka (1296.9) | 48.78078° N<br>19.95519° E<br>SUF 381<br>Q 7285b<br>alt. 1240 m | spruce forest with admixed *Larix decidua*<br>ca 170 years | fallen stem<br>side<br>ca 170 cm<br>Ø = ca 35–40 cm<br>*Exidia pythia*,<br>*Phlebiopsis gigantea*,<br>*Trichaptum abietinum*,<br>myxomycetes sp. | 18.VI.2010<br>DB |

The basidiocarps grew on the bark of the stems, branches and a root swelling. The bark was either tightly adhered to the wood or stripping, but still with indistinct marks of decay. Basidiocarps were produced mostly on the exterior layer of the bark, rarely in the deeper layer(s) (later the exterior layer stripped off) or on the breakage of the bark. In one case, the basidiocarps grew also on the interior layer of the bark. The surface of the observed stems was covered by bark for 25–100 %.

The *Picea abies* trees were (50)70–180 years old and the fallen ones had been lying for 1 to 4(5) years. Standing trees had been drying for 1 to 3 years. Bark beetles had often attacked the observed stems, especially *Ips typographus*; whose flight holes were visible throughout the bark.

While observing the basidiocarps, we noticed some other myxomycetes and/or macromycetes with *C. kubickae* on the same substrates: *Lycogala epidendrum*, one other (not identified) species of myxomycete, *Ascocoryne* sp., *Dacrymyces stillatus*, *Exidia pythia*, *E. saccharina*, *Fomitopsis pinicola*, *Hamatocanthoscypha laricionis*, *Lachnellula subtilissima*, *Pseudographis pinicola*, *Gloeophyllum sepiarium*, *Phlebiopsis gigantea*, *Pleurotus dryinus*, *Stereum sanguinolentum*, and *Trichaptum abietinum*.

As for epiphytic lichens, the stems were mostly covered by *Hypogymnia physodes*, *Pseudevernia furfuracea* and *Platismatia glauca*. No mosses grew on the stems.

We observed the production of basidiocarps in January and from May to November.

**The forest communities with the occurrence of *Crepidotus kubickae***

During our case study, supported by phytocoenological relevés (Tab. 2), *Crepidotus kubickae* occurred in (semi-)natural spruce or mixed spruce-beech communities with *Abies alba*, *Acer pseudoplatanus*, *Fagus sylvatica*, *Larix decidua*, and *Sorbus aucuparia*, where *Picea abies* was (sub-)dominant or the only one species in the tree layer. Only in one case (at Tŕstie), we observed the occurrence of *C. kubickae* also in a non-native degraded stand – a planted even-aged Norway spruce monoculture without hardly any species in the herb layer. The age of the forest communities was (50)70–180 years. They were located in the submontane to the supramontane vegetation belts; the lowest collecting site was at 665 m a. s. l., the highest at 1470 m a. s. l.

The forest communities with the occurrence of *C. kubickae* belong phytocoenologically to three orders: *Fagetalia sylvaticae* Pawłowski ex Pawłowski et al. 1928, *Athyrio-Piceetalia* Hadač 1962 and *Piceetalia excelsae* Pawłowski ex Pawłowski et al. 1928.

The most frequent occurrence of *C. kubickae* was in the *Piceetalia excelsae* Pawłowski ex Pawłowski et al. 1928, association *Vaccinio myrtilli-Piceetum* Šoltés 1976 (in which 24 of all 30 collections of *C. kubickae* were recorded).

The species sporadically occurred in two associations of the order *Athyrio-Piceetalia* Hadač 1962: *Athyrio alpestris-Piceetum* Hartmann 1959 (1 collection) and *Calamagrostio variae-Abietetum* (Sillinger 1933) Fajmonová 1976 (1 collection). However, such rare occurrence might be connected with the fact that these associations are rare or less common in the studied area.

Less frequent occurrence of *C. kubickae* was in the mixed beech forest and beech forest communities of the order *Fagetalia sylvaticae* Pawłowski ex Pawłowski et al. 1928, alliance *Fagion sylvaticae* Luquet 1926 (4 collections), e.g. in Klenovský Vepor NNR, Čertova dolina Valley, Šarkanica NNR, and Veľká Stožka NNR (sites with relevés). The studied community of Šarkanica NNR belongs to the association *Dentario enneaphylli-Fagetum* Oberd. ex W. et A. Matuszkiewicz 1960; the other communities include at least two associations: cf. *Cortuso-Fagetum* (Klika 1927) Fajmonová 1982, and cf. *Poo chaixii-Fagetum* Šomšák 1979; their tree composition was changed in the past and at present *Picea abies* is the dominant tree in the main stand.

**Survey of forest communities with occurrence of *Crepidotus kubickae***

Class *Querco-Fagetea* Br.-Bl. et Vlieger in Vlieger 1937
order *Fagetalia sylvaticae* Pawłowski ex Pawłowski et al. 1928
alliance *Fagion sylvaticae* Luquet 1926
suballiance *Acerenion* Oberd. 1957
cf. assoc. ***Cortuso-Fagetum*** (Klika 1927) Fajmonová 1982
suballiance *Eu-Fagenion* Oberd. 1957 em. R. Tx. 1958
assoc. ***Dentario enneaphylli-Fagetum*** Oberd. ex W. et A. Matuszkiewicz 1960
alliance *Luzulo-Fagion* Lohmeyer et R. Tx. in R. Tx. 1954

cf. assoc. ***Poo chaixii-Fagetum*** Šomšák 1979
Class *Vaccinio-Piceetea* Br.-Bl. in Br.-Bl. et al. 1939
order *Athyrio-Piceetalia* Hadač 1962
alliance *Athyrio alpestris-Piceion* Sýkora 1971
assoc. ***Athyrio alpestris-Piceetum*** Hartmann 1959
alliance *Abietion albae* Březina et Hadač ex Hadač 1965
assoc. ***Calamagrostio variae-Abietetum*** (Sillinger 1933) Fajmonová 1976
order *Piceetalia excelsae* Pawłowski ex Pawłowski et al. 1928
alliance *Piceion excelsae* Pawłowski ex Pawłowski et al. 1928
assoc. ***Vaccinio myrtilli-Piceetum*** Šoltés 1976

According to forest typology, the forests with the presence of *C. kubickae* belong mostly to the group of the *Fagetum abietino-piceosum* and/or *Sorbeto-Piceetum* forest types (Fabova hoľa NR, Mt. Stolica, Klenovský Vepor NNR), less to the *Abieto-Fagetum* and *Fageto-Piceetum* (Veľká Stožka NNR) and *Fageto-Aceretum* forest types (Šarkanica NNR).

From the viewpoint of forest vegetation zones, these forests belong to the 5$^{th}$, 6$^{th}$ and 7$^{th}$ vegetation zone. The most frequent occurrence was in the 6$^{th}$ – fir-beech-spruce zone and 7$^{th}$ – spruce zone.

A specific forest management for decades seems to be important for the collecting sites of *C. kubickae*. All sites are protected forests and/or special purpose forests. We did not record the species in production forests. The protection of sites with *C. kubickae* is also ensured by the landscape protection: the highest Fifth Level of Protection (i.e. without any management; dead wood is left in situ, including large dying *Picea abies* trees which are usually cleared in production forests) applies to the areas in the National Nature Reserve and some Nature Reserve categories (Klenovský Vepor NNR, Šarkanica NNR, Veľká Stožka NNR, Fabova hoľa NR). Tŕstie NR has the Fourth Level of Protection (clear-cutting prohibited). The category National Park (i.e. Čertova dolina Valley, being a part of the Muránska planina NP) falls into the Third Level of Protection. Collecting sites on the massifs of Mt. Stolica and Mt. Tŕstie (except for Tŕstie NR) belong to the protective zone of the Muránska planina NP falling into the Second Level of Protection (Act No. 543/2002 of the National Council of the Slovak Republic on Nature and Landscape Protection, as amended by later regulations).

It is obvious that the forestry management mode is essential for the distribution of this fungus. Protected areas with no logging have enough dead wood (standing and/or lying on the ground), which as a potential substrate limit the occurrence of *C. kubickae*. For example, in Fabova hoľa NR, on Mt. Stolica, in Veľká Stožka NNR and in Klenovský Vepor NNR, we found in the researched plots about 90 to 200 m$^3$ of dead lying wood per hectare during our research in 2008–2011. More precisely, in Fabova hoľa NR (with the highest number of collections) 54,871 m$^3$ of salvage felling timber (per area of ca 240 ha) was registered in 2009 (Kubanda 2010, Schóber 2010).

**Tab. 2. Phytocoenological relevés of forest communities in which *Crepidotus kubickae* occurs.** The data are divided (columns 1-7, columns 8-10) to reduce the length of the table.

Data on the phytocoenological relevés are presented in the following order: relevé no., orographic unit, village (i.e. cadastre), locality, location, latitude – longitude (with an inaccuracy of ± 6–15 m), SAF, Q, altitude, bedrocks, soil/substrate characteristics, inclination, exposition, habitat, age of the stand, research plot area (metres × metres), date (day-month-year), relevé author(s), (author's code of original relevé); association; group of forest types; forest vegetation zone.

Abbreviations, symbols and other characteristics of vegetation in the area of the relevé plot used in the following text and/or table: **v.** – village, **ca** – circa, **NR** – Nature Reserve, **NNR** – National Nature Reserve, **N** – north, **S** – south, **E** – east, **W** – west, **SUF** – spatial unit of forest arrangement (number of forest stand), **Q** – Central European mapping grid quadrant, **DB** – Drahoš Blanár, **juv.** – juveniles (trees aged less than 1 year), **agg**. – aggregate taxon (in case of *Dryopteris carthusiana* agg., this taxon includes *Dryopteris dilatata* and/or *D. expansa*, and possibly their hybrids), $\mathbf{E_T}$ – total vegetation cover, $\mathbf{E_3}$ – cover/diversity of tree layer, $\mathbf{E_2}$ – cover/diversity of shrub layer, $\mathbf{E_1}$ – cover/diversity of herb layer, $\mathbf{E_0}$ – cover/diversity of mosses and lichens, **canopy** (density) – percentage of shaded area by tree-crowns of the forest stand, **stocking –** relative indicator of stand density determined as the proportion of considered trees and the sum of considered and missing trees to full stocking (cf. Moravčík 2007), $\mathbf{h_{E3}}$ – average height of $E_3$ layer (either determined according to fallen dominant trees in the plot or estimated), $\mathbf{h_{E2}}$ – average height of $E_2$ layer, $\mathbf{h_{E1}}$ – average height of $E_1$ layer, $\mathbf{dm_{1,3}}$ – mid-stem-diameter of standing trees measured at a height of 1.3 m above the ground (all standing trees of the tree layer in the plot were measured), **necromass** – quantity of dead wood in various degree of decay per area of relevé (in our case, dead wood = fallen Norway spruce stems > 7 cm in diameter at the smaller end; stumps, branches and wood in high degree of decay, i.e. lying on the ground for more than 10–15 years were not taken into account) (cf. Čajánek et. al 1994, Halaj 1955), **L-epif.** – epiphytic lichens on standing *Picea abies* trees/stems in the tree layer, **M-lign.-s.** – lignicolous macromycetes/myxomycetes on standing *Picea abies* trees/stems in the tree layer, **M-lign.-l.** – lignicolous macromycetes/myxomycetes on fallen *Picea abies* trees/stems, **M** – macromycetes/myxomycetes, **L** – lichen, **×** (used in the table) **–** present, **.** – absent.

**Relevé no. 1:** Veporské vrchy Mts., v. Pohronská Polhora, Fabova hoľa NR, NNW of the Fabova hoľa saddle, 48.78028° N – 19.87995° E, SUF 134a, Q 7285a, alt. 1360 m, medium-grained and coarse-grained granite, loamy soil, 12°, SSE, spruce forest with open canopy with *Sorbus aucuparia* in understory, ca 150-year-old stand, 20 × 20 m, 9-7-2009, DB, (DB-9-7-2009); assoc. ***Vaccinio myrtilli-Piceetum*** Šoltés 1976; *Fagetum abietino-piceosum* of upper zone; 6th vegetation zone. $E_T$: 95 %, $E_3$: 45 %, $E_2$: 10 %, $E_1$: 90 %, $E_0$: 20 %; canopy: 45 %, stocking: 0.5–0.6, $h_{E3}$ = 20–25 m, $h_{E2}$ = 2.5 m, $h_{E1}$ = 130 cm (*Rubus idaeus*)/50–70 cm, $dm_{1,3}$ = 40 cm, necromass: 9 $m^3$/400 $m^2$ (3 trees fallen down after the windstorm disturbance in August 2007; 35 % living spruce trees occurred in $E_3$).

**Relevé no. 2:** Veporské vrchy Mts., v. Polomka, Fabova hoľa NR, ENE of the elevation point Javorinka (1434.8), 48.78336° N – 19.87671° E, SUF 408b, Q 7285a, alt. 1416 m, medium-grained and coarse-grained granite, loamy soil, 10°, NE, spruce forest with open canopy (partially dying after outbreaks of bark beetle – *Ips typographus*), ca 150-year-old stand, 25 × 25 m, 27-7-2009, DB, (DB-1/27-7-2009); assoc. ***Vaccinio myrtilli-Piceetum*** Šoltés 1976; *Sorbeto-Piceetum*; 7th forest vegetation zone. $E_T$: 98 %, $E_3$: 35 %, $E_2$: 5 %, $E_1$: 85–90 %, $E_0$: 45 %; canopy: 35 %, stocking: 0.3, $h_{E3}$ = ca 25 m, $h_{E2}$ = 2 m, $h_{E1}$ = 110 cm (*Rubus idaeus*)/70 cm, $dm_{1,3}$ = 48 cm, necromass: 11.4 $m^3$/625 $m^2$ (8 trees fallen down after windstorm disturbance probably in August 2007).

**Relevé no. 3:** Veporské vrchy Mts., v. Polomka, Fabova hoľa NR, NW of the elevation point Javorinka (1434.8), 48.78341° N – 19.87185° E, SUF 436e, Q 7285a, alt. 1420 m, augen gneiss and sheared porphyric granite, sandy-loamy soil, 20°, NNE, spruce forest with open canopy, ca 170-year-old stand, 25 × 30 m, 27-7-2009, DB, (DB-2/27-7-2009); assoc. ***Athyrio alpestris-Piceetum*** Hartmann 1959; *Sorbeto-Piceetum*; 7th forest vegetation zone. $E_T$: 98 %, $E_3$: 30 %, $E_2$: to 1 %, $E_1$: 95 %, $E_0$: 40 %, canopy: 30 %, stocking: 0.3, $h_{E3}$ = ca 25 m, $h_{E2}$ = 2 m, $h_{E1}$ = 70–110 cm/10–15 cm, $dm_{1,3}$ = 56 cm, necromass: 15 $m^3$/750 $m^2$ (3 trees fallen down after the windstorm disturbance in August 2007).

**Relevé no. 4:** Veporské vrchy Mts., v. Pohronská Polhora, Fabova hoľa NR, SSE of the elevation point Psica (1396.9), 48.78416° N – 19.85628° E, SUF 154, Q 7285a, alt. 1335–1340 m, spruce forest, augen gneiss and sheared porphyric granite, loamy soil, 10°, S, spruce forest, ca 150-year-old stand, 20 × 20 m, 5-5-2010/8-6-2010, DB, A. Guttová, Z. Palice (DB-1/2010); assoc. ***Vaccinio myrtilli-Piceetum*** Šoltés 1976; *Fagetum abietino-piceosum* of upper zone – *Sorbeto-Piceetum*; 6th–7th forest vegetation zone. $E_T$: 95 %, $E_3$: 75 %, $E_2$: < 1 %, $E_1$: 75 %, $E_0$: 25 %, canopy: 75 %, stocking: 0.7, $h_{E3}$ = 20–22 m, $h_{E2}$ = 2 m, $h_{E1}$ = 40 cm, $dm_{1,3}$ = 37 cm, necromass: ca 4.2 $m^3$/400 $m^2$ (7 trees or their parts fallen after the windstorm disturbance in August 2007).

**Relevé no. 5:** Veporské vrchy Mts., v. Pohronská Polhora, Fabova hoľa NR, ENE of the elevation point Javorinka (1434.8), 48.78563° N – 19.87830° E, SUF 408b, Q 7285a, alt. 1385–1390 m, medium-grained and coarse-grained granite, loamy-sandy soil, 10°, S, spruce forest with open canopy, ca 150-year-old stand, 15 × 25 m, 11-5-2010, DB (DB-2/2010); assoc. ***Vaccinio myrtilli-Piceetum*** Šoltés 1976; *Sorbeto-Piceetum*; 7th forest vegetation zone. $E_T$: 95 %, $E_3$: 55 %, $E_2$: < 1 %, $E_1$: 70 %, $E_0$: 15 %; canopy: 55 %, stocking: 0.6, $h_{E3}$ = ca 25 m, $h_{E2}$ = 2 m, $h_{E1}$ = 130/15–30 cm, $dm_{1,3}$ = 46 cm, necromass: ca 5.4 $m^3$/375 $m^2$ (5 trees or their parts fallen after the windstorm disturbance in August 2007 + 1 tree in high degree of decomposition).

**Relevé no. 6:** Veporské vrchy Mts., Klenovský Vepor NNR, v. Klenovec, ca 270 m SW of the elevation point Klenovský Vepor 1338.8, 48.68737° N – 19.76720° E, SUF 396a, Q 7384b, alt. 1315–1320 m, pyroxene andesite, gravel-loamy soil, 15°, SSE, spruce forest, ca 70-year-old stand, 20 × 20 m, 23-10-2009, DB (DB-23-10-2009); assoc. ***Poo chaixii-Fagetum*** Šomšák 1979; *Fagetum abietino-piceosum* of upper zone; 6th forest vegetation zone. $E_T$: 95 %, $E_3$: 70 %, $E_2$: 5 %, $E_1$: 90 %, $E_0$: 45 %; canopy: 70 %, stocking: 0.7, $h_{E3}$ = ca 20 m, $h_{E2}$ = 1.40 m, $h_{E1}$ = 80 cm (*Rubus idaeus*)/20–30 cm, $dm_{1,3}$ = 27 cm, necromass: 9.7 $m^3$/400 $m^2$ (6 trees fallen down probably after windstorm disturbances in 2004–2007).

**Relevé no. 7:** Stolické vrchy Mts., v. Muránska Zdychava, Stolica, W of the elevation point Stolica (1476.4), 48.773833° N – 20.206028° E, SUF 235a, Q 7287a, alt. 1465–1470 m, medium-grained and coarse-grained granite, loamy soil, 10°, NNW, spruce forest with open canopy, ca 170-year-old stand, 20 × 20 m, 13-8-2009, DB, (DB-1/13-8-2009); assoc. ***Vaccinio myrtilli-Piceetum*** Šoltés 1976; *Sorbeto-Piceetum*; 7th forest vegetation zone. $E_T$: 100 %, $E_3$: 55 %, $E_2$: 1 %, $E_1$: 95 %, $E_0$: 45 %; canopy: 55 %, stocking: 0.6, $h_{E3}$ = ca 20 m, $h_{E2}$ = 1.4 cm, $h_{E1}$ = 80 cm (*Rubus idaeus*)/20–30 cm, $dm_{1,3}$ = 32 cm, necromass: 3.7 $m^3$/400 $m^2$ (6 trees fallen down after the windstorm disturbances in 2007 and probably also in 2008).

**Relevé no. 8:** Muránska planina Plateau, v. Muráň, Veľká Stožka NNR, N of the elevation point Kľak (1408.7), 48.782583° N – 19.965350° E, SUF 98, Q 7285b, alt. 1320–1325 m, light-coloured limestone ("Wetterstein type"), loamy soil with limestone rocks (< 5 %), 25°, E, *Picea abies* and *Larix decidua* stand with *Abies alba* and *Acer pseudoplatanus*, ca 170–180-year-old stand, 20 × 20 m, 8-6-2010, DB, (DB-3/2010); assoc. ***Calamagrostio variae-Abietetum*** (Sillinger 1933) Fajmonová 1976; *Fageto-Piceetum* of lower zone; 6th forest vegetation zone. $E_T$: 95 %, $E_3$: 70 %, $E_2$: to 1 %, $E_1$: 80 %, $E_0$: 25 %; canopy: 70 %, stocking: 0.7; $h_{E3}$ = 20–25 m, $h_{E2}$ = 1.6 m, $h_{E1}$ = 40–50 cm (*Lonicera nigra*)/25 cm (*Vaccinium myrtillus*), $dm_{1,3}$ = 46 cm; necromass: 5.7 $m^3$/400 $m^2$ (4 trees fallen down after the windstorm disturbance in 2007 + 6 stems in high degree of decomposition).

**Relevé no. 9:** Muránska planina Plateau, v. Muráň, Veľká Stožka NNR, Zadné Hory, NE-ENE of the elevation point Veľká Stožka (1296.9), 48.78078° N – 19.95519° E, SUF 381, Q 7285b, alt. 1240 m, light-coloured limestone ("Wetterstein type"), loamy humus-rich soil with limestone rocks (to 5 %), 10–20°, NNW, spruce stand with admixed *Larix decidua*, ca 170-year-old stand, 20 × 20 m, 14-6-2010, DB, (DB-15/2010); cf. assoc. ***Cortuso-Fagetum*** (Klika 1927) Fajmonová 1982; *Abieto-Fagetum* of upper zone; the 6th forest vegetation zone. $E_T$: 100 %, $E_3$: 65 %, $E_2$: to 1 %, $E_1$: 90 %, $E_0$: 45 %; canopy: 70 %, stocking: 0.7, $h_{E3}$ = 25 m, $h_{E2}$ = 1.8 m, $h_{E1}$ = 60–110 cm (*Lonicera nigra*)/5–25 cm (*Vaccinium myrtillus*), $dm_{1,3}$ = 64 cm, necromass: 4.5 $m^3$/400 $m^2$ (3 trees fallen down after the windstorm disturbance in 2007 + 1 tree in higher degree of decomposition).

**Relevé no. 10:** Muránska planina Plateau, v. Muráň, Šarkanica NNR, ENE-NE of the elevation point Šarkanica (1151.2), 48.71448° N – 19.96847° E, SUF 536, Q 7285c, alt. 1140 m, light-coloured limestone ("Wetterstein type"), loamy soil, 2–5°, SW, mixed forest of *Picea abies*, *Larix decidua*, *Fagus*

*sylvatica*, *Abies alba*, and *Acer pseudoplatanus*, 80–120-year-old stand, 15 × 25 m, 27-5-2011, DB, (DB-8/2011); assoc. ***Dentario enneaphylli-Fagetum*** Oberd. ex W. et A. Matuszkiewicz 1960; *Fageto-Aceretum* of lower zone; 5th forest vegetation zone. $E_t$: 98 %, $E_3$: 60 %, $E_2$: 5 %, $E_1$: 88 %, $E_0$: 15 %; canopy: 60 %, stocking: 0.5; $h_{E3}$ = 30 m, $h_{E2}$ = 1–2.5 m, $h_{E1}$ = 15–25 cm/70 cm (*Dryopteris filix-mas*), $dm_{1,3}$ = 76 cm (*Larix decidua*), 49 cm (*Picea abies*), 46 cm (*Acer pseudoplatanus*); necromass: 5.0 $m^3$ / 400 $m^2$ (1 tree of *P. abies* fallen down after the windstorm disturbance in 2007).

| **taxon / relevé number** | **1** | **4** | **2** | **5** | **7** | **3** | **6** | | **8** | **9** | **10** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **$E_3$** | | | | | | | | **$E_3$** | | | |
| *Picea abies* | 3 | 5 | 3 | 5 | 4 | 3 | 4 | *Picea abies* | 3 | 4 | 3 |
| *Sorbus aucuparia* | . | . | . | . | . | . | (+) | *Larix decidua* | 2b | 1 | 1 |
| **L-epif.** | | | | | | | | *Acer pseudoplatanus* | 1 | . | 1 |
| *Hypogymnia physodes* | × | × | × | × | × | × | × | *Abies alba* | 1 | + | . |
| *Platismatia glauca* | × | × | × | × | × | × | × | *Fagus sylvatica* | . | . | (1) |
| *Lepraria* sp. div. | . | × | × | × | × | × | × | **L-epif.** | | | |
| *Usnea* sp. div. | × | × | × | . | × | × | × | *Hypogymnia physodes* | × | × | × |
| *Bryoria capilaris* | × | × | . | . | . | × | × | *Lepraria* sp. | × | × | . |
| *Bryoria implexa* | × | × | . | . | . | × | × | *Pseudevernia furfuracea* | × | × | . |
| *Bryoria* sp. div. | . | × | × | × | . | . | . | *Usnea* sp. div. | × | × | . |
| *Cetraria chlorophylla* | . | × | . | × | . | . | . | *Bryoria* sp. div. | × | . | . |
| *Chaenotheca furfuracea* | . | × | . | × | . | . | . | *Bryoria capilaris* | . | × | . |
| *Alectoria sarmentosa* | . | × | . | . | . | . | . | *Bryoria implexa* | . | × | . |
| *Hypocenomyce caradocensis* | . | × | . | . | . | . | . | *Cladonia* sp. | . | . | × |
| *Alectoria* sp. | . | . | . | × | . | . | . | *Hypocenomyce scalaris* | . | × | . |
| *Cladonia* sp. | . | . | . | × | . | . | . | *Platismatia glauca* | × | . | . |
| *Parmeliopsis ambigua* | . | . | . | × | . | . | . | **M-lign.-s.** | | | |
| *Pseudevernia furfuracea* | . | . | . | × | . | . | . | *Gloeophyllum odoratum* | . | × | . |
| **M-lign.-s.** | | | | | | | | *Fomitopsis pinicola* | . | × | . |
| *Fomitopsis pinicola* | . | × | × | × | . | × | × | **M-lign.-l.** | | | |
| *Pleurotus dryinus* | × | . | × | . | . | × | . | *Crepidotus kubickae* | × | × | × |
| **M-lign.-l.** | | | | | | | | *Trichaptum abietinum* | . | × | × |
| *Crepidotus kubickae* | × | × | × | × | × | × | × | *Exidia pythia* | . | × | . |
| *Trichaptum abietinum* | × | × | × | × | × | . | × | *Fomitopsis pinicola* | . | . | × |
| *Stereum sanguinolentum* | . | × | . | × | × | . | . | *Phellinus viticola* | × | . | . |
| *Pleurotus dryinus* | . | . | × | . | × | × | . | *Pleurotus dryinus* | × | . | . |
| *Bjerkandera adusta* | . | . | × | . | . | × | . | **$E_2$** | | | |
| *Leptoporus mollis* | . | . | × | . | × | . | . | *Sorbus aucuparia* | + | + | . |
| *Exidia pythia* | . | . | . | × | . | . | . | *Acer pseudoplatanus* | . | . | 1 |
| *Fuligo septica* | . | × | . | . | . | . | . | *Fagus sylvatica* | . | . | 1 |
| *Fomitopsis pinicola* | . | . | . | . | × | . | . | *Lonicera xylosteum* | . | . | 1 |
| *Lycogala epidendrum* | . | × | . | . | . | . | . | *Ribes grossularia* | . | . | + |
| *Panellus mitis* | . | . | . | . | . | . | × | *Daphne mezereum* | . | . | r |
| *Phellinus viticola* | . | . | . | . | × | . | . | *Salix silesiaca* | r | . | . |
| *Pseudohydnum gelatinosum* | . | . | . | . | × | . | . | **$E_1$** | | | |
| *Stereum hirsutum* | . | . | . | . | × | . | | *Oxalis acetosella* | 2b | 4 | + |

| **taxon / relevé number** | **1** | **4** | **2** | **5** | **7** | **3** | **6** | | **8** | **9** | **10** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **$E_2$** | | | | | | | | *Dryopteris filix-mas* | 1 | 3 | 2a |
| *Sorbus aucuparia* | 2a | + | 1 | + | + | . | 1 | *Urtica dioica* | r | + | 2a |
| *Picea abies* | . | + | + | + | + | + | + | *Sorbus aucuparia* | 1-2a | + | + |
| *Fagus sylvatica* | . | . | . | . | . | . | + | *Senecio ovatus* | + | 1 | 1 |
| *Rosa pendulina* | . | . | . | . | . | . | + | *Valeriana tripteris* | 1 | 1 | + |
| *Sambucus racemosa* | . | . | + | . | . | . | . | *Fragaria vesca* | +-1 | 1 | + |
| *Lonicera nigra* | . | . | . | . | . | (+) | . | *Rubus idaeus* | + | + | 1 |
| **$E_1$** | | | | | | | | *Acer pseudoplatanus* | + | + | + |
| *Vaccinium myrtillus* | 2b | 4 | 2b | 3 | 4-5 | 1 | 2b | *Galium schultesii* | + | + | + |
| *Oxalis acetosella* | 2b | 2a | 1 | 2b | 3 | 2b | 2b | *Gentiana asclepiadea* | + | + | + |
| *Rubus idaeus* | 2b | + | 2b | 2a | 2b | 1 | 2b | *Myosotis sylvatica* | + | + | + |
| *Dryopteris carthusiana* agg. | 2a | 2a | 1 | 2a | 2a | 1 | 2b | *Polygonatum verticillatum* | + | + | + |
| *Soldanella hungarica* | + | + | + | + | 2a | + | + | *Cirsium erisithales* | + | r | + |
| *Picea abies* | + | + | + | 1 | + | + | 1 | *Lilium martagon* | + | r | r |
| *Sorbus aucuparia* | 1 | + | + | + | 1 | + | + | *Galium odoratum* | . | 1 | 3 |
| *Calamagrostis villosa* | 3 | 2a | 4 | 4 | + | 2b | . | *Vaccinium myrtillus* | 3 | 1 | . |
| *Stellaria nemorum* | + | + | 1 | + | 2a | 2b-3 | . | *Adenostyles alliariae* | 1 | 2b | . |
| *Homogyne alpina* | 2a | 1 | + | 2a | 1 | 1 | . | *Lonicera nigra* | +-1 | + | . |
| *Athyrium distentifolium* | . | + | 2b | 2b | 2a | 3 | . | *Stellaria nemorum* | . | 1 | 1 |
| *Avenella flexuosa* | . | 1 | 1 | + | 2a | . | 3 | *Ajuga reptans* | . | 1 | + |
| *Luzula sylvatica* | . | 2a | + | 2b | + | 2b | . | *Aconitum variegatum* | . | + | + |
| *Athyrium felix-femina* | + | + | . | . | 1 | + | 2a | *Athyrium filix-femina* | . | + | + |
| *Picea abies* juv. | + | + | + | + | . | + | . | *Cystopteris fragilis* | + | + | . |
| *Rumex arifolia* | + | + | r | +-1 | . | . | . | *Daphne mezereum* | + | + | . |
| *Veratrum album* subsp. *lobelianum* | . | + | r | r | . | + | . | *Dentaria bulbifera* | + | . | + |
| *Adenostyles alliariae* | . | + | . | + | + | . | . | *Festuca altissima* | . | + | + |
| *Milium effusum* | . | . | + | . | + | + | . | *Galeobdolon montanum* | + | . | + |
| *Polygonatum verticillatum* | (r) | + | . | . | . | + | . | *Geranium sylvaticum* | . | + | + |
| *Chamaenerion angustifolium* | . | . | r | . | r | + | . | *Hieracium murorum* | + | + | . |
| *Streptopus amplexifolius* | . | . | (r) | . | + | (r) | . | *Luzula sylvatica* | + | + | . |
| *Acetosa arifolia* | . | . | . | 1 | . | 1 | . | *Maianthemum bifolium* | + | + | . |
| *Dryopteris filix-mas* | . | + | . | . | . | . | + | *Mycelis muralis* | + | + | . |
| *Gentiana asclepiadea* | . | . | + | . | . | + | . | *Phyteuma spicatum* | + | + | . |
| *Luzula luzuloides* subsp. *rubella* | + | . | + | + | . | . | . | *Picea abies* | + | . | + |
| | | | | | | | | *Picea abies* juv. | + | + | . |
| *Poa chaixii* | . | . | . | + | . | . | + | *Poa nemoralis* | . | + | + |
| *Calamagrostis arundinacea* | . | . | . | . | . | . | 3 | *Prenanthes purpurea* | + | + | . |
| *Deschampsia caespitosa* | . | . | . | + | . | . | . | *Primula elatior* | + | + | . |
| *Galeopsis pubescens* | . | . | . | . | . | + | . | *Pulmonaria obscura* | . | + | + |
| *Huperzia selago* | . | + | . | . | . | . | . | *Ranunculus platanifolius* | + | + | . |
| *Luzula luzuloides* | . | . | . | . | . | . | + | *Ribes alpinum* | + | + | . |
| *Prenanthes purpurea* | . | . | . | . | . | . | + | *Soldanella hungarica* | + | + | . |

| **taxon / relevé number** | **1** | **4** | **2** | **5** | **7** | **3** | **6** | | **8** | **9** | **10** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Senecio hercynicus* | . | . | . | . | . | + | . | *Dentaria enneaphyllos* | . | r | + |
| *Acer pseudoplatanus* juv. | . | r | . | . | . | . | . | *Epilobium montanum* | r | + | . |
| *Fagus sylvatica* | . | . | . | . | . | . | r | *Fagus sylvatica* | . | (r) | + |
| **$E_0$** | | | | | | | | *Abies alba* | r | r | . |
| *Polytrichum formosum* | 2a | + | 1 | 1 | 1 | + | + | *Aquilegia vulgaris* | r | r | . |
| *Lepidozia reptans* | + | + | + | + | + | + | + | *Asplenium viride* | r | r | . |
| *Dicranum scoparium* | + | 2a | + | 2b | . | 2a | 1 | *Mercurialis perennis* | . | . | 2b |
| *Plagiomnium affine* | 1 | 1 | 2a | 2b | . | 3 | . | *Calamagrostis varia* | 2a | . | . |
| *Plagiothecium curvifolium* | 1 | + | 1 | . | 2a | . | 2b | *Cardaminopsis halleri* | . | . | 2a |
| *Dicranum montanum* | . | + | 1 | 1 | + | . | 2a | *Clematis alpina* | 2a | . | . |
| *Tetraphis pellucida* | . | + | . | + | + | + | + | *Dryopteris dilatata* | . | 2a | . |
| *Dicranum polysetum* | 1 | . | 2a | + | . | . | 2a | *Gymnocarpium dryopteris* | . | 2a | . |
| *Ptilidium pulcherrimum* | + | + | + | . | . | + | . | *Petasites albus* | . | 2a | . |
| *Rhytidiadelphus squarrosus* | | 1 | . | . | + | 2a | . | *Acetosa arifolia* | . | 1 | . |
| *Blepharostoma trichophyllum* | . | + | + | + | . | . | . | *Calamagrostis arundinacea* | . | 1 | . |
| *Brachythecium reflexum* | . | + | . | + | . | + | . | *Geranium robertianum* | . | 1 | . |
| *Cirriphyllum piliferum* | + | . | . | + | . | + | . | *Hieracium lachenalii* | 1 | . | . |
| *Pohlia nutans* | . | . | + | + | . | . | + | *Hypericum maculatum* | . | . | 1 |
| *Pleurozium schreberi* | + | . | . | . | 2b | . | . | *Milium effusum* | . | . | 1 |
| *Rhytidiadelphus loreus* | . | . | 2a | . | . | 2a | . | *Picea abies* | . | 1 | . |
| *Atrichum undulatum* | . | . | 1 | + | . | . | . | *Poa chaixii* | . | 1 | . |
| *Lophocolea heterophylla* | 1 | + | . | . | . | . | . | *Acer pseudoplatanus* juv. | + | . | . |
| *Cephalozia lunulifolia* | . | . | . | . | . | + | + | *Aconitum moldavicum* | . | . | + |
| *Ditrichum heteromallum* | . | . | . | + | . | + | . | *Aegopodium podagraria* | . | . | + |
| *Lophozia incisa* | . | . | + | . | . | . | + | *Asarum europaeum* | . | . | + |
| *Brachythecium rutabulum* | . | . | . | . | . | 2a | . | *Carex digitata* | + | . | . |
| *Rhytidiadelphus triquetrus* | . | . | . | . | 2a | . | . | *Chaerophyllum aromaticum* | . | . | + |
| *Eurhynchium praelongum* | . | . | . | . | 1 | . | . | *Clematis alpina* | . | + | . |
| *Plagiothecium laetum* | . | . | . | 1 | . | . | . | *Corthusa matthiolii* | . | + | . |
| *Plagiomnium rostratum* | . | . | . | . | . | . | 1 | *Corydalis solida* | . | . | + |
| *Brachythecium starkei* | . | + | . | . | . | . | . | *Cruciata glabra* | . | . | + |
| *Calypogeia muellariana* | . | + | . | . | . | . | . | *Dactylorhiza fuchsii* subs. *fuchsii* | + | . | . |
| *Cephalozia* sp. | . | . | + | . | . | . | . | *Digitalis grandiflora* | + | . | . |
| *Dicranella* sp. | . | . | + | . | . | . | . | *Doronicum austriacum* | . | + | . |
| *Herzogiella seligeri* | + | . | . | . | . | . | . | *Dryopteris carthusiana* agg. | + | . | . |
| *Hylocomnium splendens* | . | + | . | . | . | . | . | *Epilobium collinum* | . | + | . |
| *Nowellia curvifolia* | . | . | . | . | . | . | + | *Galeobdolon luteum* | . | + | . |
| *Plagiothecium nemorale* | . | . | . | . | . | + | . | *Geum rivale* | . | + | . |
| *Pogonatum urnigerum* | . | . | . | + | . | . | . | *Impatiens noli-tangere* | . | . | + |
| *Riccardia latifrons* | . | . | . | . | . | + | . | *Isopyrum thalictroides* | . | . | + |
| *Thuidium tamariscinum* | . | . | . | + | . | . | . | *Lamium maculatum* | . | . | + |
| **L** | | | | | | | | *Lonicera xylosteum* | . | . | + |

| **taxon / relevé number** | **1** | **4** | **2** | **5** | **7** | **3** | **6** |
|---|---|---|---|---|---|---|---|
| *Cladonia ochrochlora* | . | × | . | × | . | . | . |
| *Cladonia coccifera* | . | × | . | . | . | . | . |
| *Cladonia coniocraea* | . | . | . | × | . | . | . |
| *Cladonia digitata* | . | × | . | . | . | . | . |
| *Cladonia polydactyla* | . | × | . | . | . | . | . |
| *Cladonia* sp. | × | . | . | . | . | . | . |
| *Xylographa* cf. *vitiligo* | . | × | . | . | . | . | . |
| **M** | | | | | | | |
| *Setulipes androsaceus* | × | × | × | . | × | × | × |
| *Mycena* sp. | × | . | . | . | × | . | × |
| *Lophodermium piceae* | . | × | . | × | . | . | . |
| *Russula* sp. | . | . | . | . | × | . | × |
| *Xeromphalina* sp. | . | . | × | . | × | . | . |
| *Calocera viscosa* | . | . | . | . | . | . | × |
| *Chrysomphalina chrysophyllum* | . | . | . | . | × | . | . |
| *Cortinarius* sp. | . | . | . | . | × | . | . |
| *Gymnopus acervatus* | . | . | . | . | × | . | . |
| *Gymnopus dryophilus* | . | . | × | . | . | . | . |
| *Hygrophorus olivaceoalbus* | . | . | . | . | × | . | . |
| *Lachnum bicolor* var. *rubi* | . | . | . | . | × | . | . |
| *Lactarius* sp. | . | . | . | . | × | . | . |
| *Omphalina* sp. | . | × | . | . | . | . | . |
| *Strobilurus esculentus* | . | × | . | . | . | . | . |

| | **8** | **9** | **10** |
|---|---|---|---|
| *Luzula luzuloides* | + | . | . |
| *Melampyrum sylvaticum* | + | . | . |
| *Moneses uniflora* | + | . | . |
| *Orthilia secunda* | + | . | . |
| *Paris quadrifolia* | . | . | + |
| *Polypodium vulgare* | + | . | . |
| *Rosa pendulina* | . | + | . |
| *Rubus saxatilis* | + | . | . |
| *Sesleria albicans* | + | . | . |
| *Stachys sylvatica* | . | . | + |
| *Vaccinium vitis-idaea* | + | . | . |
| *Valeriana sambucifolia* | . | + | . |
| *Veronica chamaedris* | . | . | + |
| *Viola biflora* | . | + | . |
| *Abies alba* juv. | . | r | . |
| *Campanula xylocarpa* | r | . | . |
| *Cardaminopsis arenosa* agg. | r | . | . |
| *Carex muricata* agg. | r | . | . |
| *Chaerophyllum hirsutum* | . | r | . |
| *Coeloglossum viride* | r | . | . |
| *Galium pumilum* agg. | r | . | . |
| *Heracleum sphondylium* | r | . | . |
| *Laserpitium latifolium* | r | . | . |
| *Polystichum lonchitis* | r | . | . |
| *Ranunculus lanuginosus* | . | r | . |
| *Ribes uva-crispa* | . | r | . |
| *Thalictrum aquilegiifolium* | . | r | . |
| *Larix decidua* | . | (+) | . |
| *Rubus saxatilis* | . | (+) | . |
| *Ulmus glabra* | . | (r) | . |
| $\mathbf{E_0}$ | | | |
| *Plagiomnium affine* | + | 2a | + |
| *Dicranum scoparium* | 2a | 2b | . |
| *Eurhynchium angustirete* | 1 | 2b | . |
| *Dicranum montanum* | 1 | 1 | . |
| *Herzogiella seligeri* | 1 | 1 | . |
| *Ctenidium molluscum* | + | + | . |
| *Lepidozia reptans* | + | + | . |
| *Plagiochila porelloides* | + | + | . |
| *Pohlia nutans* | + | + | |
| *Rhizomnium punctatum* | + | + | . |
| *Brachythecium rutabulum* | . | . | 2b |

| taxon / relevé number | 1 | 4 | 2 | 5 | 7 | 3 | 6 | | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | *Cirriphyllum piliferum* | . | 1 | . |
| | | | | | | | | *Blepharostoma trichophyllum* | + | . | . |
| | | | | | | | | *Brachythecium salebrosum* | + | . | . |
| | | | | | | | | *Brachythecium reflexum* | . | . | + |
| | | | | | | | | *Jamesoniella autumnalis* | + | . | . |
| | | | | | | | | *Lophocolea heterophylla* | + | . | . |
| | | | | | | | | *Lophozia incisa* | + | . | . |
| | | | | | | | | *Metzgeria furcata* | + | . | . |
| | | | | | | | | *Plagiothecium curvifolium* | . | + | . |
| | | | | | | | | *Polytrichum formosum* | + | . | . |
| | | | | | | | | *Rhytidiadelphus triquetrus* | + | . | . |
| | | | | | | | | *Tetraphis pellucida* | . | + | . |

The occurrence of such a quantity of biomass is connected with the windstorms in the years 2004 and 2007. Consequently, uprooted and broken spruce trees were followed by attack and spread of bark beetles like *Ips typographus* and *Pityogenes chalcographus*.

## The first record of *Crepidotus kubickae* for Slovakia

Within our study, we also searched the Slovak public herbaria BRA, SAV and SLO for other material of *Crepidotus kubickae* collected in Slovakia. As we did not find any specimen, we considered our collection from Fabova hoľa NR from 2002 (SLO 701) to be the first for Slovakia. However, an intensive excerption of published records of *Crepidotus* from Slovakia (Jančovičová 2011) indicated that one older collection of *C. kubickae* should exist. It was a collection from "Sitno" (Štiavnické vrchy Mts., Slovakia) by F. Kotlaba from 1958 (Kotlaba 1961). The existence of this collection was finally confirmed in the herbarium PRM: "Ad truncum emortuum *Abietis albae* in monte "Sitno" prope opp. Banská Štiavnica, Slovakia centr., 14. VIII. 1958, leg. et det. F. Kotlaba as *Crepidotus sphaerosporus*, rev. Z. Pouzar as *C. kubickae* (PRM 197699)." Moreover, there is also one more Slovak collection kept in PRM: "In declivitate montis "Skalka" (in cca 1020 m s. m.) ap. Oravice pr. Trstená, in montibus Záp. Tatry, Slov. sept.; ad corticem trunci iacentem *Piceae abietis*, 22. IX. 1971, leg. et det. F. Kotlaba as *Crepidotus subsphaerosporus*, rev. Z. Pouzar as *C. kubickae* (PRM 713570)." In the BRNM herbarium there are no collections of *C. kubickae*. Concerning the facts mentioned above, we presume that the oldest collection of *C. kubickae* from Slovakia is the one from Sitno Hill (Štiavnické vrchy Mts.) collected by F. Kotlaba in 1958. However, the existence of other material of *C. kubickae*, e.g. in private herbaria, is not excluded.

## Occurrence and ecological knowledge on *Crepidotus kubickae* in Europe

Although known from several European countries, comprehensive ecological knowledge on *Crepidotus kubickae* is missing. According to accessible literature (listed below), the fungus is reported from Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Great Britain, Italy, Norway, Poland, Russia, Spain, Sweden and Switzerland.

Ecological data are rather rich from the Czech Republic, the country from which the fungus was originally described; the first collection of *C. kubickae* was from "terram argillaceum locis muscosis in Piceto prope Poříčko ad flumen Sázava" (Pilát 1949). In the key of Bohemian species of the genus *Crepidotus*, Pouzar (2005) presented *C. kubickae* as a common fungus of mountain habitats, occurring on fallen trunks and branches of *Abies* and *Picea*. He also added that contrary to e.g. the Šumava Mts. (SW Czech Republic) it was a very rare species in the central part of the Czech Republic (Pouzar 2005). Specimens from the Šumava Mts. were also studied by Ripková (2009). According to these collections, *C. kubickae* occurs generally in spruce or mixed spruce forests; in spruce forests with admixed *Betula pubescens* and *Salix aurita* and with *Sphagnum* sp. div. in the herb layer (*Sphagno-Piceetum*), as well as in mixed forests formed by *Fagus sylvatica* and *Abies alba* with admixed *Acer pseudoplatanus* and *Ulmus* sp.; all at altitudes of 780–1340 m a. s. l.

In her study on *C. kubickae*, Ripková (2009) listed also collections from Poland originating from *Abieti-Piceetum montanum*, *Piceetum tatricum* and *Dentario glandulosae-Fagetum* forests, on wood and bark of trunks, stumps and roots of *Picea abies* and *Picea excelsa*, at altitudes of 920–1400 m a. s. l. Łuszczyński (2007) mentioned the fungus (as *C. cesatii* var. *subsphaerosporus*) from the associations of *Tilio-Carpinetum* and *Luzulo pilosae-Fagetum*, on wood of fallen *Fagus* twigs.

The fungus was reported also from Spain (as *C. cesatii* var. *subsphaerosporus*), e.g. from wood of *Eucalyptus globulus* in a forest with *Quercus pyrenaica* (Soliño et al. 2001); from a branch of *Quercus ilex* in a mixed forest with *Quercus faginea* and *Juniperus thurifera* (Hewykoop & Moreno 2007), and also from unidentified substrata (Siquier & Salom 2008).

The neotype of *C. cesatii* var. *subsphaerosporus* on fallen *Picea* twigs in the *Abieti-Fagetum* association and at an altitude of 1000 m a. s. l. was described from Switzerland (Senn-Irlet 1995). From this country, ecological data are summarised by Breitenbach & Kränzlin (2000), who present *C. cesatii* var. *subsphaerosporus* as "gregarious to imbricate on dead conifer wood, primarily of *Picea*, such as stumps or fallen branches; fairly common only at montane elevations".

As *C. subsphaerosporus*, the fungus is reported from Great Britain by Watling & Gregory (1989), who describe the habitat as follows: "on twigs and

other woody debris in woods etc.; not uncommon, recorded for all areas except Ireland, but unlikely to be absent there".

From Scandinavian countries, the fungus (as *C. cesatii* var. *subsphaerosporus*) is known from Norway and Sweden (Norstein 1990). The author noted that this is a "common fungus in areas with natural and planted *Picea*, mainly growing on wood of *Picea*, also on *Sorbus*, *Alnus*, *Fraxinus* and other unspecified deciduous wood". From Sweden, collections were also reported by Svensson (2009), namely from spruce logs in spruce-dominated habitats. Recently, Senn-Irlet (2008) resumed ecological data on the fungus (*C. cesatii* var. *subsphaerosporus*) for the Nordic countries – Norway, Sweden, Finland and Denmark – "on coniferous twigs and branches; common in the hemiboreal to boreal zone, rare but locally occasional in the temperate zone".

From France, the fungus (as *C. cesatii* var. *subsphaerosporus*) is briefly commented as characteristic of conifer habitats (Roux 2006).

Without ecological data, the fungus (as *C. cesatii* var. *subsphaerosporus*) is reported from Belgium (Walleyn & Vandeven 2006), Estonia, Germany, and Russia (Senn-Irlet 1995).

From Italy, the fungus (as *C. subsphaerosporus*) was reported by Lonati (2000) from a dead branch of *Hedera helix*. However, Consiglio & Setti (2008), authors of the recent monograph of the genus *Crepidotus*, state that *C. kubickae* / *C. cesatii var. subsphaerosporus* is conspecific with *C. cesatii*, so it is doubtful if our fungus occurs in Italy. From the same reason its presence in Austria is also questionable, even though it was reported from there by Stangl et al. (1991), Hausknecht & Klofac (2002), and Hausknecht & Jaklitsch (2003) (as *C. cesatii* var. *subsphaerosporus*). Hausknecht & Krisai-Greilhuber (2010) accepted the views of Consiglio & Setti (2008) and assume that *C. kubickae* / *C. cesatii* var. *subsphaerosporus* is a dubious taxon.

Accordingly, the taxonomic concept of the fungus is still unstable in Europe, and hence it is difficult to assign ecological data to *C. kubickae*.

## CONCLUSIONS

Our case study in the Veporské vrchy Mts., Stolické vrchy Mts. and Muránska planina Plateau (central Slovakia) in the years 2002 and 2008–2011 resulted in 30 collections of *Crepidotus kubickae* from seven localities: Fabova hoľa NR (21 specimens/20 collecting sites), Klenovský Vepor NNR (1/1), Mt. Tŕstie massif (2/2), Mt. Stolica massif (1/1), Šarkanica NNR (1/1), Veľká Stožka NNR (3/3) and Čertova dolina Valley (1/1).

In the studied area, *C. kubickae* occurred in several types of spruce or mixed forests (with dominance of *Picea abies*); in the fir-beech-spruce to spruce forest

vegetation zones. The observed forest communities belong to six associations: *Vaccinio myrtilli-Piceetum* Šoltés 1976, *Athyrio alpestris-Piceetum* Hartmann 1959, *Calamagrostio variae-Abietetum* (Sillinger 1933) Fajmonová 1976, cf. *Cortuso-Fagetum* (Klika 1927) Fajmonová 1982, cf. *Poo chaixii-Fagetum* Šomšák 1979, and *Dentario enneaphylli-Fagetum* Oberd. ex W. et. A. Matusziewicz 1960. The species occurred mostly (28 collections) at sites with altitudes of 1100–1470 m a. s. l. Only 2 collections were from lower situated sites at altitudes of 665 and 1000 m a. s. l. It preferred dead corticated fallen and standing stems of *Picea abies* of ca 15–100 cm in diameter, 70–180 years in age.

Concerning all non-lichenised fungi we found during our research, some of them are not included in the checklist of fungi of Slovakia (Bacigálová & Lizoň 1998) and might be new for Slovakia: *Pseudographis pinicola*, *Hamatocanthoscypha laricionis*, *Lachnellula occidentalis*, *L. subtilissima*, and *Phialina separabilis*.

The search for other material of *C. kubickae* from Slovakia in the herbaria BRA, SAV, SLO, BRNM and PRM showed that 2 other collections exist: a collection from "Sitno" (Štiavnické vrchy Mts.) by F. Kotlaba from 1958 and a collection from "Skalka" (Západné Tatry Mts.) by F. Kotlaba from 1971. We assume that the collection from "Sitno" is the first one for Slovakia. Moreover, this is the only one Slovak collection from *Abies alba* (all other collections are from *Picea abies*).

*C. kubickae* is reported from several European countries (Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Great Britain, Italy, Norway, Poland, Russia, Spain, Sweden, and Switzerland), but a comprehensive ecological study is missing. It was mostly collected on coniferous trees such as *Picea abies*, *P. excelsa*, and *Abies alba*, but also on deciduous trees including *Eucalyptus globosus*, *Hedera helix*, *Quercus ilex*, and *Fagus sylvatica*. The taxonomic concept of the fungus is not, however, yet stable; some authors (Consiglio & Setti 2008, Hausknecht & Krisai-Greilhuber 2010) consider it to be conspecific with *C. cesatii*. It is therefore problematic to determine its ecological preferences throughout Europe.

In conclusion, we assume that *C. kubickae* is not a rare fungus, which can be expected to occur in suitable forest habitats all over Slovakia as well as in other European countries.

## ACKNOWLEDGEMENTS

Our thanks go out to Markéta Chlebická (Praha), Ladislav Hagara (Bratislava) and Stanislav Glejdura (Zvolen), who kindly helped with the identification and re-examination of some collections of non-lichenised fungi. We are also grateful to Eva Križová (Zvolen) for the classification and revision of forest stands according

to the forest typology and to Peter Kučera (Blatnica) for his expert advice on the classification of spruce communities into the geobotanical system. Our sincere thanks belong also to the herbarium curators Jan Holec (Praha) and Vladimír Antonín (Brno), for help in the search for *Crepidotus kubickae* specimens in the herbaria PRM and BRNM. Dušan Senko (Bratislava) is gratefully acknowledged for creation of the map. The Slovak Grant Agency VEGA (grants nos. 2/0062/10, 2/0028/11 and 2/0059/11) supported this study.

## REFERENCES

BACIGÁLOVÁ K., LIZOŇ P., eds. (1998): Huby [Fungi]. – In: Marhold K., Hindák F., eds., Zoznam nižších a vyšších rastlín Slovenska [Checklist of non-vascular and vascular plants of Slovakia], p. 101–227, Bratislava.

BIELCZYK U., LACKOVIČOVÁ A., FARKAS E., LŐKÖS L., LIŠKA J., BREUSS O., KONDRATYUK S. (2004): Checklist of lichens of the Western Carpathians. Biodiversity of the Carpathians 1. – 181 p. Kraków.

BRAUN-BLANQUET J. (1964): Pflanzensoziologie. Grundzüge der Vegetationskunde, Ed. 3. – 865 p. Wien, New York.

BREITENBACH J., KRÄNZLIN F. (2000): Fungi of Switzerland, Vol. 5. Agarics 3rd part. *Cortinariaceae*. – 338 p. Lucerne.

COOPER J., KIRK P. (2011): CABI Bioscience Databases. – http://www.indexfungorum.org/ [accessed 11 October 2011]

CONSIGLIO G., SETTI L. (2008): Il genere *Crepidotus* in Europa. – 344 p. Vicenza.

ČAJÁNEK K., PČOLINSKÝ I., POKORNÝ R. (1994): Tabuľky objemu dreva guľatiny meranej s kôrou [Tables of round timber volume measured with bark[. – 215 p. Zvolen.

FAJMONOVÁ E. (1978a): K syntaxonómii spoločenstiev radu *Athyrio-Piceetalia* Hadač 1962 v Západných Karpatoch [To the syntaxonomy of communities of the order *Athyrio-Piceetalia* Hadač 1962 in the Western Carpathians]. – Biológia, Bratislava 33: 551–563.

FAJMONOVÁ E. (1978b): Podzväz *Galio-Abietenion* Oberd. 62. – Biol. Práce Slov. Akad. Vied. 24(6): 109–116.

FAJMONOVÁ E. (1982): Spoločenstvá podzväzu *Aceri-Fagenion* v Západných Karpatoch [Gesellschaften des Unterverbandes *Aceri-Fagenion* in den Westkarpaten]. – Preslia 54: 259–269.

FAJMONOVÁ E., UHLÍŘOVÁ-ŠIMEKOVÁ J. (1981): Poznámky k syntaxonómii spoločenstiev podzväzu *Cephalanthero-Fagenion* a *Galio-Abietenion* [Bemerkungen zur Syntaxonomie der Gesellschaften des Unterverbandes *Cephalanthero-Fagenion* und *Galio-Abietenion*]. – Preslia 53: 257–267.

GONOU-ZAGOU Z., DELIVORIAS P. (2005): Studies on Basidiomycetes in Greece 1: The genus *Crepidotus*. – Mycotaxon 94: 15–42.

HALAJ J. (1955): Tabuľky jednotných hmotových kriviek pre určovanie hmoty porastov [Tables of standard mass curves for stand mass determination]. – 220 p. Bratislava.

HANČINSKÝ L. (1972): Lesné typy Slovenska [Forest types of Slovakia]. – 307 p. Bratislava.

HANČINSKÝ L. (1977): Lesnícka typológia v prevádzkovej praxi [Forest typology in forestry practice]. – 223 p. Bratislava.

HAUSKNECHT A., KLOFAC W. (2002): Ergebnisse des Mykologischen Arbeitstreffens in Mondsee (Oberösterreich) im September 1999. – Österr. Z. Pilzk. 11: 163–184.

HAUSKNECHT A., JAKLITSCH W. (2003): Rezente Pilzunde aus Osttirol. – Österr. Z. Pilzk. 12: 153–192.

HAUSKNECHT A., KRISAI-GREILHUBER I. (2010): Die Gattung *Crepidotus* in Österreich. – Österr. Z. Pilzk. 19: 53–91.

HEYKOOP M., MORENO G. (2007): Catálogo provisional de la micobiota agaricolóogica de la provincia de Guadalajara (España). – Bol. Soc. Micol. Madrid 31: 35–76.

HOLMGREN P.K., HOLMGREN N.H., BARNETT L.C., eds. (1990): Index Herbariorum 1: The Herbaria of the World. – 693 p. Bronx, New York.

JANČOVIČOVÁ S. (2011): Published records of the genus *Crepidotus* from Slovakia. – Acta Bot. Univ. Comenianae 46: 27–34.

JAROLÍMEK I., ŠIBÍK J., HEGEDÜŠOVÁ K., JANIŠOVÁ M., KLIMENT J., KUČERA P., MÁJEKOVÁ J., MICHÁLKOVÁ D., SADLOŇOVÁ J., ŠIBÍKOVÁ J., ŠKODOVÁ I., UHLÍŘOVÁ J., UJHÁZY K., UJHÁZYOVÁ M., VALACHOVIČ M., ZALIBEROVÁ M. (2008): A list of vegetation units of Slovakia. – In: Jarolímek I., Šibík J., eds., Diagnostic, constant and dominant species of the higher vegetation units of Slovakia, p. 295–329, Bratislava.

JIRÁSEK J. (2001a): Klimaxové a podmáčené smrčiny (*Piceion excelsae*) [Climax and waterlogged spruce woodland (*Piceion excelsae*)]. – In: Neuhäuslová Z. et al., Mapa potenciální přirozené vegetace České republiky, p. 217–225, Praha.

JIRÁSEK J. (2001b): Montánní až supramontánní kapradinové smrčiny (*Athyrio alpestris-Piceion*) [Montane to supramontane fern-rich spruce woodland (*Athyrio alpestris-Piceion*)]. – In: Neuhäuslová Z. et al., Mapa potenciální přirozené vegetace České republiky, p. 225–228, Praha.

JIRÁSEK J. (2002): Třída *Vaccinio-Piceetea* Br.-Bl. in Braun-Blanquet, Sissingh et Vlieger 1939. – In: Husová M., Jirásek J., Moravec J., Přehled vegetace České republiky, Vol. 3. Jehličnaté lesy, p. 18–86, Praha.

KLIMENT J., UJHÁZY K., UJHÁZYOVÁ M., HRIVNÁK R., KOCHJAROVÁ J., BLANÁR D. (2010): Syntaxonomy of beech and scree forests in the southern part of the Muránska planina Mts. – Bull. Slov. Bot. Spoločn. 32, Suppl. 2: 161–211.

KORDOVÁNER J., ed. (2003): Veporské vrchy, turistická mapa (tourist's map), 1 : 50 000. – Harmanec.

KORDOVÁNER J., ed. (2006): Stolické vrchy – Revúca, turistická mapa (tourist's map), 1 : 50 000. – Harmanec.

KORNERUP A., WANSCHER J.H. (1974): Methuen handbook of colour, Ed. 5. – 248 p. London.

KOTLABA F. (1961): K mykoflóře vrcholových částí rezervace „Sitno" na Slovensku [To the mycoflora of top parts of the "Sitno" Reserve in Slovakia]. – Ochr. Přír. 16: 139–147.

KRIŽOVÁ E. (1995): Fytocenológia a lesnícka typológia [Phytocoenology and forest typology]. – 203 p. Zvolen.

KRIŽOVÁ E., NIČ J. (1991): Fytocenológia a lesnícka typológia. Návody na cvičenia [Phytocoenology and forest typology. Directions for lessons]. – 113 p. Zvolen.

KRIŽOVÁ E., UJHÁZY K., NIČ J. (2010): Fytocenológia a lesnícka typológia [Phytocoenology and forest typology]. – 192 p. Zvolen.

KUBANDA S. (2010): Návrh opatrení na ochranu lesa proti šíreniu škodlivých činiteľov z území s 5. stupňom ochrany [Proposal of suppression measures against harmful agents spreading from the areas with the 5th degree of protection]. – In: Oravkin M., ed., Lesy Slovenskej republiky, š. p. Banská Bystrica, Odštepný závod Beňuš, list č. 200/2010 zo 17. 9. 2010. (Depon. in the Administration of the Muránska planina National Park, Revúca.)

KUBÍČEK F., ŠOMŠÁK L. (1982): The herb layer production of fir forests in the eastern part of the Slovenské rudohorie Mountains. – Biol. Práce Slov. Akad. Vied. 28(3): 52–178.

KUBINSKÁ A., JANOVICOVÁ K. (1998): Machorasty [Bryophytes]. – In: Marhold K., Hindák F., eds., Zoznam nižších a vyšších rastlín Slovenska [Checklist of non-vascular and vascular plants of Slovakia], p. 297–331, Bratislava.

KUČERA P. (2010): Smrečiny Veľkej Fatry a priľahlých pohorí [Norway spruce communities of the Veľká Fatra Mountains and adjacent mountain ranges]. – 298 p. PhD theses. (Depon. in the Institute of Botany SAS, Bratislava.)

LONATI G. (2000): Il genere *Crepidotus* in area mediterranea. – Micol. Veg. Medit. 15: 161–186.

ŁUSZCYŃSKI J. (2007): Diversity of Basidiomycetes in various ecosystems of the Góry Świętokrzyskie Mts. – Monogr. Bot. 97: 1–218.

MARHOLD K., ed. (1998): Paprađorasty a semenné rastliny [Ferns and flowering plants]. – In: Marhold K., Hindák F., eds., Zoznam nižších a vyšších rastlín Slovenska [Checklist of non-vascular and vascular plants of Slovakia], p. 333–687, Bratislava.

MAZÚR E., LUKNIŠ M. (1980): Geomorfologické jednotky, mapa IV/16, 1 : 500 000 [Geomorphological units, map IV/16, 1 : 500 000]. – In: Mazúr E., ed., Atlas Slovenskej socialistickej republiky, p. 54–55, Bratislava.

MORAVČÍK M. (2007): Derivation of target stocking for forests of Norway spruce vegetation zone in Slovakia. – J. Forest Sci. 53: 352–358.

NEUHÄUSLOVÁ-NOVOTNÁ Z. (1994): Rozšíření rostlinných společenstev a jejich funkce v krajině [Distribution of plant communities and their function in landscape]. – In: Moravec J., ed., Fytocenologie, p. 277–305, Praha.

NORSTEIN S. (1990): The genus *Crepidotus* (Basidiomycotina, *Agaricales*) in Norway. – Synopsis fungorum 2: 1–115.

PILÁT A. (1949): Ad Monographium Crepidotorum Europaeorum Supplementum I. – Stud. Bot. Čechoslov. 10: 149–154.

POUZAR Z. (2005): Klíč na určování našich trepkovitek (*Crepidotus*) a poznámky k nim [A key to our species of the genus *Crepidotus* and notes to them]. – Mykol. Listy 93: 1–9.

RIPKOVÁ S. (2009): *Crepidotus kubickae* – a forgotten name. – Mycotaxon 110: 271–281.

RIPKOVÁ S., BLANÁR D. (2004): Výskyt druhov rodu *Crepidotus* na Muránskej planine a v priľahlej oblasti Slovenského rudohoria [Occurrence of species of the genus *Crepidotus* in the Muránska planina Plateau and in the adjacent area of the Slovenské rudohorie Mts.]. – Reussia 1, Suppl. 1: 41–59.

RIPKOVÁ S., ADAMČÍK S., KUČERA V., PALKO L. (2007): Huby chránenej krajinnej oblasti Vihorlat [Fungi of the Vihorlat Protected Landscape Area]. – 149 p. Bratislava.

ROUX P. (2006): Mille et un champignons. – 1223 p. Sainte-Sigolène.

SCHÓBER I. (2010): Realizačný projekt opatrení na zabránenie šírenia a premnoženia podkôrneho hmyzu z chráneného územia s 5. stupňom ochrany PR Fabova hoľa [Realisation project to suppress spreading and overreproducing of bark beetles from protected area Fabova hoľa NR with the 5$^{th}$ degree of protection]. – In: Pepich M., ed., Lesy Slovenskej republiky, š. p. Banská Bystrica, Odštepný závod Čierny Balog, list č. 1200/2010 zo 17. 9. 2010. (Depon. in the Administration of the Muránska planina National Park, Revúca.)

SENN-IRLET B. (1995): The genus *Crepidotus* (Fr.) Staude in Europe. – Persoonia 16: 1–80.

SENN-IRLET B. (2008): *Crepidotus* (Fr.) P. Kumm. – In: Knudsen H., Vesterholt J., eds., Funga Nordica, p. 864–868, Copenhagen.

SILLINGER P. (1933): Monografická studie o vegetaci Nízkych Tater [Monographic study on the vegetation of the Nízke Tatry Mts.]. – 339 p. Praha.

SIQUIER J.R., SALOM J.C. (2008): Contribució al coneixement micològic de les Illes Balears. XVI. – Revista Catalana de Micologia 30: 13–25.

SOLIÑO A., JUSTO A., CASTRO M.L. (2001): Aportacións ó catálogo macromicolóxico Calego (Ascomycota, Basidiomycota): 1998–2000. – Mykes 4: 37–64.

STANGL J., KRIEGLSTEINER G.J., ENDERLE M. (1991): Die Gattung *Crepidotus* (Fries) Staude 1857 in Deutschland unter besonderer Berücksichtigung Augsburger Funde. – Z. Mykol. 57: 117–148.

SVENSSON N. (2009): Svampars etablering på granlågor efter stormen Gudrun – En jämförande studie mellan en stormdrabbad och en orörd skog. – 43 p. Göteborg. http://www.science.gu.se/digitalAssets/1293/1293816_Natalia_Svensson.pdf [accessed 11 October 2011]

ŠOLTÉS R. (1976): Phytozönotische Analyse des Verbandes *Vaccinio-Piceion* Br.-Bl. 1938 in den Westkarpaten. – Acta Fac. Rerum Nat. Univ. Comenianae, Bot. 24: 139–67.

ŠOMŠÁK L. (1979): *Poo chaixii-Fagetum*, eine neue Assoziation in den Westkarpaten. – Phytocoenologia 6: 505–513.

UHLÍŘOVÁ-ŠIMEKOVÁ J. (1978): Podzväz *Cephalanthero-Fagenion* Tx. 55. – Biol. Práce Slov. Akad. Vied 24(6): 100–109.

VELLINGA E.C. (1988): Glossary. – In: Bas C., Kuyper T.W., Noordeloos M.E., Vellinga E.C., eds., Flora agaricina neerlandica, Vol. 1, p. 54–64, Rotterdam.

VYKOUKOVÁ I., HRUBÁ S. (2009): Fytocenologické a ekologické zmeny v spoločenstve *Poo chaixii-Fagetum* Šomšák 1979 v Slovenskom rudohorí (Volovské vrchy) [Phytocoenological and ecological changes in the association *Poo chaixii-Fagetum* Šomšák 1979 in the Slovenské rudohorie Mts. (Volovské vrchy Mts.)]. – Bull. Slov. Bot. Spoločn., Bratislava 31: 53–62.

WALLEYN R., VANDEVEN E., eds. (2006): Standaardlijst van Basidiomycota en Myxomycota van Vlaanderen en het Brussels Gewest. –143 p. Brussel. http://www.inbo.be/docupload/3062.pdf [accessed 11 October 2011]

WATLING R., GREGORY N.M. (1989): *Crepidotaceae*, *Pleurotaceae* and other pleurotoid agarics. – British Fungus Flora 6: 1–157.

WESTHOFF V., VAN DER MAAREL E. (1978): The Braun-Blanquet approach. – In: Whittaker R.H., ed., Classification of plant communities, p. 289–399, The Hague.

ZLATNÍK A. (1959): Přehled slovenských lesů podle skupin lesních typů [An overview of forests of Slovakia according to the forest types groups]. – 92 p. Brno.

ZLATNÍK A. (1976): Lesnická fytocenologie [Forest phytocoenology]. – 495 p. Praha.