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This number of Czech Mycology

is dedicated

to Mirko Svrček

to his 80th birthday

To commemorate the eightieth birthday of Mirko Svrček

KAREL PRÁŠIL

Photo A. Kubátová

This year the famous Czech mycologist Dr. Mirko Svrček celebrated his eightieth birthday. His course of life and scientific work have been described in details in former commemorative contributions – see Čes. Mykol. 29: 219–228 (1975), Čes. Mykol. 39: 243–249 (1985), Preslia 57: 378–379 (1985) and Czech Mycol. 49: 53–58 (1996).

Here I just briefly remind the reader of some basic facts. Born in 1925 in Prague, he started with mycology during the study at secondary grammar school and subsequently at Charles University, Faculty of Science. In 1946 he joined the staff of the Botanical Department (later Mycological Department) of the National Museum in Prague, where he has regularly been working up to 1992, when he officially retired. During several decades his interest has been focused especially on cup fungi (Discomycetes), but also on Myxomycetes and several groups of gilled fungi.

In the past ten years Dr. Svrček continued his mycological activities not only in the National Museum, but also at many field trips to the surroundings of Prague, southern Bohemia and the Šumava Mountains, collecting material of many groups of Ascomycetes, Basidiomycetes and Myxomycetes. Moreover, he elaborated some ascomycetes and basidiomycetes for the first Red list of fungi (macromycetes) of the Czech Republic which will be published in 2006 and participated on mycological research of some nature reserves on the Czech territory. As an excellent field mycologist he is always a welcome leader of excursions for amateur mycologists and students of mycology. Moreover, he is an active member of the Czech Scientific Society for Mycology and chairman of the Section for Study of Microscopic Fungi of this Society.

Dr. Svrček has become a real doyen of Czech mycology. From this point of view his sustained interest in contact with students and young mycologists must be emphasised. He offers his stimulating thoughts and inspiration to all beginning mycologists, who find their way to an older and experienced, but amicable colleague.

It is a pleasure for me to congratulate Dr. Svrček and to wish him physical health and peace of mind for a long time to come on behalf of all Czech mycologists.

Bibliography of Dr. M. Svrček over the period 1995–2005

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CZECH MYCOL. 57(3–4): 183–219, 2005

A revision of selected material of lignicolous *Lachnum* species from the Czech Republic with a note on graminicolous material of the *Lachnum pygmaeum* complex

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Suková M. (2005): A revision of selected material of lignicolous *Lachnum* species from the Czech Republic with a note on graminicolous material of the *Lachnum pygmaeum* complex. – Czech Mycol. 57(3–4): 183–219.

Selected material of lignicolous species of the genus *Lachnum* from the Czech Republic was studied. *Lachnum impudicum* and *Lachnum subvirgineum* (nom. prov.) are published for the first time from the Czech Republic. These taxa were not distinguished in earlier Czech literature. *Lachnum crataegi*, *Lachnum corylinum*, *Lachnum fasciculare*, *Lachnum fulvellum* and *Lachnum piceum* are lectotypified here. *Lachnum fulvellum* is a synonym of *Lachnum fasciculare*, and *Lachnum piceum* of *Lachnum pygmaeum*. *Lachnum impudicum* as well as *Lachnum corylinum* are close (possibly synonyms) to *Lachnum pubescens* (type specimen of *L. pubescens* examined). *Lachnum crataegi* is close to *Lachnum fasciculare*. One specimen from authentic material of *Lachnum grande* is designated a lectotype and *Lachnum grande* is synonymised with *Lachnum pygmaeum*. *Lachnum pygmaeum* was found to be a variable taxon. In the studied set of material, lignicolous specimens of *Lachnum pygmaeum* show wider and somewhat more protruding paraphyses than non-lignicolous specimens. *Lachnum rhizophilum* seemed to be the earliest possible name for the non-lignicolous taxon (with asci arising from croziers). The type of *Lachnum rhizophilum*, however, is a fungus with asci arising from simple septa.

Key words: J. Velenovský, Bohemia, Moravia, taxonomy, nomenclature

Suková M. (2005): Revize vybraného materiálu lignikolních druhů rodu *Lachnum* z České republiky s poznámkami ke graminikolnímu materiálu z okruhu *Lachnum pygmaeum*. – Czech Mycol. 57(3–4): 183–219.

Byly studovány lignikolní druhy rodu *Lachnum* (chlupáček) na vybraném materiálu z území České republiky. Poprvé jsou z území České republiky publikovány druhy *Lachnum impudicum* a *Lachnum subvirgineum* (nom. prov.). V dřívější české literatuře nebyly odlišovány. Byly stanoveny lektotypy druhů *Lachnum crataegi*, *Lachnum corylinum*, *Lachnum fasciculare*, *Lachnum fulvellum* a *Lachnum piceum*. *Lachnum fasciculare* a *Lachnum fulvellum* jsou synonyma. *Lachnum piceum* patří do synonymiky druhu *Lachnum pygmaeum*. Druh *Lachnum impudicum* a z jiného hlediska i druh *Lachnum corylinum* jsou blízké (možná synonyma) druhu *Lachnum pubescens* (typový materiál *L. pubescens* revidován). Druh *Lachnum crataegi* je blízký druhu *Lachnum fasciculare*. Jedna položka z autentického materiálu *Lachnum grande* je stanovena lektotypem a *Lachnum grande* patří do synonymiky *Lachnum pygmaeum*. Bylo zjištěno, že druh *Lachnum pygmaeum* je variabilní. U materiálu z dřevních substrátů byly zaznamenány širší a z hymenia více vyčnívající parafýzy než u materiálu z ostatních substrátů. Jméno *Lachnum rhizophilum* bylo nalezeno v literatuře jako možné nejstarší pojmenování pro nelignikolní taxon, ale ukázalo se, že typový materiál druhu *Lachnum rhizophilum* má vřecka vyrůstající z jednoduchých sept, což nesouhlasí.

INTRODUCTION

Studying discomycetes has a long tradition in the Czech Republic. Collections of *Lachnum* s.l. in the herbaria PRM and BRNM are rich. Most material has been collected by M. Svrček and J. Velenovský (PRM), F. Šmarda (BRNM), and many specimens were collected by V. Vacek, J. Kubička and F. Kotlaba (PRM). Velenovský's specimens are unfortunately often in poor condition. Many of Velenovský's types were already revised by M. Svrček, in about 1978, who arranged them into envelopes and wrote labels using brief information noted directly in the specimens and information from Velenovský's manuscripts. Only some important collections were revised by H.O. Baral using modern methods of observation under a light microscope.

In the modern taxonomy of *Hyaloscyphaceae* and *Lachnaceae* the ascus basis provides an important character as well as presence of guttules in the living ascospores, paraphyses or hairs (see e.g. Haines 1989, Huhtinen 1990, Baral 1992 and Raitviir 2004). Since no living material was studied, the presence of hyaline refractive vacuolar bodies in hairs and paraphyses (Baral 1992) was not observed. Their presence, however, can be recognised in herbarium specimens by a brownish coloration of the cytoplasm (Baral 1992). This was observed in e.g. old collections of *Lachnum fasciculare* and *Lachnum fulvellum*. Dark coloured discs were observed also in *Lachnum crataegi*. Further important characters in the modern taxonomy of *Lachnum* are the character of hair apices (capitate, clavate, cylindrical) and the difference between the length of marginal hairs and the length of flank hairs (see e.g. Baral in Baral and Krieglsteiner 1985: *Lachnum subvirgineum*, *L. impudicum*).

MATERIAL AND METHODS

Material from herbarium specimens was prepared under a Olympus SZ–61 stereomicroscope using tap water as a mountant by putting a piece of apothecium into a drop of 3 % KOH on a slide, where it was cut using a pin and a blade. Freshly made slides in KOH were used for measurements and drawings of microcharacters. The term "warted" is used in the sense of Leenurm et al. (2003) as an equivalent to the earlier widely used terms "incrustate" or "encrusted". The term "paraphyses protruding" (Baral 2003) is an equivalent of "paraphyses exceeding the asci". Amyloidity of the ascoapical apparatus was observed in Melzer's reagent mostly after pretreatment in 5 % KOH (marked KOH/MLZ). Ascus bases and croziers were studied mostly in KOH at a magnification of 1000x or 2000x using an oil-immersion lens on an Olympus BX–51 microscope. Other characters were studied at magnifications of 1000x (measurements) and 2000x (drawings). Colours of dried apothecia are in some cases provided with codes referring to a lexicon of colours (Kornerup and Wanscher 1981), e.g. '4–A5' means tab. 4, colour A5. Abbreviations used in the drawings are: 'h.' = hairs, 'fh.' = flank hairs, 'mh.' = marginal hairs, 'e.' = paraphyses exceeding the asci, 'a.' = asci, 'p.' = paraphyses, 's.' = ascospores. Selected material from the herbaria PRM and BRNM was revised. Localities, substrata and dates from labels of important old collections are cited outside square brackets. Explanatory information or additional information from Velenovský's manuscripts is added in square brackets. Published records of studied species from the Czech Republic are listed. In case specimens of these were studied, the results of the revision are given. Czech generic and specific names are proposed or follow earlier Czech literature.

RESULTS

Key to the examined species based on studied material

In the following key, characters observed on dried material and in slides in KOH from dried material are used unless stated otherwise.

1a Asci ≥ 60 µm frequent, some shorter asci may also be present in the same apothecium (dried apothecia long stalked, 1–5 mm high, asci arising from croziers or rarely from simple septa).

2a Growing directly on wood (mostly coniferous, but also deciduous), paraphyses (2.2–)3–5 µm wide, hairs up to 70 µm long. – *Lachnum pygmaeum* s. str.

2b On other substrata (rhizomes of grasses or *Cyperaceae*, soil, sometimes only freely attached to deciduous wood), paraphyses (1.7–)2–3(–3.3) µm wide, hairs up to 60 µm long.

3a Asci arising from croziers. – *Lachnum* sp. (see under *L. pygmaeum*).

3a Asci arising from simple septa. – *Lachnum rhizophilum* (see under *L. pygmaeum*).

1b Asci ≤ 55(–63) µm (asci arising from croziers or simple septa).

4a Hairs ≤ 70 µm.

5a Paraphyses stout, 2.8–5.3(–6) µm wide, protruding by (7–)11–23(–31) µm. – *Lachnum pudibundum* (asci arising from simple septa, on deciduous wood and also conifers, discs brownish orange to dark reddish brown).

5b Paraphyses narrower and less protruding, 2–3.8(–4) µm wide, protruding by ≤ 13 µm.

6a On conifers. – *Lachnum papyraceum* (apothecia becoming brown on drying).

6b On deciduous wood.

7a Asci arising from simple septa, ascospores (2–)2.3–3 µm wide. – *Lachnum brevipilosum.*

7b Asci arising from croziers, ascospores up to 2 µm wide.

8a(a–c) Ascospores (4.5–)4.8–6.3(–6.6) × 1.2–1.8 µm, paraphyses narrowly lanceolate, (2.1–)2.4–3.1(–3.3) µm wide. – *Lachnum impudicum* (probably synonym of *L. pubescens*).

8b Ascospores (6.1–)6.6–8.1(–9.3) × (1.4–)1.5–1.8(–2.1) µm, paraphyses narrowly lanceolate to lanceolate, (2–)2.3–3.3(–4) µm wide. – *Lachnum pubescens.*

8c Ascospores (4.7–)6–7.5(–8.6) × 1.3–1.8 µm, paraphyses lanceolate, (2.3–)3–4.1(–4.5) µm wide. – *Lachnum corylinum* (possibly synonym of *L. pubescens*).

4b Hairs longer than 70 µm present.

9a Discs dark coloured (dark brown or dark blackish vinaceous brown).

10a Paraphyses 3–5 µm wide, protruding by 11–31(–35) µm. – *Lachnum crataegi* (perhaps synonym of *L. fasciculare*).

10b Paraphyses 2.2–4.2 µm wide, 5–17(–20) µm protruding. – *Lachnum fasciculare.*

9b Discs paler (whitish or with pale orange, brown or beige–brown tint; up to beige–brown with slight reddish tint).

11a Marginal hairs up to 60(–63) µm long, flank hairs up to 80 µm long. → **8**.

11b Marginal hairs as well as flank hairs ≥ (55–)65 µm, up to 95 or 120(–160) µm long.

12a Hairs up to 95 µm, apex distinctly capitate. – *Lachnum subvirgineum.*

12b Hairs up to 120(–160) µm, apex cylindrical or slightly subclavate. – *Lachnum virgineum.*

Selected publications useful for identification: Rehm (1893), Dennis (1949), Raitviir (1970), Dennis (1981), Baral (in Baral and Krieglsteiner 1985), Vesterholt (2000), Baral (2003).

Lachnum Retz. – chlupáček

Lachnum Retz., Fl. Scand. Prodr., p. 256, 1779. Type species: *L. agaricinum* Retz. [= *L. virgineum* (Batsch: Fr.) P. Karst. fide Gray (1821: 671), Fries (1822: 90), Karsten (1871: 169), Nannfeldt (1932: 260)].

Syn.: *Dasyscyphus* (Nees) ex Gray, Nat. Arrang. Brit. Pl., 1: 670, 1821. Type species: *D. virgineus* (Batsch: Fr.) Gray, lectotype designated by Korf (1954).

Note: Svrček in Svrček et al. (1976) introduced the Czech name "chlupáček" for *Dasyscyphus*. *Dasyscyphus* is a synonym of *Lachnum* and has been understood as its synonym in atlases and floristic literature in our country, although there have been various opinions on the typification and content of the genus *Dasyscyphus* in the world (see Suková 2005). Therefore the name "chlupáček" began to be used for *Lachnum* (e.g. Hagara et al. 1999, Papoušek 2004). The earlier Czech name "huňočíška", which was proposed by Opiz (1852) for *Lachnum*, is archaic, therefore I prefer "chlupáček" for *Lachnum* rather than "huňočíška".

Lachnum brevipilosum Baral ss. Baral – chlupáček krátkochlupý Fig. 1, 2.

Lachnum brevipilosum Baral sensu Baral in Baral et Krieglst., Beih. Z. Mykol. 6: 74, 1985, nom. nov. [≡ *Dasyscypha brevipila* Le Gal, Rev. Mycol. (Paris) 4: 26, 1939 sensu Baral in Baral et Krieglst., Beih. Z. Mykol. 6: 74, 1985; non *Lachnum brevipilum* (Höhn.) Nannf., Nova Acta Regiae Soc. Sci. Upsal. [Ser. 4], 8(2): 262, 1932.]

Description (incl. PRM 901967). Dried apothecia stipitate, 0.4–0.9(–1.1) mm high, 0.25–0.9(–1.1) mm in diam., cup-shaped (not flattened), discs pastel yellow (2–A4), outer surface of the same colour, but covered with short, white hairs. Hairs hyaline, warted, mostly with slightly enlarged apices, 2–3-septate, 35–53(–63) × 3.7–4.5 µm. Asci arising from simple septa, 45–52 × 4–5 µm, KOH/MLZ+. Ascospores fusiform, 6.9–10.5 × (2–)2.3–3 µm. Paraphyses narrowly lanceolate, (2–)2.2–3.2(–3.7) µm wide, exceeding the asci by 5–10 µm.

Comments. Species characteristic by asci arising from simple septa and narrower and less exceeding paraphyses than in *Lachnum pudibundum*. *Lachnum pudibundum* differs also by its discs becoming reddish brown to dark brown on drying.

An earlier homonym of *Dasyscypha brevipila* combined to *Lachnum* would be *Lachnum brevipilum* (Höhn.) Nannf., a fungus occurring on herbaceous stems, similar to *Cistella grevillei* (Berk.) Raitv. Therefore the new name *Lachnum brevipilosum* Baral (in Baral and Krieglsteiner 1985) was necessary for *Dasyscypha brevipila* Le Gal. The type of *Dasyscypha brevipila* Le Gal was revised later, by Baral (2003: HB 6872). He described and illustrated the microcharacters, identified the substrate as *Fraxinus* and the fungus as *Lachnum brevipilosum*, but noted that *Lachnum pudibundum* could also be considered. Moreover, Baral (2003: keys) proposed that *Dasyscypha brevipila* Le Gal and *L. brevipilosum* ss. Baral are perhaps different taxa. According to his revision, paraphyses of the type (observed in KOH + Congo Red) are 2–3 µm wide and exceed by 3–10 µm, ascospores are 6.5–8.8 × 1.9–2.3 µm large and discs of dried apothecia deep brown. The paraphyses could indicate *Lachnum brevipilosum*, but the deep brown discs do not agree. Such dark disc colour is known from Czech collections of *Lachnum pudibundum*, whereas it was not observed in *Lachnum brevipilosum*. Also the ascospore width of the type agrees with Czech collections of *Lachnum pudibundum*. The length of paraphyses could depend on maturity of the apothecium. The asci illustrated by Baral (although containing ascospores) and the note that free ascospores were rare, seem

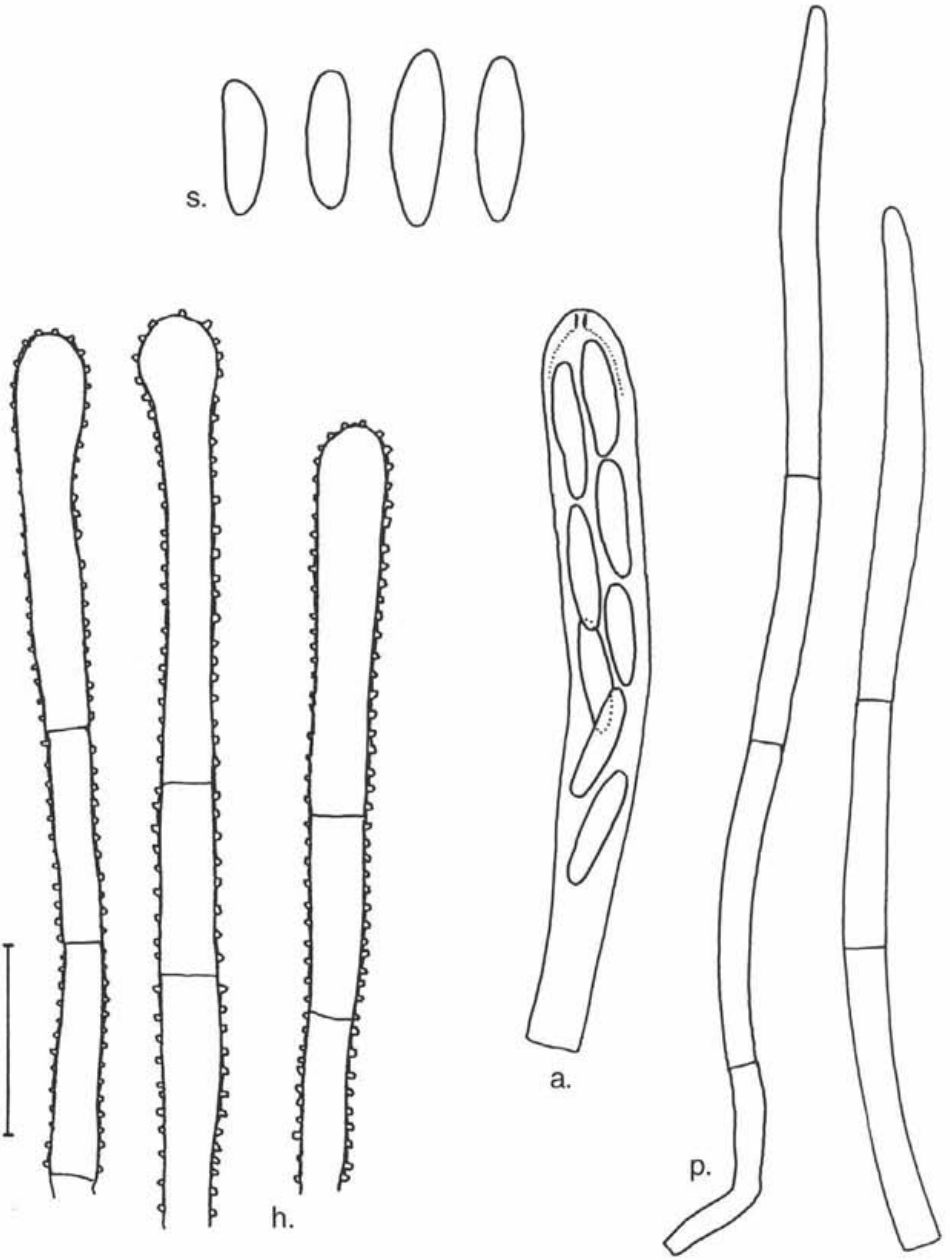

Fig. 1. *Lachnum brevipilosum* Baral ss. Baral, PRM 901967. Scale bar = 10 µm.

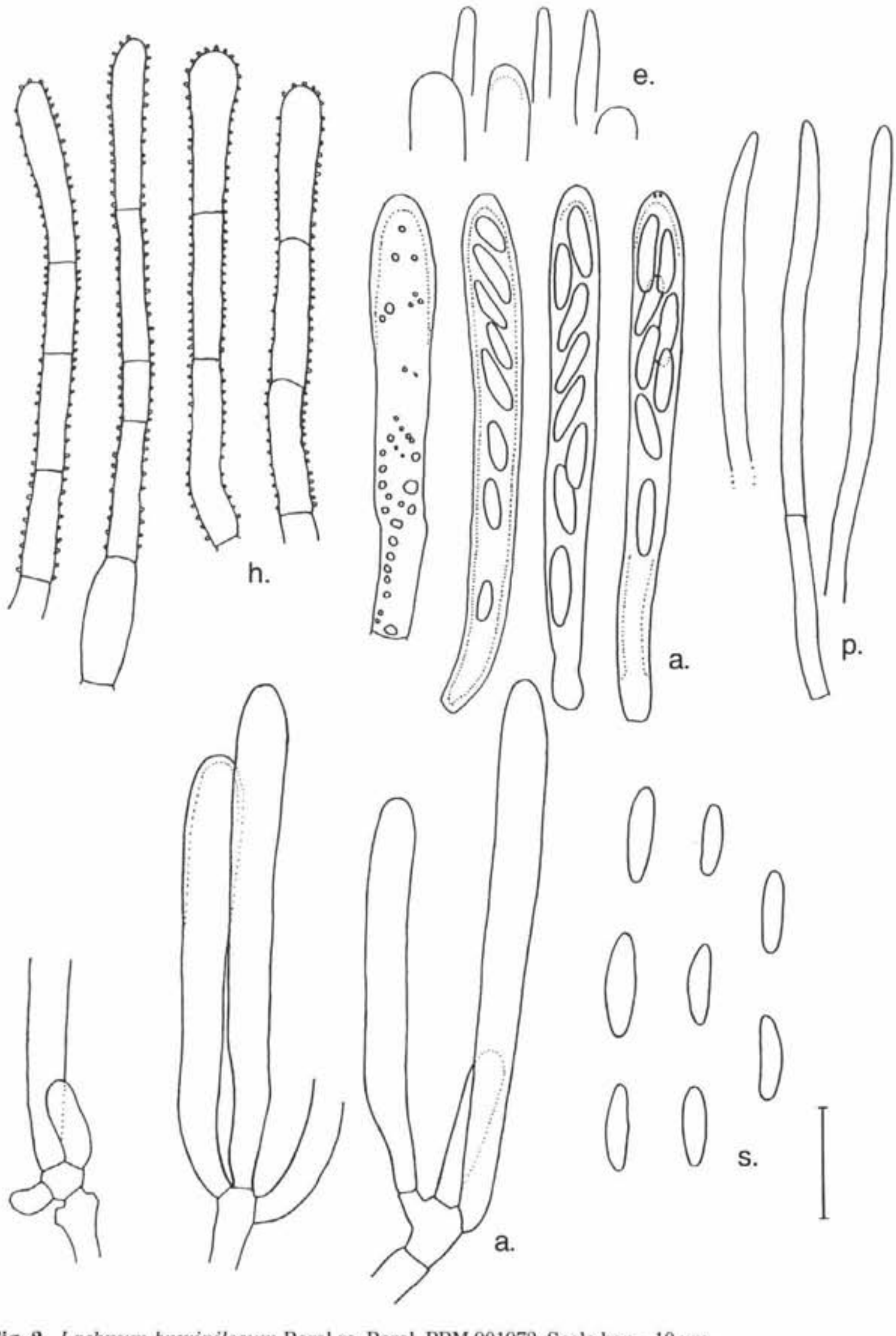

Fig. 2. *Lachnum brevipilosum* Baral ss. Baral, PRM 901973. Scale bar = 10 µm.

to indicate rather immature material. I agree with Baral (2003) that the type of *Dasyscypha brevipila* is rather different from *L. brevipilosum* ss. Baral. However, since no other name has so far been found for the taxon (see also discussion under *Lachnum pubescens*), I have kept the studied Czech and Polish collections provisionally under the name *Lachnum brevipilosum* Baral ss. Baral (in Baral and Krieglsteiner 1985).

Published records: Svrček 1978: 77 (as *Dasyscyphus brevipilus*, Southern Bohemia: Třeboň, pond Svět, on *Tilia*; Soběslavská blata). – Papoušek 2004: 44–45 (as *Lachnum brevipilum* erroneously cited as *L. brevipilum* '(Höhn.) Nannf.', Southern Bohemia, Novohradské hory Mts., Žofínský prales, on wood of *Fagus sylvatica* – revision of the ascus basis character would be necessary to confirm the identification).

Material revised: Central Bohemia: Jevany, on decaying wood of *Fagus sylvatica*, November 1923, leg. et det. J. Velenovský (as *Lachnum microsporum* Velen. in herb., non *L. microsporum* Velen., Mon. Disc. Bohem., p. 260, 1934 published from leaves of *Vaccinium myrtillus*), PRM 149633. – Central Bohemia: Studený vrch hill near Stříbrná Skalice, Ve Studeném nature reserve c. 1.5 km ESE of the village of Samechov, on decaying upper part of lying log of *Acer* cf. *platanoides*, 17 October 2004, leg. L. Edrová et M. Suková, det. M. Suková, PRM 901973. – Southern Bohemia: Cetoraz near Pacov, by Vlček pond, on twig of *Alnus*, 2 August 1962, leg. J. Kubička, det. M. Svrček, PRM 568558. – Třeboň, by the pond Svět, on bark of *Tilia*, 9 December 1957, leg. V. Ježek, det. M. Svrček, PRM. – Třeboň, by Svatojánský rybník (pond), on *Salix caprea*, 29 October 1958, leg. et det. M. Svrček, PRM 617306.

Comparative material from other countries: Eastern Poland, Białowieski National Park, c. 6.5 km N of the village of Białowieża, quadrat no. 256, alt. c. 150 m, 52° 44' 32" N, 23° 49' 51" E, on wood of *Carpinus betulus*, 7 October 2003, leg. A. Chlebicki et M. Suková, det. M. Suková, PRM 901967.

Lachnum corylinum Velen.

Lachnum corylinum Velen., Novit. Mycol. Noviss., p. 131, 1947.

Description. Dried apothecia c. 2.7 mm high, 1.4–1.9 mm in diam., stalks very long (c. 1.55 mm), distorted, outer surface with scarce (hardly standing out) hairs, cups often collapsed, discs as well as outer surface of cups beige brown, orange brown or beige-brown with reddish tint, stalks mostly pale beige. Hairs hyaline, warted, cylindrical, rarely enlarged or pointed, mostly 4–septate, (30–)40–72(–83) × 3–3.8 µm, in lower parts up to 4.7 µm wide, marginal hairs sometimes smooth in lower parts. Asci arising from croziers, (40–)43–53 × (3.2–)3.5–4.3 µm. Ascospores one–celled, (4.7–)6–7.5(–8.6) × 1.3–1.8 µm. Paraphyses lanceolate, with acute tips (to subacute in younger hymenium), (2.3–)3–4.1(–4.5) µm in diam., exceeding the asci by (6.6–)8.8–13.7 µm.

Comments. While *Lachnum pygmaeum* s. str. and *Lachnum* sp. have dried apothecia which are cup-shaped with circular discs of various deep colours, *Lachnum corylinum* resembles in shape a rather helotiaceous fungus, the stipe is gradually widened towards the usually collapsed cup. Asci of *Lachnum corylinum* are short and hairs are scarce in macroscopical view.

The taxonomic position of *Lachnum corylinum* is still poorly known. *Lachnum grande* described earlier by Velenovský (1934) cannot be conspecific with *L. corylinum*, despite its being described from deciduous wood, because *L. grande* has long asci as is typical of the *Lachnum pygmaeum* complex.

The shape of apothecia of *Lachnum corylinum* is similar to *Lachnum fasciculare* (syn. *L. fulvellum*). In the lectotype of *Lachnum fulvellum* (PRM 150122, see under *L. fasciculare*) there are present: A. small, but long and slender stalked, brown, hair-rich apothecia (probably younger, shape the same as in *L. fasciculare*), B. two big, hair-rich apothecia, externally brown, but with dark blackish wine-brown coloured discs strongly resembling *Lachnum pudibundum* (probably not young), and C. apothecia with scarce hairs and collapsed cups. The apothecia characterised under A. and B. and probably also C. belong to one taxon. The third ones although very similar (collapsing, less hairy) differ from *Lachnum corylinum* in having the dark coloured discs (visible also from the outer surface).

In microcharacters (mainly cylindrical hairs and size of ascospores), *Lachnum corylinum* is close to *Lachnum pubescens*. *Lachnum pubescens* differs in its apothecia not becoming so coloured and cups not collapsing on drying. On the other hand, the discs of *L. corylinum* are not dark brown and perhaps their colour is in the range of variability of *L. pubescens*. Also the second character (collapsing cups) appeared to have no taxonomic value, which is demonstrated e.g. under *Lachnum rhizophilum* in this paper and in the case of *Lachnum fulvellum* above. *Lachnum corylinum* has in comparison with *Lachnum pubescens* somewhat bigger apothecia, scanty, mostly 4–septate hairs and paraphyses up to 4.1(–4.5) µm wide.

Type studies and comments on revised type material. There are two specimens of *Lachnum corylinum* in the herbarium PRM. As label data of both specimens (PRM 151434, 151582) agree with the ambiguous information given in the protologue, the specimens are syntypes. The specimen PRM 151582 has the following characters: apothecia beige brown when dried, about 2.7 mm high, 1.4–1.9 mm in diam., stalks very long (about 1.55 × 0.2 mm), distorted, cups collapsed, outer surface with scarce (hardly standing out) hairs; hairs hyaline, warted, marginal hairs sometimes smooth in lower part, cylindrical or upper cell slightly pointed, mostly 4–septate, 59–71(–83) × 3–3.6 µm; asci arising from croziers, 40–45(–53) × 3.5–4 µm; ascospores one-celled, (4.7)5.7–7.8(–8.6) × 1.3–1.7 µm; paraphyses lanceolate, with acute tips, 3.2–4.3 µm in diam., exceeding the asci by 9–13.5 µm.

The studied piece of the specimen PRM 151434 contained younger material of the same species. Hairs on the outer surface were often only one-celled, immature; paraphyse tips not so acute; asci with young, short spores; excipulum textura prismatica, cells about 21 × 4.5 µm; hairs cylindrical (mostly slightly gradually tapered towards tip), 40–54 × (3.5–)3.8–4.8 µm; asci arising from croziers, 45–53 × (3.2–)3.5–4.3 µm; ascospores (6.2–)6.5–7.3(–7.9) × (1.4–)1.7–1.8 µm; paraphyses lanceolate, with subacute tips, (2.9–)3.2–4.1(–4.5) µm in diam., exceeding the asci by (6.5–)8–13.7 µm.

The material in both syntypes is conspecific and agrees well with the original description of *L. corylinum*. The size of apothecia and short hairs indicate *Lachnum pygmaeum*. Only the asci are, also in agreement with the protologue, shorter than in *Lachnum pygmaeum*. Both specimens contain several apothecia. The specimen PRM 151434 was indicated by Velenovský in herb. as "origin." and is designated here a lectotype.

Published records: Velenovský 1947: 131 (vicinity of Mnichovice, on decaying trunks of *Corylus avellana* – revised, see Type studies).

Material revised: [Central Bohemia, Mnichovice], "Lehman – in dumetis", on trunk of *Corylus* [*avellana*], 25 July 1940, leg. et det. J. Velenovský, PRM 151434 (lectotype of *Lachnum corylinum*). – [Central Bohemia, Mnichovice], "Brožek", on trunk of *Corylus* [*avellana*], August 1940, leg. J. Velenovský et V. Vacek, det. J. Velenovský, PRM 151582 (syntype of *Lachnum corylinum*).

Lachnum crataegi Velen. Fig. 3.

Lachnum crataegi Velen., Monogr. Discom. Bohem., p. 248, 1934.

Description. Dried apothecia mostly of similar shape as *L. pudibundum* (stalk as long as apothecium diam.), 0.45–0.95(–1.8) mm high, 0.45–1.25 mm wide, sometimes disc flattened and folded in marginal part (then apothecia 0.5–0.6 mm high and 1.3–1.65 mm wide). Outer surface dark brown, very densely covered with white, rarely pastel white-brown, medium long hairs (only when too old already in the field then hairs brown). Discs dark brown. Hairs hyaline (only rarely secondarily becoming brown), warted (also apices), apically capitate or less frequently slightly clavate or cylindrical or rarely attenuated towards apex, 49–83 × (3–)3.5–5.7 µm. Asci arising from croziers, 41.5–58 × 3.7–5.2 µm, KOH/MLZ+. Ascospores fusiform, 6.2–8.8 × 1.5–2.1 µm. Paraphyses lanceolate, 3–5 µm wide, acute with very narrow rounded tips, exceeding the asci by 11–31(–35) µm.

Comments. See discussion under *Lachnum fasciculare*. *Lachnum crataegi* is surely not conspecific with *Lachnum fasciculare* ss. Le Gal, and is more close to *Lachnum fasciculare* in its original sense. Its differences from *Lachnum fasciculare* in its original sense are mainly in characters of dried apothecia observed under a stereomicroscope and in measurements of paraphyses. However, these features are possibly not correlated (see specimen PRM 148663 under Comments on studied type material) and perhaps *Lachnum crataegi* belongs to the synonymy of *Lachnum fasciculare*.

Comments on studied type material. Velenovský (1934) added to the name *L. crataegi* the note "(*L. xanthippae* Vel. in herb.)". The specimen marked "*L. xanthippae*" (PRM 149301) and other specimens agreeing with the habitat given in the protologue are syntypes. The lectotype (PRM 149301, designated here) agrees very well with Velenovský's description and illustration. The other syntypes contain material of various species – e.g. *Lachnum pudibundum* (on *Salix*: e.g. PRM 149158; on *Fraxinus*: PRM 149193), *Dasyscyphella* sp. (on *Quercus*: PRM 148332), and material in poor condition (on *Sorbus*: PRM 152029).

Lectotype of *L. crataegi* Velen. (PRM 149301). Dried apothecia in comparison with "*L. fulvellum*" and specimen PRM 148663 (described below) relatively short-stalked, (0.45–)0.6–0.8 mm high, (0.65–)1.05–1.25 mm wide and robust (not slender) when 'young' (not opened), 0.5–0.6 mm high and 1.3–1.65 mm wide when opened, discs large, flat, in marginal part often folded, outer surface dark brown, but very densely covered with white or pastel brown, medium long hairs, discs dark brown. Hairs hyaline or secondarily becoming brown, but not pigmented, warted (also apices), mostly capitate, less frequently clavate, rarely cylindrical (all types present in one apothecium), 49–83 × (3.5–)4.3–5.7 µm. Asci arising from croziers, 50–58 × 3.7–4.5 µm. Ascospores fusiform, 6.2–8 × 1.6–1.8 µm.

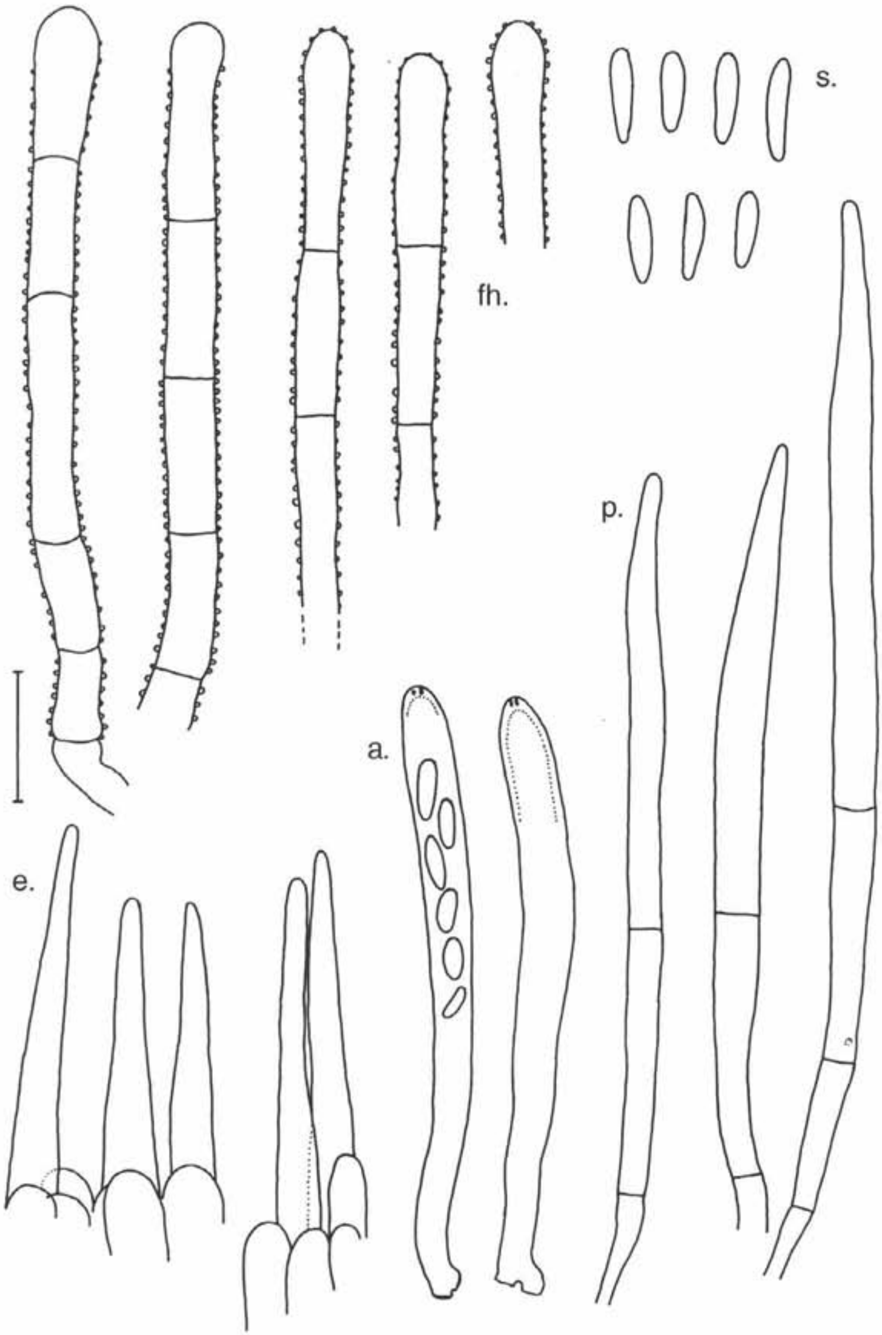

Fig. 3a. *Lachnum crataegi* Velen., PRM 149301 (lectotype). Scale bar = 10 µm.

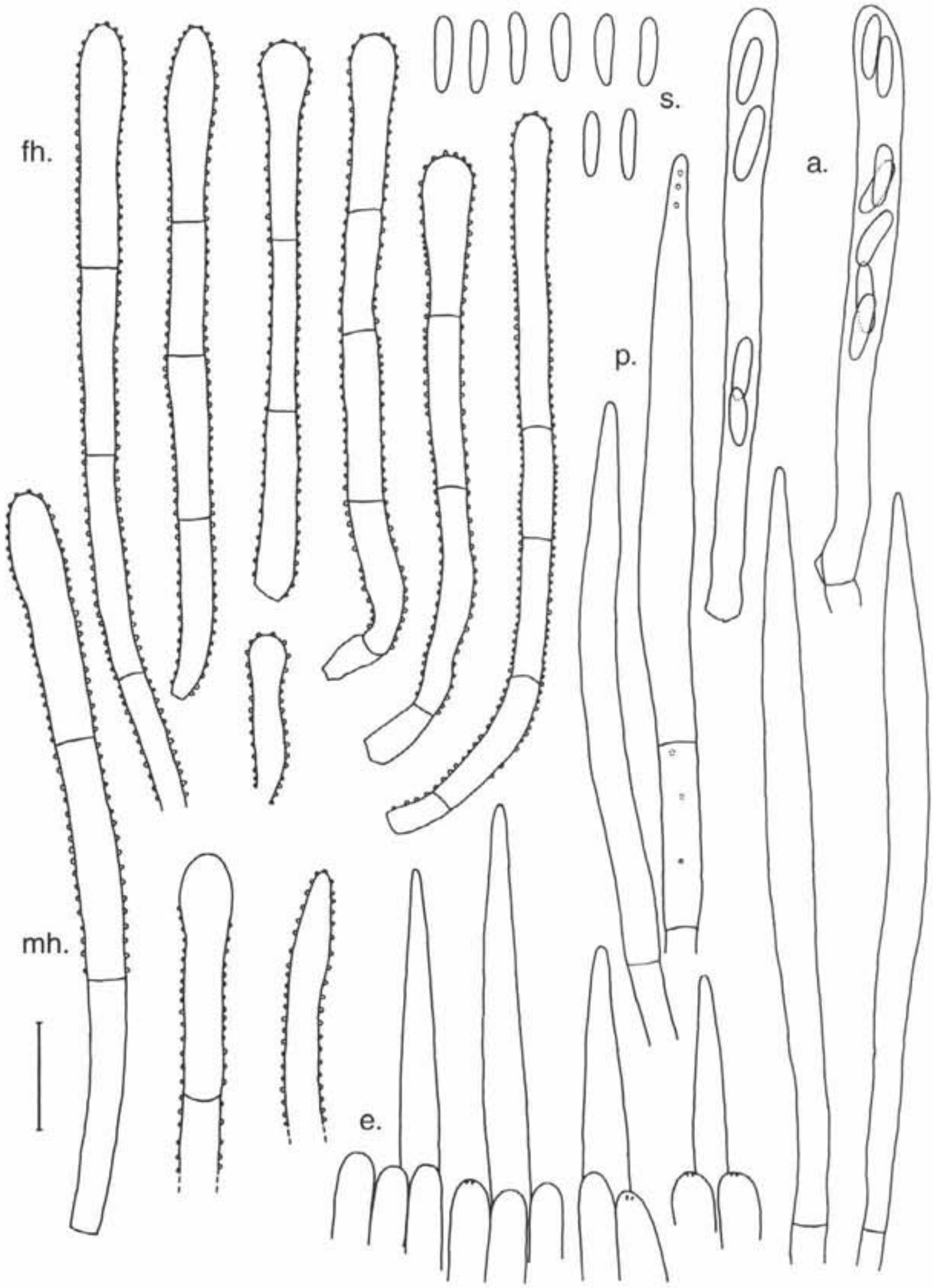

Fig. 3b. *Lachnum crataegi* Velen., PRM 149301 (lectotype). Preparation from a piece of another apothecium. Scale bar = 10 µm.

Paraphyses lanceolate, acute-shaped, but rounded at the narrow tips, 3.5–4.3(–4.8) µm wide, exceeding the asci by 12.5–29.5 µm.

Specimen PRM 148663 (syntype of *Lachnum alneum* Velen., Monogr. Discom. Bohem., p. 247, 1934; non the true *L. alneum* Velen., l. c. which is *Dasyscyphella* sp.) contained big, robust, not yet opened apothecia, up to 1.8 mm high, up to 1.1 mm in diam., very densely covered with pastel brown, in their upper parts whitish hairs. The apothecia were much more robust and hairy than in the B-type of the lectotype of "*L. fulvellum*" (see comments on *L. corylinum*), but the discs were dark, of the same colour. Hairs warted (also apices), almost regularly capitate, 74–83 × (3–)3.6–5.2 µm. Asci arising from croziers, 46–57 × 4.7–5.2 µm. Ascospores fusiform, 6.6–8.8 × 1.5–2.1 µm. Paraphyses lanceolate, 3–4.3 µm wide, exceeding the asci by (7–)11–17.5 µm. The material resembles *Lachnum crataegi* by robust, rich-hairy apothecia, pastel brown colour of dried hairs and capitate hair apices, but the length of paraphyses is more close to *Lachnum fasciculare* in its original sense described below.

Published records: Velenovský 1934: 248 (as a common species, on wood of *Betula*, *Quercus*, *Sorbus*, *Salix*, *Cornus* and *Crataegus* – most specimens revised, results of revision see under Comments on studied type material).

Material revised: Central Bohemia: Hlásná Třebáň, on hard wood of a deciduous twig, 5 August 1945, leg. et det. M. Svrček, PRM 816351. – [Central Bohemia: Praha-] Kosoř – Choteč, [on piece of wood of *Alnus*,] May 1924, leg. J. Velenovský, PRM 148663 (syntype of *Lachnum alneum*; non *L. alneum*). – [Central Bohemia:] Mnichovice, [on wood of] *Betula*, August 1928, leg. et det. J. Velenovský, PRM 149301 (lectotype of *Lachnum crataegi*).

Lachnum fasciculare Velen. – chlupáček svazčitý   Fig. 4.

Lachnum fasciculare Velen., Monogr. Discom. Bohem., p. 247, 1934.
Syn.: *Lachnum fulvellum* Velen., Monogr. Discom. Bohem., p. 247, 1934.

Description. Dried apothecia mostly relatively long-stalked, brown or flesh coloured, covered with pale beige brown hairs, stalks often distorted, discs dark brown sometimes with wine-red tint. Hairs warted, mostly cylindrical or only slightly capitate, mostly 3-septate, hairs (46–)56–86 × 3.2–5.6 µm. Asci arising from croziers, 42–54 × 3.6–5.4 µm, KOH/MLZ+. Ascospores fusiform, 6.2–9.4 × 1.6–2.2 µm. Paraphyses lanceolate, 2.4–4.2 µm wide, exceeding the asci by 5–17(–20) µm.

Comments. *Lachnum fasciculare* differs from *Lachnum pudibundum* by asci arising from croziers. Differences between *Lachnum fasciculare* and *L. crataegi* are mainly in the length of paraphyses (see key). In comparison with *Lachnum fasciculare*, apothecia of *Lachnum crataegi* are less gregarious and shorter stalked, resembling *Lachnum pudibundum*, but have darker discs than *Lachnum pudibundum*.

Paraphyses with brown internal droplets are given in the literature (Le Gal 1939, Dennis 1949, Vesterholt 2000) for *Lachnum fasciculare* sensu Le Gal (1939). Also Velenovský (1934) described the droplets and illustrated them in a drawing. In the studied, old material of *Lachnum fasciculare* and *L. crataegi* no droplets were found, however, the observed secondary brown-coloured hymenium indicates their presence in fresh material.

In comparison with studied long-paraphysed species from the Czech Republic, *Lachnum fasciculare* ss. Le Gal has shorter hairs than *Lachnum crataegi* and narrower paraphyses than *Lachnum pudibundum*. Information about ascus bases is unfortunately not given. Brown internal droplets in the paraphyses reported for *Lachnum fasciculare* ss. Le Gal indicate rather *L. crataegi* than *L. pudibundum*. I do not presume such conspicuous brown droplets in fresh material of *Lachnum pudibundum*, because the dried discs of *L. pudibundum* are of paler colours than in *Lachnum crataegi* and *Lachnum fasciculare*. Baral (2003: keys) distinguished in *Lachnum fasciculare* two possibly separate species. One with living asci 43–55 µm long, hairs 50–85 µm long, paraphyses 4.5–7 µm broad, protruding by 15–30 µm, and the other one with living asci 48–70 µm long, hairs 70–110 µm long, paraphyses 3–5 µm broad and protruding by 3–20 µm. The characters of the first one indicate *Lachnum fasciculare* ss. Le Gal and the second one (see also Baral 2003: HB 7106) is *Lachnum fasciculare* in its original sense. Hairs in *Lachnum crataegi* are not shorter than in *Lachnum fasciculare* (cf. the key characters by Baral), on the contrary, and they are also not so short as given in the previous literature: 25–60 µm (Le Gal 1939, Dennis 1949, Vesterholt 2000). Also asci in *Lachnum crataegi* are rather larger and not smaller in comparison with *Lachnum fasciculare* (cf. Baral 2003: keys). Therefore *Lachnum crataegi* (though long- paraphysed) is not conspecific with *Lachnum fasciculare* ss. Le Gal, the latter species has not yet been reported from the Czech Republic.

Type studies and comments on studied type material. *Lachnum fasciculare* has two syntypes, both explicitly cited in the protologue. Asci in the specimen PRM 150796 (lectotype indicated by Svrček in herb., proposed by Baral (2003: HB 7184), formally designated here) arise from croziers, in the specimen PRM 151529 (see under *L. pudibundum*) they arise from simple septa. The former is selected as a lectotype because the ascus bases as drawn by Velenovský (1934) indicate that the illustrated material had asci with croziers. From Velenovský's manuscripts it is clear that the description, measurements and drawing come from specimen PRM 150796 (lectotype). Velenovský only combined the width of hairs of both specimens. In his measurements it was 2.5–3 µm for PRM 150796 (*L. fasciculare*), 5 µm for PRM 151529 (*L. pudibundum*) and 2–4 µm in the publication (Velenovský 1934).

Dried apothecia of the lectotype of *L. fasciculare* are mostly relatively long-stalked, brown, densely, but not fully covered with beige-brownish hairs, has stalks which are often somewhat distorted and relatively densely covered with standing out, brownish hairs. Hairs warted, mostly cylindrical or only slightly capitate – apices can be smooth, mostly 3-septate, hairs (46–)56–76 × 3.7–4.6 µm, marginal hairs 50–73 µm long, flank hairs 56–76 µm long. Asci arising from croziers, 42–48 × (3.7–)3.9–4.3 µm, KOH/MLZ+. Ascospores fusiform, 6.2–7.5 × 1.6–2 µm. Paraphyses lanceolate, 2.4–3.2 µm wide, exceeding the asci by 6.9–17 µm.

In the protologue of *Lachnum fulvellum* (Velenovský 1934) four syntypes were cited, which are kept in the PRM herbarium (PRM 150122, 149127, 151619, 147742). The specimens PRM 150122 and 149127 were identified by H.O. Baral as conspecific and agreeing with the protologue of *Lachnum fulvellum*. Substrates of PRM 149127 ('in trunco putrido salicino prope Kosoř' as published by Velenovský 1934) and PRM 150122 were identified by him as *Alnus*. He (Baral, pers. comm.) selected the specimen PRM 150122 (lectotype designated here by H.O. Baral) as lectotype (for description and drawing see Baral 2003: HB 7106), because it contains rich material while the second specimen (PRM

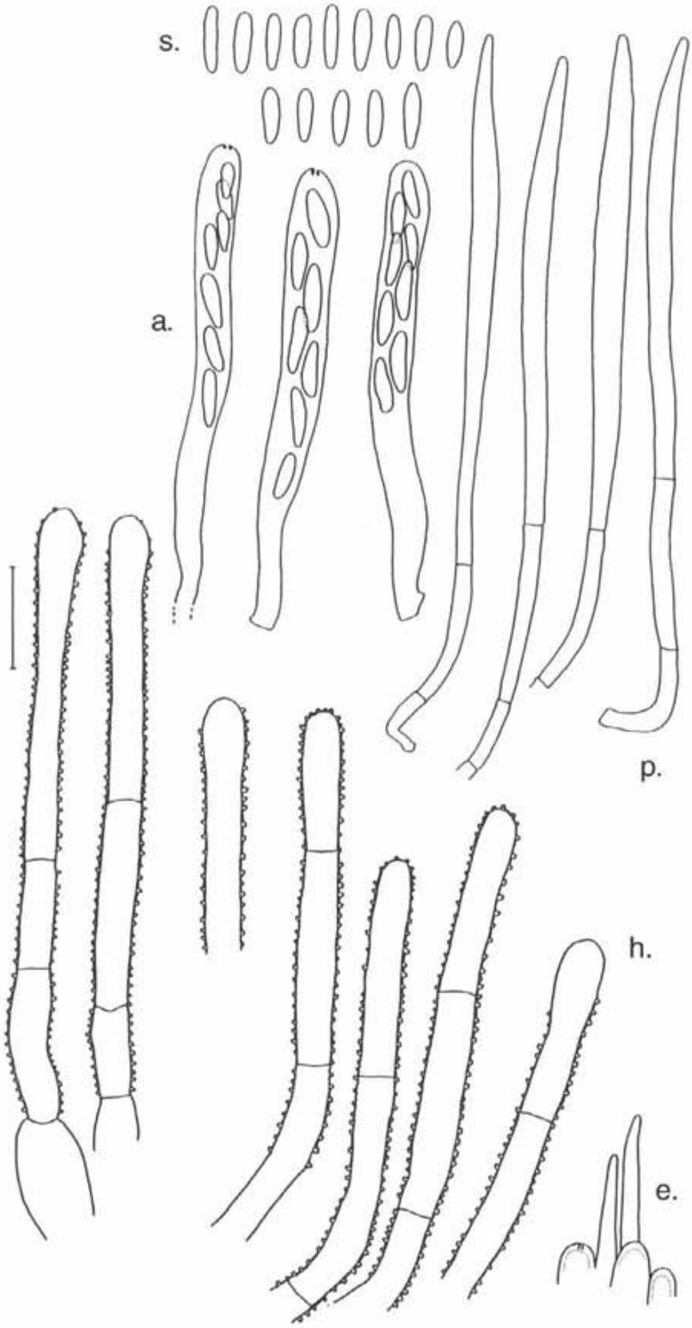

Fig. 4. *Lachnum fasciculare* Velen., PRM 150796 (lectotype). Scale bar = 10 µm.

149127) contains only 2 strongly overmature apothecia. The substrate of the third type specimen ('in trunco salicino pr. Zdice', PRM 151619) was confirmed by H.O. Baral to be *Salix* and the fungus is, according to him, *Lachnum* aff. *impudicum*, which differs from *L. impudicum* by the form of the ascospores. I recently identified the material as *Lachnum pubescens*. The fourth type specimen (PRM 147742, 'in ramis quercinis prope Mnichovice') contains 10 apothecia of *Lachnum virgineum*.

The largest part of the original description of *Lachnum fulvellum* (Velenovský 1934: 247) and probably also the drawing of an apothecium originated from the specimen 'in trunco putrido salicino prope Kosoř' (PRM 149127) according to Velenovský's manuscript. The drawing of a non-capitate hair belongs to the specimen PRM 151619 (recently identified as *Lachnum pubescens*) and a capitate hair belongs to a collection from *Rubus* under Ondřejov ('na ostružinách pod Ondřejovem VI. 1925, ?', PRM 149703), which Velenovský (1934) left unpublished.

Dried apothecia of the lectotype of *L. fulvellum* (PRM 150122) are very long-stalked, up to 1.5(–2.8) mm high and 1.45 mm in diam. The outer surface of cup and stalk are beigeish flesh coloured and hairy (hairs pale pastel brown), the disc is dark wine brown, stalks are often distorted. Hairs have secondarily become brown (excl. apices); warted; 56–86 × (2.7–)3.2–5.6 µm; mostly slightly capitate, but also cylindrical hairs and at margin also hairs with pointed apices (then completely warted) present; hair apices mostly (slightly refractive) hyaline and smooth [also Velenovský (1934) demonstrated this feature in an illustration]. Hymenium have also secondarily become brown. Asci arising from croziers, about 46–54 × 3.6–5.4 µm. Ascospores fusiform, 6.2–9.4 × 1.7–2.2 µm. Paraphyses lanceolate, with subacute (rounded) apices, 2.4–4.2 µm wide, exceeding the asci by (0.2–)5–12(–20) µm.

Published records: Velenovský 1934: 247 (as *Lachnum fasciculare*: Stránčice, Sv. Anna, *Alnus*; Mnichovice, Velenovský's garden, *Corylus*; as *Lachnum fulvellum*: Kosoř, *Salix*; Ondřejov, *Quercus*; Zdice, *Salix* – revised, see Type studies and comments to studied type material).

Material revised: [Central Bohemia:] Stránčice, Sv. Anna, *Alnus* [wood], 31 May 1928, leg. et det. J. Velenovský, PRM 150796 (lectotype of *L. fasciculare*). – [Central Bohemia: Ondřejov,] "duby pod Ondřejovem" [oaks under Ondřejov; on wood of *Alnus*, host det. H.O. Baral], 4 June 1924, leg. et det. J. Velenovský, PRM 150122 (lectotype of *Lachnum fulvellum*).

Lachnum impudicum Baral — Fig. 5.

Lachnum impudicum Baral in Baral et Krieglst., Beih. Z. Mykol. 6: 77, 1985.

Description. Dried apothecia cup-shaped, 0.5–1.4 mm high, cups patelliform, 0.2–1.4 mm in diam., discs yellowish orange (dark yellow, 4–A8), outer surface of apothecia pale orange yellow (4–A6), covered with short, white hairs. Hairs hyaline, cylindrical or with only very slightly enlarged apices, marginal hairs (37–)43–55.5(–57) × 3–3.8 µm, flank hairs (41–)46.5–68(–74) × (3–)3.2–3.9(–4.1) µm, up to 3-septate. Asci arising from croziers, (31–)34–43.5 × (3.3–)3.5–4.1 µm, KOH/MLZ+. Ascospores one-celled, (4.5–)4.8–6.3(–6.6) × 1.2–1.8 µm. Paraphyses narrowly lanceolate, with obtuse to subacute ends, (2.1–)2.4–3.1(–3.3) µm wide, exceeding asci by 5–11.2 µm.

Comments. The material (PRM 907122) is surely conspecific with *Lachnum impudicum* in its original sense, represented for the purpose of my study by descriptions, drawings and ecological data by Baral (in Baral and Krieglsteiner 1985) and Baral (2003). However, it seems very probable, that the material is only a younger representative of *Lachnum pubescens*. In comparison with *L. pubescens* it yields only slightly smaller values in all characters. *Lachnum*

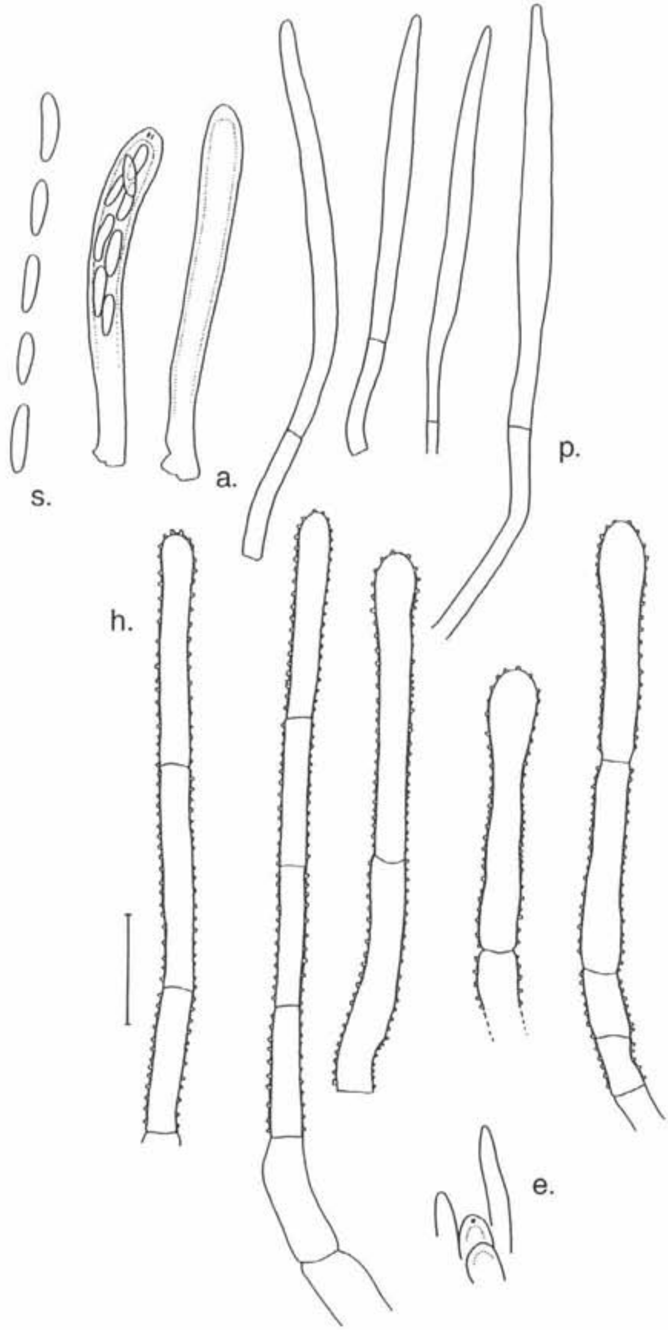

Fig. 5. *Lachnum impudicum* Baral, PRM 907122. Scale bar = 10 µm.

impudicum possibly belongs to the synonymy of *Lachnum pubescens*. Only the phenology of *L. pubescens* does not agree with data (September – May) given for *Lachnum impudicum* by Baral (in Baral and Krieglsteiner 1985) and Baral (pers. comm.), because I revised also collections of *Lachnum pubescens* from summer.

Material revised: Southern Bohemia: Českomoravská vrchovina, Protected Landscape Area Třeboňsko, 4.3 km ENE of the village of Libořezy, Fabián nature reserve, alt. 590–610 m, on lying log of *Fagus sylvatica*, 18 October 2003, leg. M. Tůmová, det. M. Suková, PRM 907122.

Lachnum papyraceum (P. Karst.) P. Karst.

Peziza papyracea P. Karst., Not. Sallsk. Faun. Fl. Fenn. Förh. 10: 193, 1869. – *Lachnum papyraceum* (P. Karst.) P. Karst., Bidrag Kännedom Finlands Natur Folk 19: 169, 1871.

Description (BRNM 50800). Dried apothecia dark brown, 0.4–0.55 mm in diam., 0.9–1.1 mm high, with not very dense short concolorous to whitish hairs, long-stalked, stalks mostly thin. Hairs hyaline, densely warted, cylindrical, 38–70 × 2.9–4 µm. Asci not observed. Ascospores hyaline, fusoid, 4.6–7.5 × 1.5–1.9(–2.3) µm. Paraphyses narrowly lanceolate, not more than 2 µm wide.

Comments. This species (according to Karsten 1871: 169, Dennis 1949 and Vesterholt 2000) is characteristic by its small ascospores, 4–6 (3–7) × 1–1.5 µm, apothecia becoming brown on drying and its occurrence on coniferous substrata. Apothecia 0.5–3 mm in diam. with 0.7–1 mm long, slender stalks, asci 35–50 × 3–4 µm, hairs 40–50(–80) × 3 (2–4) µm, paraphyses 2 or 3–4 µm wide and exceeding by up to 10 µm are given in the literature. Baral (2003) reported asci arising from croziers and guttules in living hairs and paraphyses. The guttules are responsible for the brown colour of the dried material. *Lachnum pygmaeum* from coniferous wood differs by longer asci.

Published records: Velenovský 1934: 245 (as a common species, on cones of *Pinus*, *Picea* and *Larix*, twigs of *Picea* and *Juniperus*) – revised, one of the revised specimens belongs to *Dasyscyphella conicola* (PRM 152023), other specimens to *Lachnum virgineum* (PRM 147696, 148990, 151412, 152056), *Lachnum pudibundum* (PRM 148591) and possibly to *Lachnum* cf. *papyraceum* (PRM 151651).

Material revised: Central Bohemia: Karlštejn, Bubová [Boubová, on cone of *Pinus*], May 1925, leg. et det. J. Velenovský (as *Lachnum conisedum* Velen. in herb.), PRM 151651 (material in poor condition, microcharacters not seen). – Moravia: Lomnice near Tišnov, below Sýkoř hill, valley of Krčalovský potok (brook), *Abieto-Fagetum*, alt. 500 m, on wood of trunk of *Abies*, 18 October 1946, leg. et det. F. Šmarda, BRNM 50800.

Lachnum pubescens (Rehm) Svrček – chlupáček pýřitý Fig. 6.

Dasyscypha pubescens Rehm, Ascomyceten in Rabenhorst's Krypt.-Fl. Deutschl., Oest. und Schweiz, 1/3: 836, 1893. – *Lachnum pubescens* (Rehm) Svrček, Česká Mykol. 43: 225, 1989.

Description (incl. holotype from herb. S). Dried apothecia stalked, cup-shaped, 0.8–1.4 mm high, 0.4–1.4 mm in diam., discs orange to brick or brownish orange, outer surface of apothecia white with pale beige brown tint or pale orange,

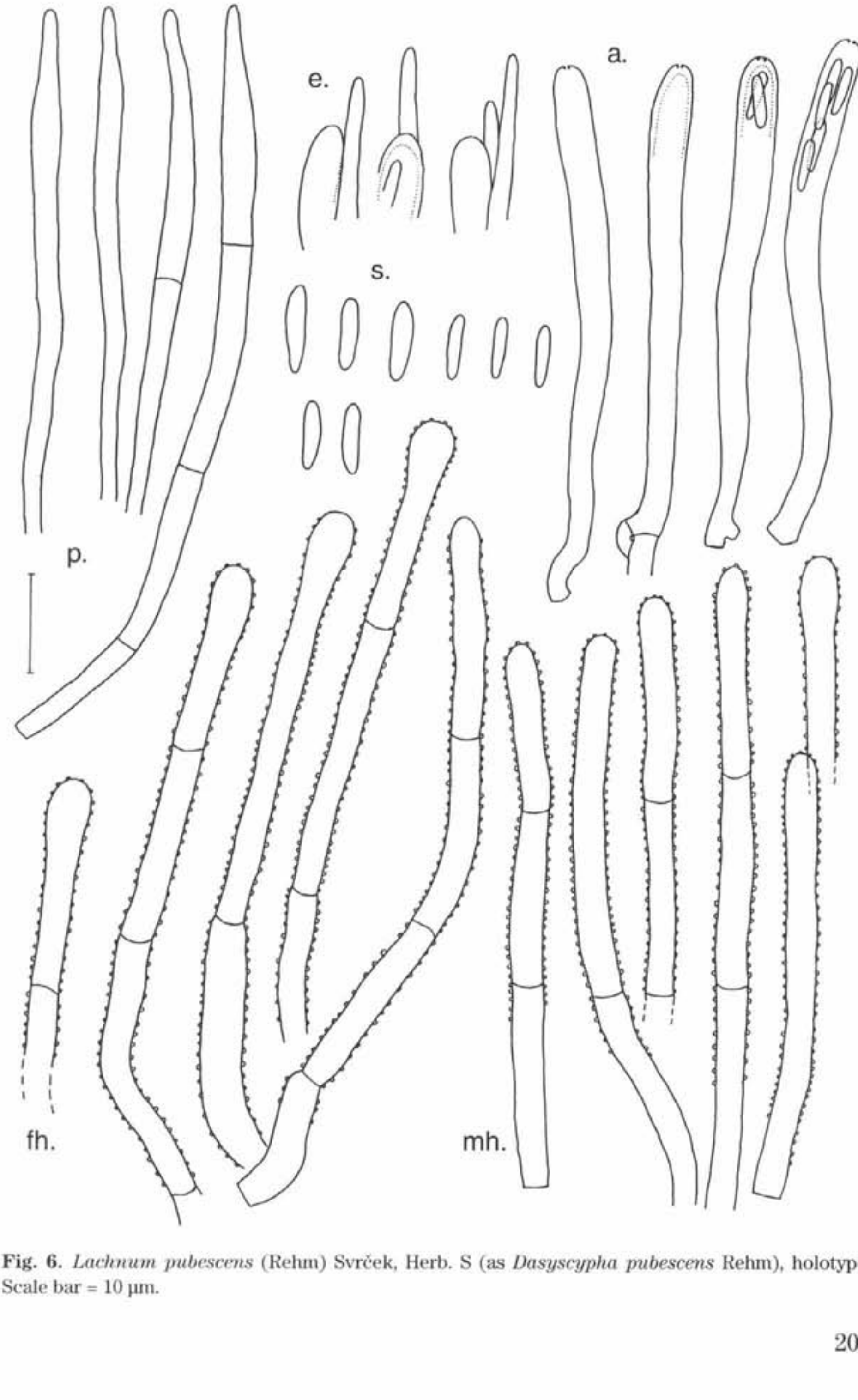

Fig. 6. *Lachnum pubescens* (Rehm) Svrček, Herb. S (as *Dasyscypha pubescens* Rehm), holotype. Scale bar = 10 µm.

covered with short, white hairs. Hairs hyaline, cylindrical or slightly clavate or slightly capitate, up to 3-septate. Marginal hairs (41.5–)47–60(–63) × (2.9–)3.2–4.4(–5.0) µm, flank hairs (52.5–)59–76(–80) × (2.6–)3.2–4.6(–5.1) µm. Asci arising from croziers, 45–51.5(–52.7) × 3.5–4.7(–5.3) µm. Ascospores one-celled, (6.1–)6.6–8.1(–9.3) × 1.4–2.1 µm. Paraphyses narrowly lanceolate to lanceolate, (2.0–)2.3–3.3(–4) µm wide, exceeding the asci by 3.3–12.6 µm.

Comments. In the past, *Lachnum pubescens* was not distinguished from *Lachnum brevipilosum*. *Lachnum brevipilosum* differs from it by asci arising from simple septa, wider ascospores, a more constant size of apothecia and a mostly pastel yellow (not orange) colour of discs. Macroscopically, dried *Lachnum pubescens* is somewhat similar to *Lachnum* sp. (see under *Lachnum pygmaeum*) due to the presence of big apothecia and coloured discs. However, it differs from *Lachnum* sp. in occurring directly on wood and from *Lachnum pygmaeum* s. str. in shorter asci and shorter ascospores.

The name, *Dasyscypha pubescens*, was mentioned in literature as a possible earlier synonym of *Lachnum brevipilosum* and *Lachnum impudicum*. Baral (in Baral and Krieglsteiner 1985) suggested that *Dasyscypha pubescens* may be an earlier synonym of *Lachnum brevipilosum*. Svrček (1989) identified his personal collections (see under Published records) with the protologue of *Dasyscypha pubescens* and combined the epithet *pubescens* into *Lachnum*. Svrček (1989) presented in his discussion the idea that *Lachnum brevipilosum* and *Lachnum impudicum* are probably synonyms of *Lachnum pubescens*. Rehm's original description seems to indicate rather *Lachnum brevipilosum* according to spore width (2.5 µm). However, revision of the type specimen of *Dasyscypha pubescens* (see Type study below) showed that *Lachnum pubescens* differs from *Lachnum brevipilosum* by asci arising from croziers and ascospores up to 2 µm wide and, moreover, that it also differs from *Lachnum impudicum*. In comparison with the protologue of *Lachnum impudicum* (Baral in Baral and Krieglsteiner 1985), the type of *L. pubescens* has slightly longer marginal hairs, slightly longer ascospores and wider paraphyses, for all that the protologue is based on characters of fresh material (marginal hairs 40–60 µm, paraphyses 2.5–3.5 µm wide, ascospores 5–7(–8) × 1.5–2.3 µm). Baral (2003: keys) reported fresh ascospores 5–9 × 1.5–2.3 µm for *L. impudicum*. Ascospores of *L. impudicum* examined in slides from dried material using KOH measure 4.5–7.5 × 1.7–2 µm according to Baral (2003: HB 6867, HB 6868) and 4.5–6.6 × 1.2–1.8 µm according to my description of *Lachnum impudicum*. Baral (in Baral and Krieglsteiner 1985) originally described *Lachnum impudicum* as a species occurring during the winter (October – April) on deciduous wood, most frequently on *Fagus*, but also on *Fraxinus*, *Quercus*, *Alnus*, *Salix*, *Populus* and ?*Robinia*. The type of *Lachnum pubescens* was collected in October on *Salix* and other studied specimens of *Lachnum* *pubescens* from the Czech Republic date from June, July and October, and come from *Acer*, *Alnus*, *Carpinus*, *Quercus* and *Salix*.

Type study. *Dasyscypha pubescens* Rehm nov. spec., Rinkerode, on decorticated twig of *Salix* (host det. M. Suková et H.O. Baral), 22 October 1890, leg. G. Lindau, Herb. S (reg. no. F 63/2). The original notes on characters and measurements written in pencil within the type specimen fit well with the protologue (e.g. measurements of ascospores 6–8 × 2.5 µm) and indicate that the specimen is really the holotype of *D. pubescens*. The type contains many apothecia, 0.9–1.4 mm high, 0.7–1.4 mm in diam., with short, white hairs, orange discs and paler orange or pale beige outer surface. Description based on studied fragments from two apothecia: Hairs hyaline, not becoming brown, cylindrical or especially flank hairs with very slightly enlarged apices. Marginal hairs 55–63 × 3.1–3.7 µm, up to 2–septate, flank hairs (52–)56–76(–80) × (3.3–)3.7–4.7(–5.1) µm, up to 3–septate. Asci arising from croziers, 45–52 × 3.7–5.3 µm. Ascospores one-celled, in one apothecium (6.1–)6.4–7.6(–8.2) × 1.4–1.8(–1.9) µm, in the other apothecium (6.6–)7–8.1(–8.7) × 1.6–1.9(–2.0) µm. Paraphyses narrowly lanceolate to lanceolate, 2.3–3.0 µm wide and exceeding by (3.5-)4–8(-10.5) µm in the first apothecium, 2.8–3.8(-4.0) µm wide and exceeding by 6.5–10.5 µm in the second apothecium.

Published records: Svrček 1989: 225 (Central Bohemia, nature reserve Kohoutov near Jablečno, on fallen trunks of *Fagus sylvatica*, 28 September 1988 – not revised, however the published description strongly indicates that it could have been *Lachnum impudicum*; Southern Bohemia, Šumava Mts., Boubínský prales virgin forest, on fallen trunks of *Fagus*, 7 June 1979 – not revised, however the description, except for the presence of numerous crystals resembling those of *Dasyscyphella nivea*, seems to indicate *Lachnum pubescens*).

Material revised (in herbarium mostly as *Dasyscypha brevipila* Le Gal): Central Bohemia: Zdice, on trunk of *Salix* (host rev. H.O. Baral), October 1933, leg. F. Fechtner, det. J. Velenovský (as *Lachnum fulvellum*), PRM 151619 (syntype of *L. fulvellum*). – NE of Rakovník, SSE of Řevničov, NNW of Horní Kracle pond, *Carpinus* forest with *Betula* and *Picea*, on wood of lying decorticated deciduous twigs, 14 October 2005, leg. et det. M. Suková, PRM 907372. – Southern Bohemia: Soběslavská blata (bogs) near Soběslav, on wood of *Acer* sp. (host det. A. Chlebicki), 21 October 1950, leg. F. Kotlaba, PRM 901958 (as *Lachnum pygmaeum*). – Smržov near Lomnice nad Lužnicí, by pond Dvořiště, on radicle of *Quercus*, 3 June 1960, leg. et det. M. Svrček, PRM 522591. – Třeboň, Alnetum "U Jindrů", on *Alnus glutinosa* (host rev. A. Chlebicki), 6 June 1959, leg. M. Svrček, PRM 614081. – Northern Moravia: Rychlebské hory Mts., Račí údolí (valley), wet ground on right bank of Račí potok (brook), stand with *Quercus*, *Carpinus*, *Salix*, *Fraxinus*), alt. 300 m, on dead distorted twigs or roots (cf. *Carpinus*, but wood in poor condition because of lying in mud, rev. A. Chlebicki), 28 July 1961, leg. K. Kříž, PRM 615929 – this specimen contains old apothecia with apically enlarged hairs and a lacking hymenium (only plenty of ascospores (5.5–)7–9(–10.3) × 1.2–1.4 µm) which cannot be identified, and young to mature apothecia of *Lachnum pubescens* with pale orange discs.

Lachnum pudibundum (Quél.) J. Schröt. – chlupáček stydlivý Fig. 7.

Erinella pudibunda Quél., C. R. Ass. Franç. Av. Sci. (Grenoble) 14(2)[1885]: 452, 1886. – *Lachnum pudibundum* (Quél.) J. Schröt., Krypt.-Fl. Schlesien 3/2: 91, 1908.

Description from deciduous trees and shrubs. Dried apothecia 0.48–1.4 mm high, 0.35–0.85(–1.00) mm in diam., stalked, cup-shaped, discs brownish orange (cf. orange 6–B6 to 6–B7) or pale reddish brown, outer surface concolorous, but not so deeply coloured and densely covered with white or whitish, less frequently brown hairs, cups not collapsing on drying. Hairs hyaline, warted (apices sometimes with scarce warts or smooth), capitate and less frequently cylindrical, (34–)40–63 × 3–5.7 µm, (1–)2–4–septate. Asci arising from sim-

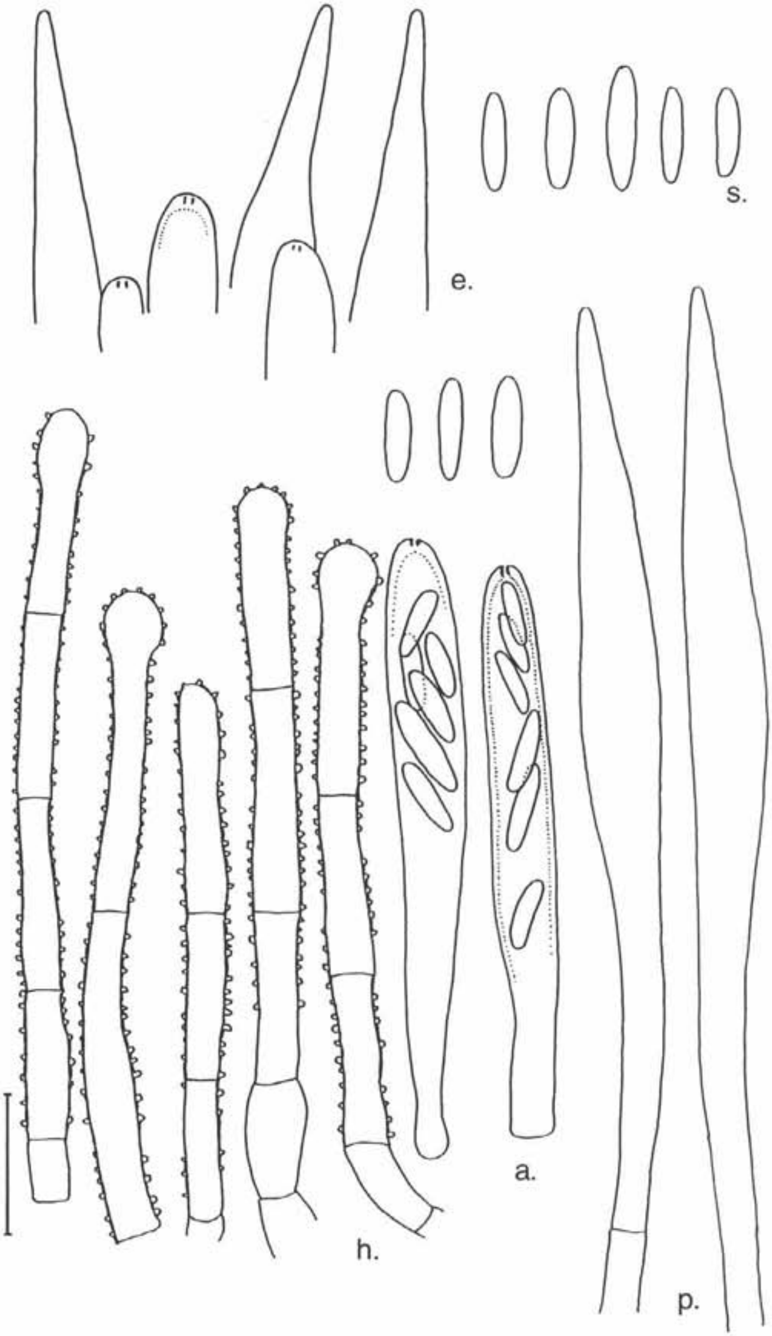

Fig. 7. *Lachnum pudibundum* (Quél.) J. Schröt., PRM 816341. Scale bar = 10 µm.

ple septa, 39–45.5 × 3.7–5 µm, 8–spored, KOH/MLZ+. Ascospores hyaline, one-celled, narrowly fusoid, 6.6–9.5 × 1.4–2.3 µm. Paraphyses lanceolate with sub-acute tips, 2.8–5.3(–6) µm wide, exceeding the asci by (7–)11–23(–31) µm.

Description from wood of *Pinus* (PRM 148591). Dried apothecia 0.48–1.1 mm high, 0.35–0.7 mm in diam., long-stalked, cup-shaped, discs dark reddish brown to wine brown, outer surface densely covered with pastel-brownish to whitish hairs, cups not collapsing on drying. Hairs hyaline, incrustate, cylindrical, (42–)59–67 × 4–4.5 µm, (1–)2–4–septate. Asci arising from simple septa, 44–56 × 4–5 µm, 8–spored, KOH/MLZ+. Ascospores hyaline, one–celled, narrowly fusoid, 7.5–10.5 × 1.9–2.2 µm. Paraphyses lanceolate with subacute tips, 2.8–3.8(–4.4) µm wide, exceeding the asci by 9.5–11.5 µm.

Published records: Svrček 1978: 78 as *Dasyscyphus pudibundus* (Quél.) Sacc. (5 localities in Southern Bohemia: Lomnice nad Lužnicí, pond Velký Tisý, on *Salix cinerea*; Třeboň, "U Jindrů", on *Alnus glutinosa*; Cetoraz near Pacov, pond Vlček, on *A. glutinosa* – revised; Nový Dvůr near Čimelice, on *A. glutinosa* – revised; Laziště near Čimelice, pond Tisíčky, on *Salix cinerea* – revised). – Svrček 1986: 14 (Western Bohemia, Vladměřice near Manětín, on *Alnus glutinosa*. – Papoušek 2004: 44 (Southern Bohemia, Třeboň, Mokrá vrata, on deciduous twig in virgin willow forest).

Material revised: Central Bohemia: Praha-Zbraslav, Károvské údolí, on twigs of *Ulmus* sp., 3 June 1945, leg. et det. M. Svrček (as *Lachnum crataegi*), PRM. – Zvánovice, "Zvánovické údolí" valley, on wood of *Pinus sylvestris* (coniferous wood, possibly *Pinus*, rev. A. Chlebicki), 5 August 1923, leg. et det. J. Velenovský (as *L. pinicolum* Velen. in herb., publ. as *L. papyraceum*), PRM 148591. – Chocerady, probably on *Salix*, June 1925, leg. et det. J. Velenovský (as *L. minutum* Velen. in herb., publ. as *L. crataegi*), PRM 149158. – Mnichovice, Velenovský's garden, on *Corylus* [possibly a root of *Rosaceae* according to Baral (2003: "*L. pudibundum* 7.29")], July 1929, leg. et det. J. Velenovský (as *Lachnum alneum* Velen. in herb., according to Velenovský's manuscripts syntype of *L. fasciculare*), PRM 151529 [revised and identified as *L. pudibundum* also by H. O. Baral (Baral 2003: "*L. pudibundum* 7.29")]. – Southern Bohemia: Laziště near Čimelice, pond Tisíčky, on *Salix* cf. *cinerea*, 27 July 1964, leg. et det. M. Svrček, PRM 613289, 613290. – Nový Dvůr near Čimelice, on fallen decorticated twig of *Alnus glutinosa*, 3 August 1964, leg. et det. M. Svrček, PRM 613292. – Bissingrov near Čimelice, on twigs of *Viburnum opulus*, 12 June 1961, leg. et det. M. Svrček, PRM 613938. – Cetoraz near Pacov, by pond Vlček, on corticated twig of *Alnus*, 2 August 1962, leg. J. Kubička, det. M. Svrček, PRM 568558 pro parte (the wide apothecium). – Třeboň, Alnetum "U Jindrů", on twig of *Alnus glutinosa*, 30 October 1965, leg. M. Svrček, PRM 610216 (as *Dasyscyphus crystallinus*).

Lachnum pygmaeum (Fr.: Fr.) Bres. Fig. 8, 9.

Peziza pygmaea Fr., Syst. Mycol. 2(1), p. 79, 1822. – *Peziza pygmaea* Fr.: Fr., Syst. Mycol. 2(1), p. 79, 1822. – *Lachnum pygmaeum* (Fr.: Fr.) Bres., Ann. Mycol. 1: 121, 1903.

Syn.: *Lachnum piceum* Velen., Monogr. Discom. Bohem., p. 245, 1934 (= *Lachnum pygmaeum* s. str.).

Description (based on material growing directly on wood; *Lachnum pygmaeum* s. str., Fig. 8). Dried apothecia 1–5 mm high, 0.3–2.5 mm in diam., very long-stalked, stalk often massive, up to 0.3 mm in diam., more or less covered with hairs, discs brownish orange (cf. orange 6–B6 to 6–B7), outer surface pale beige, orangeish to yellowish (pale orange to pale yellow, 5–A5 to 4–A5), covered with short whitish hairs. Hairs warted, cylindrical or gradually widened towards their apical part or with enlarged apices, up to 1–3(–4)–septate, (34–)42–60(–70) ×

(3.5–)3.7–4.9(–5.6) µm. Asci arising from croziers, (50–)53–73(–83) × (3.8–)4.1–5(–5.9) µm, KOH/MLZ+. Ascospores fusiform to narrowly fusiform, (5.7–)7.3–9.7(–12) × (1.5–)1.7–2.1(–2.3) µm (average 8.5 × 1.9 µm). Paraphyses lanceolate, (2.2–)2.9–4.1(–4.9) µm wide (average 3.5 µm), exceeding the asci by (5.5–)8.5–17.5(–25) µm. Very rarely a fine incrustation of paraphyse tips was observed (as frequent as one paraphyse per preparation – PRM 147371, 151997).

Description (based on material from other substrata with asci arising from croziers; *Lachnum* sp.). Dried apothecia 1.0–4.6 mm high, 0.3–2.6 mm in diam., very long-stalked, discs pale orange (5–A5), brownish orange (cf. orange 6–B6 to 6–B7) to wine brown (cf. violet brown, 11–E8), outer surface concolorous or paler, rarely pale yellow (4–A5) or becoming brown on drying, covered with short whitish hairs. Hairs warted, cylindrical or gradually widened towards their apical part, up to 2–3–septate, (16–)25–43(–49.5) × (3–)3.7–5 µm. Asci arising from croziers, 53–64 × 3.9–4.7 µm, KOH/MLZ+. Ascospores mostly fusiform, (5.6–)6.6–9.4(–10.5) × (1.3–)1.7–2.3(–2.5) µm (average 8 × 2 µm). Paraphyses lanceolate, (1.7–)2–2.9(–3.3) µm wide (average 2.45 µm), exceeding the asci by (2.5–)5.5–12(–14) µm.

Description (based on material from other substrata with asci arising from simple septa, incl. G 52853; *Lachnum rhizophilum* (Fuckel) Velen., basionym *Helotium rhizophilum* Fuckel, Fig. 9). Dried apothecia 3–6 mm high, 0.8–1.4 mm in diam., stalks very long, cups not collapsed, discs pale vermillion red and hairs conspicuous, or cups collapsed, discs and outer surface of cup dark ochraceous and apothecia seemingly glabrous. Hairs warted, cylindrical or slightly enlarged, (28–)30–48(–60) × 3.6–5.9 µm. Asci arising from simple septa, 65–75(–83) × 4.4–5.5(–6.2) µm. Ascospores fusiform to narrowly fusiform, (7.4–)9.3–12.5(–13.6) × (1.4–)1.8–2.2 µm (average 10.9 × 2 µm). Paraphyses lanceolate, (1.7–)2–2.8(–3.1) µm wide (average 2.4 µm), exceeding the asci by 3.5–16.5 µm.

Comments. *Lachnum pygmaeum* (s. l.) is characteristic by its big apothecia with very long stalks and short hairs on the outer surface of cup and stalk as well as by long asci (asci longer than 60 µm were observed in every specimen, although also shorter asci were usually present). Asci arise from croziers, however rarely also specimens with asci arising from simple septa can be found in the *Lachnum pygmaeum* complex, e.g. PRM 151970 (syntype of *L. piceum*, see Type studies below) from naked soil or HB 5693 reported by Baral (2003) from *Festuca cinerea* or the type of *Lachnum rhizophilum* from basal parts of a grass. The apothecia have cups mostly not collapsed when dried, with deeply ochraceous to wine red discs. The outer surface is covered with short, whitish hairs. The dried apothecia have rarely collapsed cups and scanty, macroscopically invisible hairs. Apothecia occur on various woody or graminoid (*Poaceae*, *Cyperaceae*) substrata which are in contact with soil and were observed also in a moss cushion (PRM 129023), but no connection with moss plants was demonstrable.

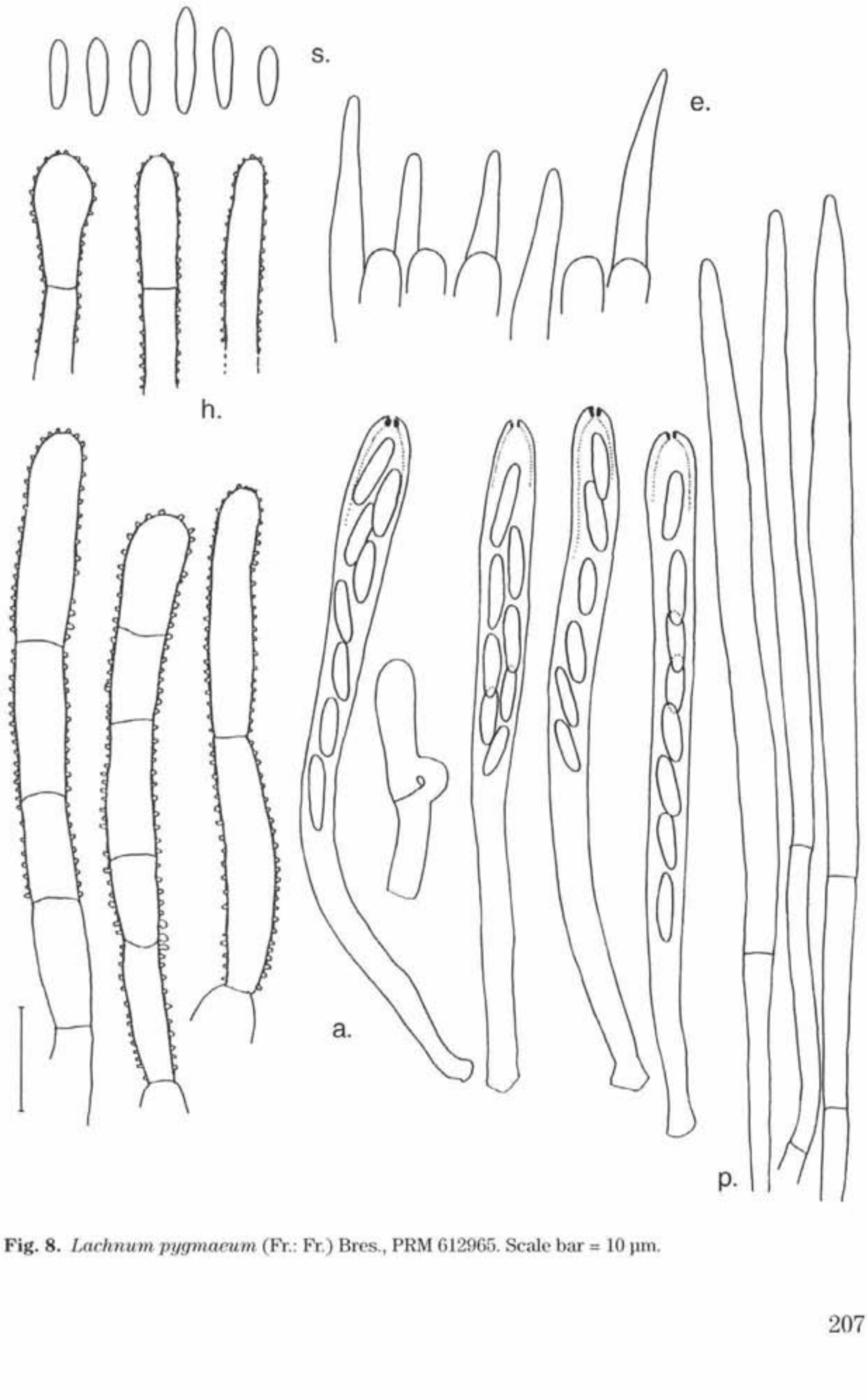

Fig. 8. *Lachnum pygmaeum* (Fr.: Fr.) Bres., PRM 612965. Scale bar = 10 µm.

In comparison with Vesterholt (2000), who reported paraphyses 4–5 µm broad and exceeding the asci by 15–25 µm, narrower and only slightly protruding paraphyses were observed in many specimens and of mature hymenia. All studied material well fits the description by Dennis (1949), who gave these measurements: paraphyses up to 5 µm broad, up to 25 µm protruding.

During the study of the *Lachnum pygmaeum* complex represented by many specimens in PRM there appeared to be differences between collections from woody substrata and those from non-woody substrata (soil [sometimes freely attached to wood], basal parts of *Poaceae*, *Cyperaceae*). The first group had wider and more exceeding paraphyses, and somewhat longer hairs and asci. The taxon from conifers should be named *Lachnum pygmaeum* (Fr.: Fr.) Bres. The species was described from a decaying trunk of *Picea* [as "ad truncum abiegnum"] (Fries 1822) without any information on microcharacters. The earliest name for the second taxon occurring on non-woody substrata seemed to be *Lachnum rhizophilum*, but the revised type specimen contains material with asci arising from simple septa, whereas for the specimens from non-woody substrata, asci arising from croziers are characteristic. Only one specimen from the Czech Republic with asci arising from simple septa belonging to *Lachnum rhizophilum* was studied.

Survey of names in synonymy of *Lachnum pygmaeum* (Fr.: Fr.) Bres. sensu lato, taken over from Bresadola (1903) and White (1942):

Helotium rhizophilum Fuckel, Fungi rhenani, no. 1598, 1865 – from basal parts of a grass (see Type study below). *Lachnum rhizophilum* (Fuckel) Velen., Monogr. Discom. Bohem., p. 258, 1934.

Helotium affinissimum Peck, Annual Rep. New York State Mus. 33[1880]: 32, 1883 – orig.: "Decaying sticks buried in the ground" (Peck 1883).

Helotium rhizogenum Ellis et Everh., J. Mycol. 4: 100, 1888 – orig.: "On exposed dead roots of *Andropogon*".

Helotium subrubescens Rehm, Ann. Mycol. 7: 524, 1909. – orig.: "In cortice incrassato ramuli terrae infossi putrescentis". This is possibly not a *Lachnum*, because glabrous apothecia are given in its protologue, however hairs are sometimes scanty and hardly observable even under a light microscope.

Lachnum grande Velen. (Velenovský 1934) also belongs to the synonymy of *Lachnum pygmaeum* s. lato. It was originally described from deciduous substrata, but see discussion under Doubtful species below.

Type studies. Results of revision of syntypes of *Lachnum piceum* Velen. PRM 152001: [Central Bohemia, Mnichovice, Boukalova stráň (hillside)] "Mn., Boukal. stráň", spruce needle lying on ground in forest, [11] August 1931, leg. et det. J. Velenovský (as *Lachnum piceum*). The specimen contains no apothecia. – PRM 151970: The specimen contains one apothecium (1.4 mm in diam.) without substratum, along its stipe dirty from soil containing dead pieces of unidentified plants. Hairs are cylindrical or very slightly enlarged, up to 3-septate, 27.5–39 × 3.5–4.5(–6) µm, very abundant at the margin of the apothecium, asci arise from simple septa!, 72–83 × 4.8–5.7 µm,

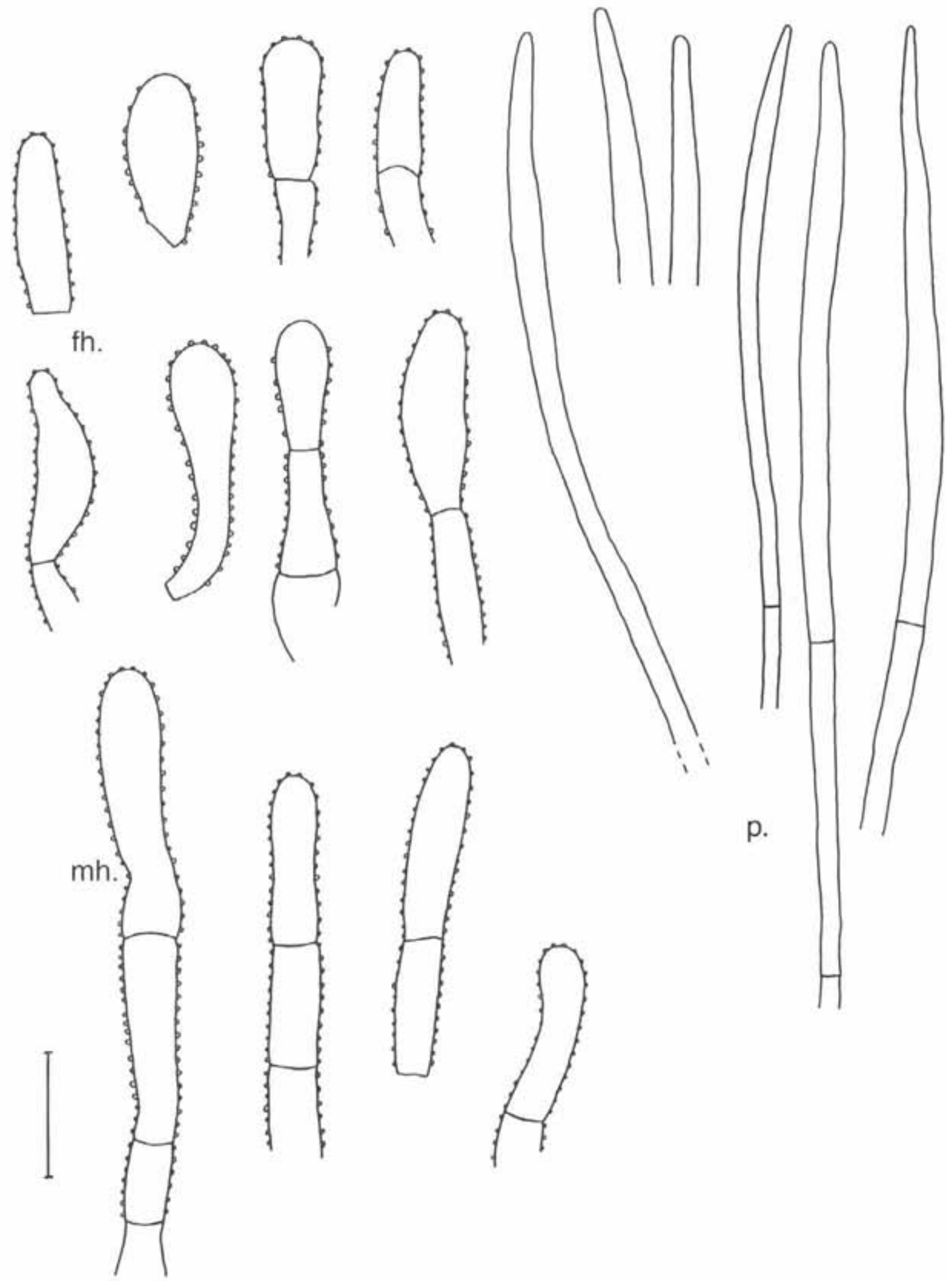

Fig. 9a. *Lachnum rhizophilum* (Fuckel) Velen., G 52853 (as *Helotium rhizophilum* Fuckel), type. Hairs and paraphyses. Scale bar = 10 µm.

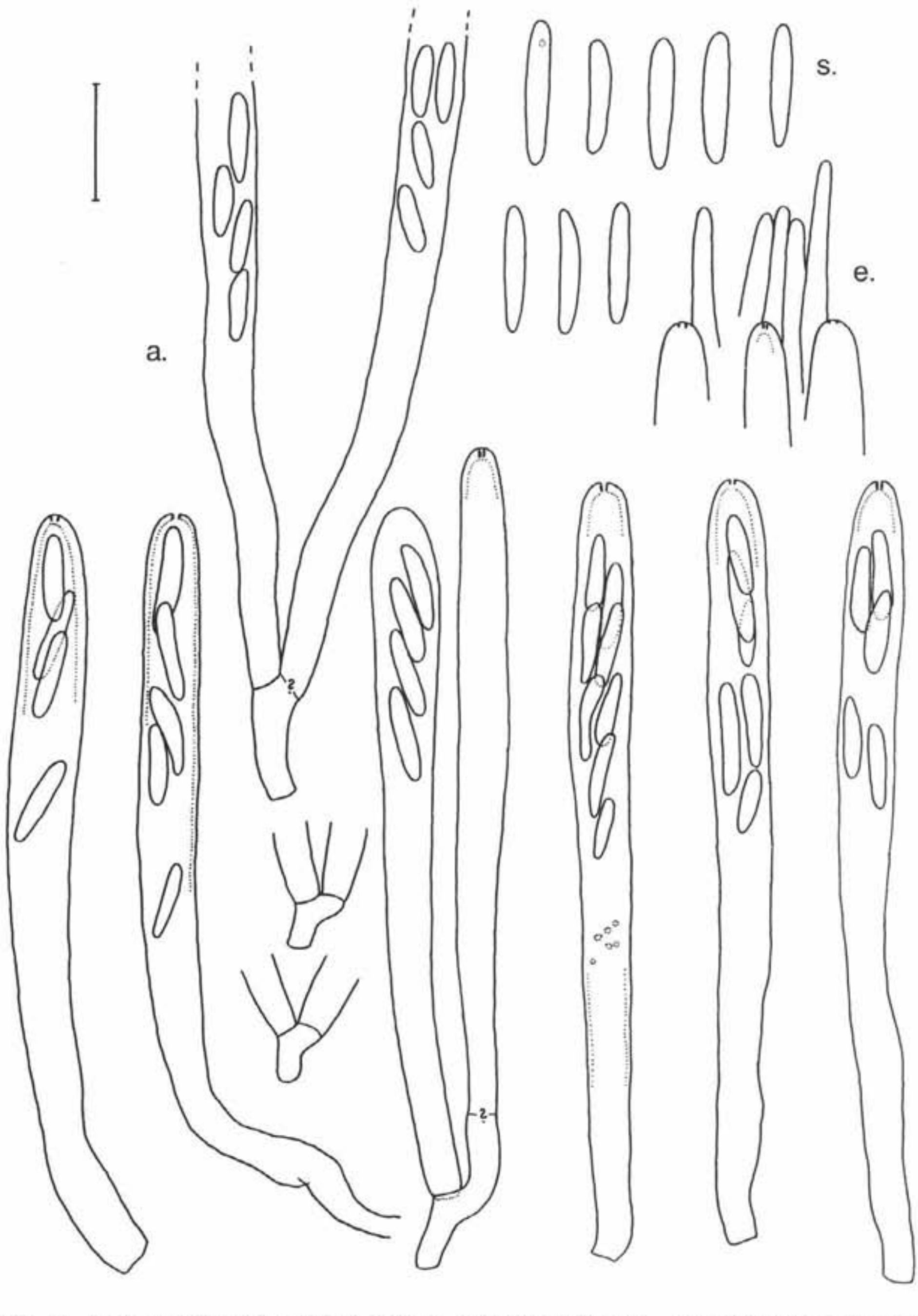

Fig. 9b. *Lachnum rhizophilum* (Fuckel) Velen., G 52853 (as *Helotium rhizophilum* Fuckel), type. Asci, ascospores and paraphyses exceeding the asci. Scale bar = 10 µm.

ascospores 8.9–11.3 × 1.8–2.2 µm and paraphyses 1.9–2.6 µm wide, exceeding the asci by (3.5–)5–10.2 µm. The material belongs to *Lachnum rhizophilum*. The apothecium has the same colour and shape as expected for *Lachnum* sp., however, the microcharacters agree well with *Lachnum rhizophilum*. The specimen is somewhat similar to *Lachnum pudibundum* (PRM 148591, from pine wood) due to the cup not collapsing on drying, a coloured disc (paler, rather orange brown colour) and asci arising from simple septa. However, the longer asci and hairs, narrower and less exceeding paraphyses and probably detritus in soil as a substratum refer to the *Lachnum pygmaeum* complex. – PRM 149414: Lectotype of *Lachnum piceum* (indicated by Svrček in herb., designated here) contains one apothecium 1 mm in diam. with the stalk 0.3 mm in diam. in upper part, hairs 48–65(–69) × 4–5 µm, asci (63–)65–81(–83) × 3.8–4.9 µm, ascospores (6.8–)7.6–9.3(–10.6) × 1.7–2.3 µm and paraphyses 2.9–3.8(–4) µm wide, exceeding the asci by 8.5–16 µm. As the material is slightly overmature, croziers were not seen, but the ascus bases indicating that asci are arising from croziers were observed.

Result of revision of the type of *Lachnum rhizophilum* (G 52853). Dried apothecia c. 3–4 mm high, c. 0.8–1 mm in diam., seemingly non-hairy, stalks very long, white-beige, cups collapsed, outer surface of cup as well as discs dark ochraceous. Hairs warted, cylindrical, often slightly constricted at septa, 30–60 × 3.6–4.7(–5.3) µm. Asci arising from simple septa, 65–70(–75) × 4.5–5.5(–6.2) µm. Ascospores fusiform to narrowly fusiform, (7.4–)10.5–12.4(–13.6) × (1.4–)1.8–2.2 µm. Paraphyses lanceolate, (1.7–)2–3.1 µm wide, exceeding the asci by 7.5–16.5 µm.

Published records: Velenovský 1947: 129 as *Dasyscypha pygmaea* Sacc. (Central Bohemia, Praha-Krč, pine, July 1941, leg. V. Vacek – revised, PRM 149954, on deciduous wood according to Svrček in herb., not pine as published by Velenovský, material in poor condition, cups brown, hairs c. 60 µm long, clavate to slightly capitate, asci c. 50 µm, paraphyses more than 2.6 µm wide, ascospores 7.3–8.5 × 1.5–2 µm, possibly *Lachnum fasciculare*; Božkov, 1941, leg. J. Velenovský – not revised).

Material of *Lachnum pygmaeum* s. str. revised: Western Bohemia: Mariánské Lázně, on bark of *Picea excelsa*, 8 June 1950, leg. et det. M. Svrček, PRM 690215. – Central Bohemia: Praha-Krč, on radicle of *Picea*, 29 May 1945, leg. et det. V. Vacek, PRM 690314. – [Central Bohemia,] Kunice [near Mnichovice], on spruce [*Picea excelsa*], August 1923, leg. et det. J. Velenovský (as *Lachnum piceum*), host rev. A. Chlebicki, PRM 149414 (lectotype of *L. piceum*). – [Central Bohemia, Kunice near Mnichovice, Kunický les forest] "Kunický les", [on piece of wood of *Pinus*, probably of decorticated branch; host det. A. Chlebicki], July 1931, leg. et det. J. Velenovský (as *Lachnum grande*), PRM 151997 [according to Velenovský's manuscript this specimen is the syntype of *Lachnum grande* Velen., which was published as "prope Kunice" by Velenovský (1934), and contains two apothecia and probably is the only preserved syntype, see also discussion under Doubtful species]. – Kersko near Poříčany, on piece of wood (deciduous wood, substrate det. A. Chlebicki), 15 June 1958, leg. O. Dvořák, det. M. Svrček, PRM 612965. – Southern Bohemia: Chotýčany, valley of Libochovka river, on bark of radicles of *Picea excelsa*, 13 July 1962, leg. et det. M. Svrček, PRM 567993.

Material of *Lachnum* sp. revised (material from radicles of *Quercus* was only attached to them and grew rather from sandy soil): Southern Bohemia: Čimelice near Písek, meadows on bank of Skalice river, on naked soil with pieces of dead grasses, 13 June 1961, leg. et det. M. Svrček, PRM 616113. – Smržov near Lomnice nad Lužnicí, pond Dvořiště, on radicle of *Quercus*, 10 July 1962, leg. M. Svrček et J. Kubička, det. M. Svrček, PRM 567991. – Chotýčany, Velechvínský revír (shooting-ground), at source of Libochovka river, on radicle of *Quercus*, 13 July 1962, leg. et det. M. Svrček, PRM 567992.

Material of *Lachnum rhizophilum* revised (incl. G 52853 from Germany): [Central Bohemia, Mnichovice, on a hill above Myšlín] "Na vřesovin. kopci nad Myšlínem z holé země", on naked soil, August 1931, leg. et det. J. Velenovský (as *Lachnum piceum*), PRM 151970 (syntype of *L. piceum*). – Germany, Budenheim, Pinetum, on putrid rhizomes of *Koeleria glauca*, autumn, leg. et det. L. Fuckel (as *Helotium rhizophilum*), G 52853 (type, Fungi rhenani, no. 1598).

Lachnum subvirgineum Baral nom. prov. Fig. 10.

Lachnum subvirgineum Baral in Baral et Krieglst., Beih. Z. Mykol. 6: 83, 1985, nom. prov.

Description. Dried apothecia very long-stalked and big (1–2 mm high, 0.45–1.35 mm in diam.), becoming whitish only with slight brownish or brown-beige tint on drying. Hairs warted, capitate and less frequently cylindrical, mostly 5-septate and not more than 5–septate, (54–)65–95 × (4.3–)5.4–6.1 µm. Asci arising from croziers, 44–54 × (3.5–)4–4.5 µm, KOH/MLZ+. Ascospores narrowly fusiform, 6–9 × 1.4–1.8 µm. Paraphyses lanceolate, (3–)3.5–4.2(–4.8) µm wide, exceeding the asci by 7–15 µm.

Comments. The features of the apothecia, the wide paraphyses, size of asci and ascospores and long hairs indicate a relation to *Lachnum virgineum*, but hairs of *L. subvirgineum* are less long, mostly conspicuously apically enlarged (capitate) and apothecia are bigger than in *Lachnum virgineum*. *Lachnum subvirgineum* differs from *Lachnum pygmaeum*, which also has large, long-stalked apothecia, in having longer hairs and shorter asci. The longer hairs and whitish to (not deep) brownish colour of the apothecia are macroscopically conspicuous under a stereomicroscope. *Lachnum papyraceum* differs from *L. subvirgineum* in having narrower paraphyses and smaller ascospores (fide Dennis 1949, Vesterholt 2000). *Lachnum crataegi* differs by more protruding paraphyses and dark coloured discs when dried and *Lachnum pubescens* by shorter, mostly 3–septate hairs.

Material revised: Moravia: Drahonín near Tišnov, gorge, alt. 350 m, on wood of *Picea excelsa* partially immersed in water, 11 July 1941, leg. F. Šmarda, BRNM 50827 (as *Lachnum papyraceum*).

Lachnum virgineum (Batsch: Fr.) P. Karst. – chlupáček bělostný Fig. 11.

Peziza virginea Batsch, Elench. Fung., p. 125, 1783. – *Lachnum virgineum* (Batsch: Fr.) P. Karst., Bidrag Kännedom Finlands Natur Folk 19: 169, 1871.

Description. Dried apothecia 0.45–1.3 mm high, 0.25–0.7(–0.9) mm in diam., mostly long-stalked, cup-shaped, covered with long white hairs, outer surface and disc mostly pale yellow (4–A4) to yellow orange (4–A7, rarely 4–A8), cups not collapsing on drying. Hairs hyaline, warted, cylindrical or with slightly (mostly gradually) enlarged apices, 70–120(–160) × 3.7–4.6 µm, mostly 2–5–septate, wall 0.7–0.9 µm thick. Asci arising from croziers, 39.5–53.5 × 3.7–5 µm, KOH/MLZ+. Ascospores fusiform, 6.8–9(–10.2) × 1.4–2 µm. Paraphyses lanceolate with subacute tips, (2.3–)2.9–5.4 µm wide, exceeding asci by 8.5–15.5 µm.

Comments. In literature (e.g. Vesterholt 2000) a width of paraphyses 3–6 µm is stated. The specimen of *Lachnum virgineum* (as *Lachnum alnisedum* Velen. in herb., PRM 149560) from female *Alnus* strobiles possessed narrower paraphyses 2.5–3.0 µm in diam. However, e.g. specimen PRM 816369 from the same substratum possessed paraphyses 3–4.6 µm wide. Also specimens from co-

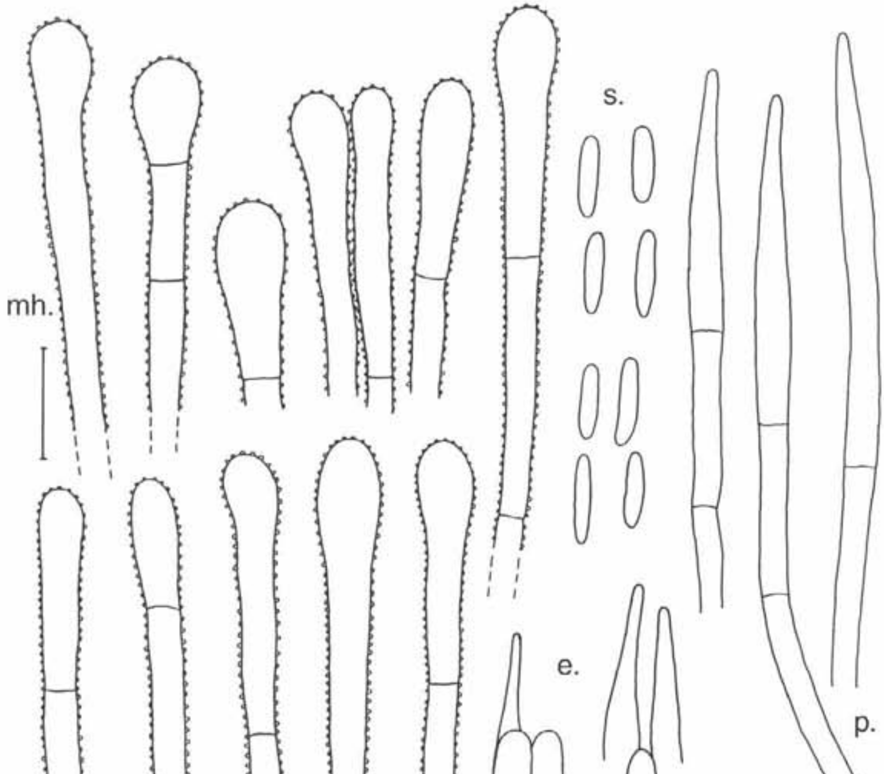

Fig. 10. *Lachnum subvirgineum* Baral (nom. prov.), BRNM 50827. Scale bar = 10 µm.

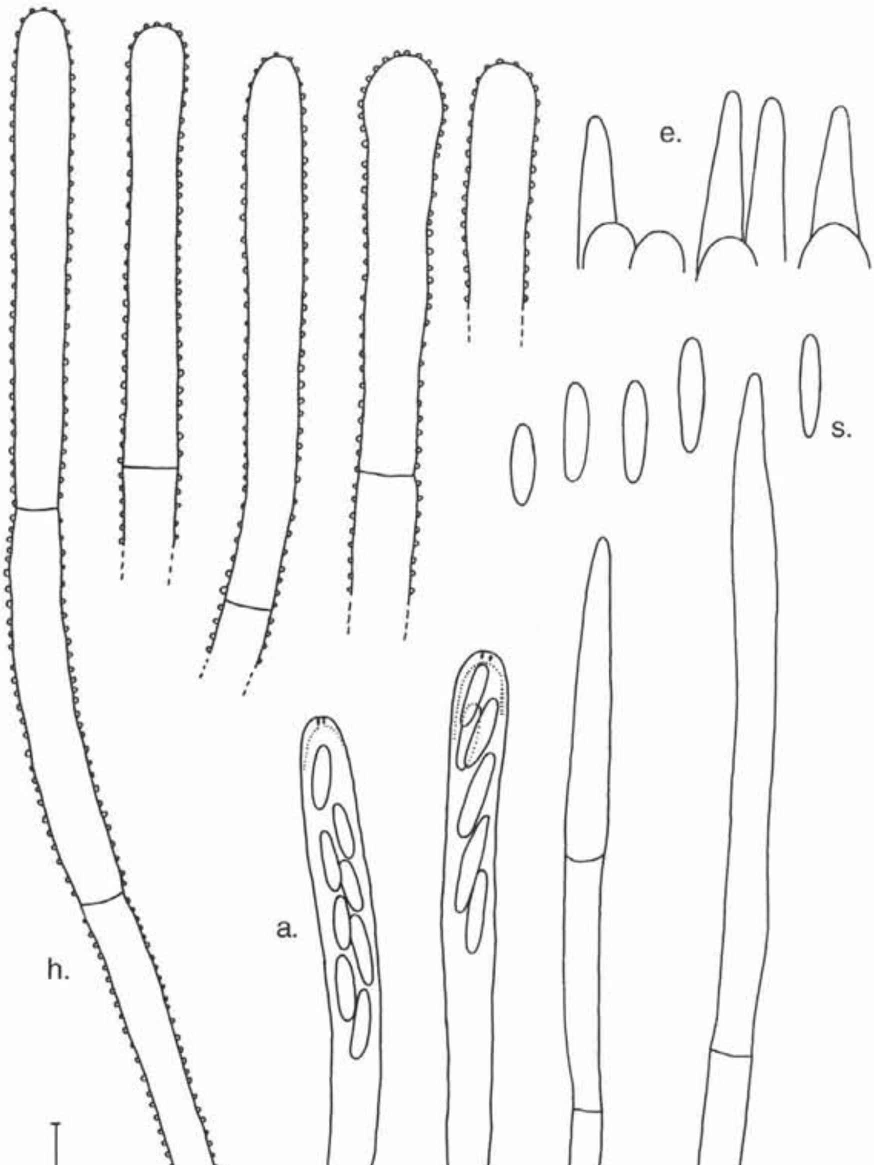

Fig. 11. *Lachnum virgineum* (Batsch: Fr.) P. Karst., PRM 152058 (asci and ascospores), 560428 (hairs), 560561 (paraphyses exceeding the asci and the shorter paraphyse), 816387 (paraphyse). Scale bar = 10 µm.

niferous cones showed somewhat narrower paraphyses, 2.3–2.6(-4) µm wide (BRNM 50814). However, e.g. specimen BRNM 50818 from the same substratum had paraphyses (2.6-)3–4 µm wide. As broader paraphyses were also seen in other material from female *Alnus* strobiles and coniferous cones, the narrower, probably less mature paraphyses are considered to be in the range of variability of *L. virgineum*.

Published records: Velenovský 1934: 248 (as common species, on *Quercus*, *Carpinus*, *Betula*, *Tilia*). – Svrček 1953: 204 (Central Bohemia, Protected Landscape Area Křivoklátsko, valley of Klíčava brook, on *Carpinus betulus* and on deciduous wood). – Svrček 1953: 207 as *Lachnum virgineum* (Batsch) P. Karst. 'f. *carpophila* Pers.' (Central Bohemia, Protected Landscape Area Křivoklátsko, valley of Klíčava brook, on *Fagus sylvatica*). – Svrček 1986: 13, 14 (Western Bohemia: nature reserve Bělýšov near Chudenice, on cupules of *Fagus sylvatica*; Sedmihoří, Mezholezy, on *Frangula* and *Alnus glutinosa*; nature reserve Osojno, on cupules of *Fagus sylvatica*; Plzeň, on cupules of *Fagus sylvatica*; nature reserve Bělýšov, on cupules of *Fagus sylvatica*; Defurovy Lažany, on *Alnus glutinosa*; nature reserve Lužany at Lužany, on *Alnus glutinosa*; Western Bohemia, Horomyslice, on *Quercus*; Plzeň, nature reserve Zábělá, on *Acer pseudoplatanus*). – Prášil 1999: 24 (Hřebeny hills, valley of Moklický potok brook, on *Alnus*, *Quercus*, *Fagus*, and on cupules of *Fagus*). – Réblová and Prášil 1999: 30 (Western Bohemia, Šumava Mts., Černé jezero lake and Čertovo jezero lake, on *Fagus sylvatica*). – Svrček 2001: 204 (Western Bohemia, Javornická hornatina Mts.: "Zábrdí", on *Alnus glutinosa*).

Material revised: Northern Bohemia: České středohoří hills, NNW of saddle between Lovoš hill and Kybyčka hill, alt. c. 440–460 m, on lying decorticated branch of *Tilia* or *Acer*, 3 May 2005, leg. L. Edrová, det. M. Suková, PRM 907138. – České středohoří hills, valley of Milešovský potok (brook) between Velemín and Opárno, on female strobiles of *Alnus*, 3 May 2005, leg. L. Edrová, det. M. Suková, PRM 907141. – Central Bohemia: Zbečno, valley of Klíčava river, Kovářův luh, on cupules of *Fagus sylvatica*, 28 May 1948, leg. et det. M. Svrček, PRM 816395. – Hřebeny Mts., Dobříš, on cupules of *Fagus sylvatica*, 23 May 1948, leg. et det. M. Svrček, PRM 816387. – Roblín, on spruce [twig of *Picea excelsa*], 16 May 1925, leg. et det. J. Velenovský (as *Lachnum conisedum* Velen. in herb., publ. as *L. papyraceum*), PRM 149293. – NW of village Dobřichovice, Karlické údolí (valley), alt. 250–280 m, on cupules of *Fagus sylvatica*, 25 May 2002, leg. et det. M. Suková, PRM 900753. – Praha-Radotín, on female strobiles of *Alnus* sp., April 1924, leg. et det. J. Velenovský (as *Lachnum alnisedum* Velen. in herb.), PRM 149560. – Mnichovice, Kožený vrch hill, on partially decorticated twig, probably *Quercus*, June 1927, leg. et det. J. Velenovský (as *Lachnum fulvellum*), PRM 147742 (syntype of *L. fulvellum*). – Černý Kostelec, [on cone of *Larix europaea*,] May 1927, leg. et det. J. Velenovský (as *Lachnum conisedum* Velen. in herb., publ. as *L. papyraceum*), PRM 148990. – Hrusice, [on decaying cone of *Pinus*,] [6] April 1927, leg. et det. J. Velenovský (as *Lachnum conisedum* Velen. in herb., publ. as *L. papyraceum*), PRM 147696. – Hrusice, [on decaying cone of *Pinus*,] 20 April 1941, leg. L. Hostáňová, det. J. Velenovský (as *Lachnum papyraceum*), PRM 151591. – Mnichovice, on decaying cone of *Picea excelsa*, May 1934, leg. et det. J. Velenovský (as *Lachnum crystallinum*), PRM 152058. – Mnichovice, on cone of *Larix* [*europaea*], 4 May 1929, leg. et det. J. Velenovský (as *Lachnum papyraceum*), PRM 152056. – Kunice near Mnichovice, on spruce [on twig of *Picea excelsa*, to be exact on old (woody) bud involucres], May 1928, leg. et det. J. Velenovský (as *Lachnum papyraceum*), PRM 151412. – Choteč, on female strobiles of *Alnus incana*, 13 March 1949, leg. et det. M. Svrček, PRM 816369. – Southern Bohemia: Šumava Mts., virgin forest Boubínský prales near Horní Vltavice, on cupules of *Fagus sylvatica*, 19 May 1965, leg. et det. M. Svrček, PRM 604108. – Braná near Třeboň, at Fráterský rybník (pond), on a deciduous twig, 17 May 1962, leg. et det. M. Svrček, PRM 560463. – Slepičí hory Mts., by path to Kohout hill, on cupules of *Fagus sylvatica*, 17 May 1962, leg. et det. M. Svrček, PRM 560428. – Slepičí hory Mts., Klení, on cupules of *Fagus sylvatica*, 17 May 1962, leg. et det. M. Svrček et J. Kubička, PRM 560561. – Slepičí hory Mts., Klení, on female strobiles of *Alnus viridis*, 17 May 1962, leg. M. Svrček et

J. Kubička, det. M. Svrček, PRM 560562. – Moravia: Řikonín near Tišnov, valley of Libochovka ("Libochúvka") river, alt. 350 m, on cone of *Picea excelsa*, 22 June 1941, leg. et det. F. Šmarda, BRNM 50818. – Moravia: forest Obora near Veveří, on cupules of *Fagus sylvatica*, 18 May 1969, leg. et det. M. Svrček, PRM 684254. – Krnovec hill near Veveří, on cupule of *Quercus*, 18 May 1969, leg. et det. M. Svrček, PRM 684255.

Doubtful species

Lachnum grande Velen.

Lachnum grande Velen., Monogr. Discom. Bohem., p. 247, 1934.

Comments. In the synonymy of '*Lachnum grande* Velen., sp. n.' Velenovský (1934) quoted *Helotium pileatum* Velen. This indicates that *Lachnum grande* could be considered as a new name for *Helotium pileatum* (*H. pileatum* Velen., České houby, vol. 4–5, p. 850, 1922; non *H. pileatum* (P. Karst.) P. Karst., Bidrag Kännedom Finlands Natur Folk 19: 130, 1871; nec *H. pileatum* Peck, Annual Rep. New York State Mus. 28: 67, 1875). In such a case *Lachnum grande* has the same type as the name which was replaced (*H. pileatum*). In agreement with the protologue (Velenovský 1922), there is a big, non-hairy apothecium in the holotype of *H. pileatum* (PRM 824894). According to Svrček (1984), who revised the holotype, this is *Hymenoscyphus vernus* (Boud.) Dennis.

Svrček (1984) tended to consider *Lachnum grande* a new taxon (which he synonymised with *Lachnum pygmaeum* s. l.) and held the opinion that Velenovský had made a mistake by synonymising *Helotium pileatum* with *Lachnum grande*. In the herbarium we can see that early after the publishing of České houby, vol. 4–5 (Velenovský 1922) Velenovský began with labelling material of true *Lachnum* specimens with the name *Helotium pileatum*. Only one specimen of *H. pileatum*, the holotype, contains material of a *Hymenoscyphus*.

If we consider *Lachnum grande* described from deciduous substrata an independent new taxon (not a new name), it has at least two or three syntypes cited in the protologue, of which only one exists and unfortunately it is the one (PRM 151997) whose substratum is in fact wood of *Pinus*. The specimen (belonging to *Lachnum pygmaeum* s. str.) contains two apothecia, 1.2 and 2.5 mm in diam., with hairs (36–)38–48.5(–52.5) × 3.5–4.5(–4.9) µm, asci arising from croziers, (50–)52–66(–68.5) × 4.3–4.9 µm, ascospores (5.7–)6.6–8.5(–9) × 1.5–2.3 µm and paraphyses (2.2–)2.6–3.6(–3.9) µm wide, exceeding by (5.5–)8.5–18.5(22.5) µm. According to Velenovský's manuscripts, fresh material of this specimen had apothecia 3–6 mm in diam., asci 70–90 × 5–6 µm, ascospores 6–8 µm long. In the published drawing (Velenovský 1934), the two apothecia on the left and the two hairs on the right come from this specimen.

According to his manuscript Velenovský studied 5 specimens [briefly: Struhařov, *Carpinus*, VIII. 1922; Zbuzany, *Alnus* forest, VIII. 1924; Ondřejov, *Carpinus*, VIII 1925; no data, VIII. 1927; Kunice, deciduous twig, no date given, but it was the last find]. He erroneously added information from these to his sheet devoted to his previously published *Helotium pileatum* [by the way, the sheet also includes a nice unpublished drawing of *H. pileatum*]. Therefore such large sizes of apothecia appeared in the original description of *L. grande*. One of the 5 specimens (Kunice, as deciduous twig, in fact *Pinus*, PRM 151997) is discussed above. I found that only one more specimen from the authentic material is preserved in PRM [Struhařov, *Carpinus*, VIII. 1922, PRM 147999, sub *Helotium pileatum*]. The specimen contains several, well preserved apothecia with hairs up to 54 µm long, asci arising from croziers, c. 74 × 4.2 µm, ascospores 8.8 × 2.0–2.2 µm, paraphyses 2.3–3 µm (average 2.8 µm) wide, exceeding by 7–10.3 µm.

According to the only specimen formerly appropriate to be a syntype (PRM 151997), *Lachnum grande* would belong to the synonymy of *Lachnum pygmaeum* s. str. However, it is clear that the coniferous substrate of the syntype and also the fungus itself (according to Velenovský's species concept discussed below) conflicts with the protologue of *L. grande*, therefore I do not recommend selecting the specimen as a lectotype. The other studied specimen from *Carpinus* fits the original description better, although it was not cited in the protologue. Consequently, the specimen from *Carpinus* (PRM 147999) is designated here as lectotype (see Note 2 of Art. 9.). *Helotium affinissimum* Peck, described from decaying sticks buried in the ground (Peck 1883) might be conspecific with *Lachnum grande* and would in that case have priority.

I confirm the opinion that *Lachnum grande* is a new species and not only a new name and mentioning the name *Helotium pileatum* as a synonym by Velenovský was a mistake in identification, which however lead to partial confusion in the original description.

As I understand it, the species *Lachnum grande* was described by Velenovský (1934) for material of *Lachnum pygmaeum* s. l. from deciduous woody substrata. Illustrations and protologues of *Lachnum grande* and *Lachnum piceum* (Velenovský 1934) show slightly narrower and less protruding paraphyses in *L. grande*. This fact agrees with my observations: paraphyses 2.9–3.8(–4) µm (average 3.35 µm) wide, exceeding by (8.8–)9.5–14.4(–15.7) µm in the lectotype of *Lachnum piceum* and 2.3–3 µm (average 2.8 µm) wide, exceeding by 7–10.3 µm in the lectotype of *Lachnum grande*. In *Lachnum pygmaeum* s. str., paraphyses are (2.2–)2.9–4.1(–4.9) µm (average 3.5 µm) wide and exceed by (5.5–)8.5–17.5(–25) µm. Only one specimen, which I included into my description of *Lachnum pygmaeum* s. str., comes from deciduous wood (the specimen PRM 612965) and its paraphyse measurements yield large values: paraphyses (2.6–)3–4.2(–4.7) µm (average 3.6 µm), exceeding by 9–17 µm. Therefore the material growing directly on deciduous wood should not be separated on the basis of smaller paraphyses from the material from conifers and *Lachnum grande* belongs to the synonymy of *Lachnum pygmaeum* s. str.

Material studied: [Central Bohemia, Kunice near Mnichovice, Kunický les forest] "Kunický les", [on piece of wood of *Pinus*, probably of a decorticated branch; host det. A. Chlebicki], VII. 1931, leg. et det. J. Velenovský (as *Lachnum grande*), PRM 151997 (rev. M. Suková as *Lachnum pygmaeum* s. str.). – [Central Bohemia,] Struhařov, *Carpinus* [*betulus*], VIII. 1922, leg. et det. J. Velenovský (as *Helotium pileatum*), PRM 147999 (rev. M. Suková as *Lachnum grande*, synonym of *L. pygmaeum* s. str.), lectotype of *Lachnum grande*.

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Entomopathogenic fungi associated with insect hibernating in underground shelters

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Kubátová A. and Dvořák L. (2005): Entomopathogenic fungi associated with insect hibernating in underground shelters. – Czech Mycol. 57(3–4): 221–237.

In the period 2001–2004, several hundreds of underground shelters (mainly abandoned galleries, caves, and cellars) in W and SW Bohemia (Czech Republic) were explored for insect cadavers with visible fungal growth. At 27 localities, 94 infected cadavers of six insect taxa were collected. The most frequent infected insects were *Triphosa dubitata*, *Scoliopteryx libatrix* (*Lepidoptera*; *Geometridae* and *Noctuidae*, resp.) and unidentifed mosquitoes (*Diptera*, *Culicidae*). On the collected cadavers, altogether 20 species of microfungi (including sterile mycelia) were recorded, most of them belonging to entomopathogens. The most frequent was *Paecilomyces farinosus* (36 % of all samples) and *Cordyceps* sp. (15 %) which had affinity to *C. tuberculata* and *C. riverae*. Close association with insects was shown by *Cordyceps* sp. (with *Triphosa dubitata*) and *Conidiobolus destruens* (with unidentified mosquitoes). On the contrary, *Paecilomyces farinosus* was recorded on five different insect species. Also several other interesting species were found (e.g. *Hirsutella guignardii*, *Engyodontium* cf. *parvisporum*), probably not yet recorded from the Czech Republic. Microphotographs of some microfungi studied are included.

Key words: entomopathogenic micromycetes, hypogean galleries, overwintering moths, butterflies and mosquitoes

Kubátová A. a Dvořák L. (2005): Entomopatogenní houby na hmyzu přezimujícím v podzemních prostorách. – Czech Mycol. 57(3–4): 221–237.

V letech 2001–2004 bylo prozkoumáváno několik set lokalit s podzemními prostorami (hlavně opuštěné štoly, jeskyně, sklepy) v západních a severozápadních Čechách. Na 27 lokalitách byl nalezen mrtvý hmyz s viditelným porostem mikroskopických hub. Celkem bylo sebráno 94 vzorků šesti taxonů hmyzu napadených houbami. Mezi napadeným hmyzem byly nejčastější zástupci řádu *Lepidoptera*: píďalka jeskynní (*Triphosa dubitata*, *Geometridae*) a můra sklepní (*Scoliopteryx libatrix*, *Noctuidae*) a *Diptera*: neurčení komáři (*Culicidae*). Na vzorcích hmyzu bylo zjištěno celkem 20 druhů mikromycetů (včetně sterilních mycelií), patřících většinou mezi entomopatogeny. Nejhojnější byl *Paecilomyces farinosus* (36 % vzorků) a *Cordyceps* sp. (15 %), blízký druhům *C. tuberculata* a *C. riverae*. Úzká vazba na hmyz byla zjištěna u *Cordyceps* sp. (na *T. dubitata*) a *Conidiobolus destruens* (na neurčené komáry). Naproti tomu *P. farinosus* byl zaznamenán na 5 různých druzích hmyzu. Nalezeny byly i další zajímavé druhy hub (např. *Hirsutella guignardii*, *Engyodontium* cf. *parvisporum*), které pravděpodobně nebyly dosud v České republice zaznamenány. Článek je doplněn mikrofotografiemi některých studovaných druhů.

INTRODUCTION

In underground habitats (galleries, caves, cellars etc.) live different types of organisms, hidden to the eyes of man. Many of them, so called troglobionts, are adapted to the somewhat unfavourable abiotic factors of hypogean shelters.

As regards insects, especially members of *Lepidoptera*, *Hymenoptera* and *Diptera* are found there in some phase of their life cycle. Several lepidopteran species of butterflies (family *Nymphalidae*), moths (family *Geometridae* and *Noctuidae*), and *Microlepidoptera* (family *Oecophoridae*) use underground shelters for hibernation. Those species live from summer to next spring and after hibernation they have to go outside where reproduction proceeds. In the Czech Republic, *Inachis io*, *Triphosa dubitata*, and *Scoliopteryx libatrix* are known as the most common hibernants in underground shelters in west Bohemia (Dvořák 2000). Concerning *Hymenoptera*, only fertilised females of several species of *Ichneumonidae* hibernate in underground shelters. Their life cycle is similar as in the mentioned *Lepidoptera* – ichneumonid females have to fly outside the hibernation shelter to lay eggs. The spectrum of hibernating species was studied in west Bohemia. *Diphyus quadripunctorius* is the most common species in underground shelters (Šedivý and Dvořák 2002). Members of *Diptera* (especially *Heleomyzidae*) occur in caves and galleries very regularly, more or less during the whole year and may reproduce there (Papp 1981). Fertilised females of mosquitoes (*Culicidae*) hibernate in underground shelters (e.g. Kjaerandsen 1993) and reproduce outside. According to Minář and Hájková (1966), *Culex pipiens* is the only common species in cellars and caves in south Moravia.

During the hibernation, insects can be infected by entomopathogenic fungi, other inhabitants of underground hollows. Fungi parasiting on insects in caves have drawn the attention of man for a long time. For example, Lagarde (1913, 1917, 1922) published extensive papers dealing with different groups of fungi (including entomopathogens) occurring in French, Algerian and Spanish caves. More recent papers are for example those by Rombach and Samson (1983), Samson et al. (1984), Pacioni (1978), Malloch (Internet), Gunde-Cimerman et al. (1998), and Matočec and Ozimec (2001), dealing with entomopathogenic fungi in Europaean caves.

In the Czech Republic only several authors have studied the mycobiota of caves or other underground habitats, e.g. Fassatiová (1970), Marvanová et al. (1992), Bosák et al. (2001), Kubátová et al. (2005), focusing on micromycetes predominantly in air, soil and on various surfaces of hypogean localities.

The study of entomopathogenic fungi has a long tradition in the Czech Republic which was formed e.g. by Rozsypal, Fassatiová, Samšiňáková, Krejzová, Weiser, and later by Landa, Oborník, etc. However, no papers (with exception of

Weiser and Batko 1966) have yet been published on entomopathogenic fungi on insects in underground shelters.

During recent excursions of the second author to underground galleries, caves and cellars mainly in western Bohemia (Czech Republic), numerous insects were found on which micromycetes parasitised. Thus, the main aim of the current paper is to extend our knowledge on the occurrence of entomopathogenic microfungi infecting insects in underground shelters.

MATERIALS AND METHODS

Cadavers (= samples) of moths, mosquitoes and other insects with visible fungal growth were collected by the second author in several types of underground shelters (old abandoned mine galleries, caves and cellars) during three winters in the period December 2001 to January 2004. Most insect samples were collected in western and south-western Bohemia, one sample originated from the Moravian Karst (southern Moravia), Czech Republic. Although several hundreds of underground shelters were visited, insect cadavers were collected only at 27 localities. A great number of insect samples (13 cadavers) were collected in several galleries of nature reserve Amálino údolí near Kašperské Hory. Most localities were visited only once. Localities and collected insects are listed in Tab. 1. Altogether, 94 infected cadavers of 6 insect taxa were studied: 70 belonging to *Lepidoptera*, 21 to *Diptera*, and 3 to *Hymenoptera* (Tab. 2).

In the laboratory, both direct microscopic examination of infected insect cadavers and cultivation of fungi from insects were carried out. For the isolation of fungi, malt extract agar (MEA) after Pitt (1979) and potato carrot agar (PCA) after Fassatiová (1986) were used. Microscopic features were observed in mounts with lactic acid and cotton blue or in water. The microscopic fungi were identified according to Weiser and Batko (1966), Gams (1971), Weiser (1977), de Hoog (1978), Pacioni (1978), Gams et al. (1984), Domsch et al. (1993), Tzean et al. (1997), Matočec and Ozimec (2001), and Zare and Gams (2001). Photographs were taken on an Olympus BX–51 microscope using Nomarski (DIC) and phase contrast (Ph).

Herbarium specimens were deposited in PRC (Herbaria of Dept. of Botany, Faculty of Science, Charles University, Prague), six fungal isolates were deposited at CCF (Culture Collection of Fungi, Dept. of Botany, Faculty of Science, Charles University, Prague) – see note in Tab. 3.

Tab. 1. Localities of collected insect samples (all in the Czech Republic).
Note: PLA = Protected Landscape Area, NR = Nature Reserve, NM = Nature Monument, NP = Nature Park, x = lost.

PRC Herbarium specimens	Insect species, locality, date of sampling
	Diphyus quadripunctorius (*Hymenoptera, Ichneumonidae*)
64, 65	SW Bohemia, PLA Šumava, NR Amálino údolí, gallery „II“, c. 1.5 km SE of Kašperské Hory, 720 m a.s.l., 49°07'53" N, 13°34'29" E, I. 2002
x	SW Bohemia, PLA Šumava, NR Amálino údolí, gallery „I“, c. 1.5 km SE of Kašperské Hory, 710 m a.s.l., 49°07'51" N, 13°34'32" E, III. 2002
	***Heleomyza* sp.** (*Diptera, Heleomyzidae*)
57, 75, 88–91	SW Bohemia, NM Loreta, underground limestone mine, 1.5 km NE of Týnec, 495 m a.s.l., 49°21'26" N, 13°17'05" E, XII. 2001, IV. 2002, XII. 2002
95	W Bohemia, PLA Křivoklátsko, Modřejovice, gallery in valley of stream c. 2 km W of the village, 328 m a.s.l., 49°59'41" N, 13°40'11" E, I. 2003
	Inachis io (*Lepidoptera, Nymphalidae*)
80	SW Bohemia, Tuškov, SE periphery of the village, military bunker, 640 m a.s.l., 49°09'27" N, 13°32'43" E, VIII. 2002
132	W Bohemia, Luka, brewery cellars, near a pond N of the village, 630 m a.s.l., 50°09'43" N, 13°09'45" E, III. 2003
138	W Bohemia, PLA Slavkovský les, Kostelní Bříza, cellars in the castle park, SW of the village, 618 m a.s.l., 50°06'51" N, 12°37'10" E, I. 2004
	Scoliopteryx libatrix (*Lepidoptera, Noctuidae*)
63	S Bohemia, NM Kněží hora, between Katovice and Poříčí, graphite gallery, 430 m a.s.l., 49°16'50" N, 13°48'45" E, I. 2002
70	SW Bohemia, PLA Šumava, NR Amálino údolí, gallery „Myší díra“, c. 1.5 km SE of Kašperské Hory, 705 m a.s.l., 49°08'03" N, 13°34'14" E, III. 2002
71–73	SW Bohemia, PLA Šumava, NR Amálino údolí, gallery „Veřejné záchodky“, c. 1.5 km S of Kašperské Hory, 675 m a.s.l., 49°08'01" N, 13°33'45" E, III. 2002
74	SW Bohemia, PLA Šumava, NR Amálino údolí, gallery „A“, c. 1.5 km S of Kašperské Hory, 695 m a.s.l., 49°08'02" N, 13°33'46" E, III. 2002
76–78	SW Bohemia, NR Borek, gallery, SW of the village Velhartice, 610 m a.s.l., 49°15'44" N, 13°24'00" E, IV. 2002
81	SW Bohemia, NR Čepičná, gallery „Čepice“, 1 km W of the village Čepice, 500 m a.s.l., 49°16'03" N, 13°35'13" E, IX. 2002
92	W Bohemia, Stříbro, gallery „Urban III“, Úhlavka river valley, S periphery of the town, 380 m a.s.l., 49°44'17" N, 13°00'04" E, I. 2003
96	W Bohemia, Svinná, cellars of small castle in the village, 450 m a.s.l., 49°53'38" N, 13°37'19" E, I. 2003
97, 98	W Bohemia, NM Červený vrch, mine on Červený vrch hill, SE of the village Otov, 480 m a.s.l., 49°28'57" N, 12°51'14" E, I. 2003
100–102	W Bohemia, Černá Řeka, gallery in Mt. Jindřichova hora, c. 2 km WNW of the village, 575 m a.s.l., 49°25'50" N, 12°43'55" E, I. 2003
105, 106	W Bohemia, PLA Slavkovský les, Bečov nad Teplou, cellars of the castle, N periphery of the town, 520 m a.s.l., 50°05'07" N, 12°50'21" E, I. 2003
110, 136, 137	W Bohemia, Oloví, gallery in „Pplk. Sochora street“, 510 m a.s.l., 50°15'13" N, 12°33'19" E, I. 2003, II. 2004

111, 112	W Bohemia, Zlatý Kopec, gallery „Ementál“, c. 1.2 km SW of the village, 852 m a.s.l., 50°25'53" N, 12°49'48" E, II. 2003
113–115	W Bohemia, Zlatý Kopec, gallery „Rezonanční“, c. 1.2 km SW of the village, 852 m a.s.l., 50°25'51" N, 12°49'48" E, II. 2003
133	W Bohemia, Andělská Hora, gallery under Stichlův Mlýn, c. 1.2 km NE of the village, 617 m a.s.l., 50°12'43" N, 12°58'50" E, III. 2003
135	W Bohemia, Vysoká Pec, gallery under the village, 688 m a.s.l., 50°20'46" N, 12°42'12" E,II. 2003
142	W Bohemia, Kamenec, gallery, c. 1.2 km E of the village, 390 m a.s.l., 49°52'49" N, 13°36'59" E, I. 2004
	Triphosa dubitata (*Lepidoptera*, *Geometridae*)
58–62	S Moravia, Křtiny, NR U Výpustku, Drátenická jeskyně cave, 395 m a.s.l., 49°17'26" N, 16°43'47" E, XII. 2001
66	SW Bohemia, PLA Šumava, NR Amálino údolí, gallery „Barbastelí“, c. 1.5 km SW of Kašperské Hory, 715 m a.s.l., 49°08'04" N, 13°33'46" E, II. 2002
67	SW Bohemia, PLA Šumava, NR Amálino údolí, gallery „Kristýna“, c. 1.5 km SE of Kašperské Hory, 700 m a.s.l., 49°07'49" N, 13°34'49" E, XII. 2001
68, 69	SW Bohemia, PLA Šumava, NR Amálino údolí, gallery „II“, c. 1.5 km SE of Kašperské Hory, 720 m a.s.l., 49°07'53" N, 13°34'29" E, III. 2002
103	W Bohemia, Černá Řeka, gallery in Mt. Jindřichova hora, c. 2 km WNW of the village, 575 m a.s.l., 49°25'50" N, 12°43'55" E, I. 2003
107–109	W Bohemia, PLA Slavkovský les, Bečov nad Teplou, cellars of the castle, N periphery of the town, 520 m a.s.l., 50°05'07" N, 12°50'21" E, I. 2003
116–118	W Bohemia, Horní Hrad, cellars of the castle, 470 m a.s.l., 55°20'44" N, 12°58'07" E, II. 2003
119, 143–145	W Bohemia, PLA Slavkovský les, Výškov, NR Lazurový vrch, gallery „Trampský převis“, c. 2 km NNE of the village, 600 m a.s.l., 49°54'47" N, 12°46'50" E, II. 2003, I. 2004
120–121	W Bohemia, PLA Slavkovský les, Výškov, NR Lazurový vrch, gallery „Pokojíček“, c. 2 km NNE of the village, 600 m a.s.l., 49°54'49" N, 12°46'50" E, II. 2003
122–131	W Bohemia, Valeč, cellars in the castle park, 550 m a.s.l., 50°10'37" N, 13°14'54" E, III. 2003
139	W Bohemia, Vítkov near Sokolov, mining magazine of former mine, 707 m a.s.l., 50°09'25" N, 12°41'21" E, I. 2004
146–149	W Bohemia, Valeč, cellars of farm building in the castle complex, 545 m a.s.l., 50°10'30" N, 13°15'01" E, I. 2004
	unidentified mosquito (*Diptera*, *Culicidae*)
79	SW Bohemia, Velhartice, NR Borek, gallery SW of the village, 610 m a.s.l., 49°15'44" N, 13°24'00" E, IV. 2002
82	SW Bohemia, NR Čepičná, gallery „Čepice“ 1 km W of the village Čepice, 500 m a.s.l., 49°16'03" N, 13°35'13" E, X. 2002
83–86	S Bohemia, NM Kněží hora, between Katovice and Poříčí, graphite gallery, 430 m a.s.l., 49°16'50" N, 13°48'45" E, XI. 2002
87	SW Bohemia, PLA Šumava, NR Amálino údolí, gallery „Kristýna“, c. 1.5 km SE of Kašperské Hory, 700 m a.s.l., 49°07'49" N, 13°34'43" E, XI. 2002
93	W Bohemia, Stříbro, gallery „Urban III“, Úhlavka river valley, S periphery of the town, 380 m a.s.l., 49°44'17" N, 13°00'04" E, I. 2003
94, 140, 141	W Bohemia, PLA Křivoklátsko, Přísednice, Matčina hora hill, gallery, c. 0.5 km W of a village, 362 m a.s.l., 49°52'55" N, 13°44'20" E, I. 2003, I. 2004 (resp.)
99	W Bohemia, Černá Řeka, gallery in Mt. Jindřichova hora, c. 2 km WNW of the village, 575 m a.s.l., 49°25'50" N, 12°43'55" E, I. 2003
104	W Bohemia, Hostičkov, gallery in Trdlina hill, c. 2 km SSW of the village, 569 m a.s.l., 49°53'03" N, 12°48'57" E, I. 2003
134	SW Bohemia, NP Buděticko, Rabí, cellars of the castle, S periphery of the village, 500 m a.s.l., 49°16'46" N, 13°37'12" E, II. 2003

Tab. 2. Studied insect specimens collected in underground shelters in the Czech Republic.

Taxonomic group of insects (order, family)	Insect species (Latin, English and Czech name)	Number of cadavers
Lepidoptera, Geometridae	*Triphosa dubitata* – Tissue (píďalka jeskynní)	37
Lepidoptera, Noctuidae	*Scoliopteryx libatrix* – Herald (můra sklepní)	30
Lepidoptera, Nymphalidae	*Inachis io* – European Peacock (babočka paví oko)	3
Diptera, Culicidae	unidentified – mosquitoes (komárovití)	14
Diptera, Heleomyzidae	*Heleomyza* sp. – heleomyzid flies (lanýžovkovití)	7
Hymenoptera, Ichneumonidae	*Diphyus quadripunctorius* – ichneumonid (lumek)	3
Total number	**6**	**94**

RESULTS AND DISCUSSION

Overall results

On 94 cadavers of 6 insect species collected in underground shelters in the Czech Republic, altogether 20 species of microfungi (including four different types of sterile mycelium) were recorded (Tab. 3). The most frequent was *Paecilomyces farinosus* (36 % of all samples), *Cordyceps* sp. (15 %) and several types of sterile mycelia (32 %).

Most recorded fungi belong to entomopathogens: *Beauveria*, *Conidiobolus*, *Cordyceps*, *Engyodontium*, *Hirsutella*, *Lecanicillium*, *Paecilomyces*, and *Simplicillium*. Only *Acremonium bacillisporum*, *Aphanocladium album*, *Engyodontium rectidentatum*, *Mortierella* sp., and *Mucor* sp. are not generally considered to be entomopathogenic.

It is interesting that the majority of them belongs to anamorphic *Hypocreales* (Ascomycota), exception for three members of the Zygomycota: *Conidiobolus* (*Entomophthorales*), *Mortierella* (*Mortierellales*) and *Mucor* (*Mucorales*).

Insect – fungus associations

Most insect cadavers (85 %) were occupied by one fungus only. On 15 % of samples, two fungal species were recorded. More than two fungi on the same cadaver were not observed. Among the fungal couples on one insect body were *Conidiobolus destruens* and *Acremonium bacillisporum* (3 samples of unidentified *Culicidae*), *Paecilomyces farinosus* and *Lecanicillium muscarium* (3 samples of *Scoliopteryx libatrix*), *Cordyceps* sp. and *Simplicillium* cf. *lamellicola* (2 samples). Other couples occurred only once.

Tab. 3. Observed microscopic fungi and their association with insect species.
Notes: CCF = Culture Collection of Fungi, Prague, c = successful cultivation, e = empty perithecia, f = fertile perithecia, i = immature perithecia.

Fungus – insect association	PRC Herbarium specimens	Number of samples
Acremonium bacillisporum (Onions et G. L. Barron) W. Gams		
unidentified *Culicidae*	83, 85, 93, 94	4
Aphanocladium album (Preuss) W. Gams		
Triphosa dubitata	139	1
Beauveria bassiana (Bals.–Criv.) Vuill.		
unidentified *Culicidae*	87	1
Beauveria brongniartii (Sacc.) Petch		
Heleomyza sp.	57^{c}	1
Conidiobolus destruens (Weiser et A. Batko) Ben–Ze´ev		
unidentified *Culicidae*	85, 93, 94, 141	4
Cordyceps sp.		
Triphosa dubitata	60^{e}, 67^{f}, 107^{f}, 108^{e}, 109^{i}, 119^{i}, 125^{i}, 128^{e}, 129^{e}, 130^{e}, 131^{e}, 139^{f}, 147^{e}, 148^{f}	14
Engyodontium cf. *parvisporum* (Petch) de Hoog		
Triphosa dubitata	145	1
Engyodontium rectidentatum (Matsush.) W. Gams, de Hoog, Samson et H. C. Evans		
Scoliopteryx libatrix	81^{c} = **CCF 3541**	1
Hirsutella guignardii (Maheu) Samson, Rombach et Seifert		
Heleomyza sp.	75	1
Lecanicillium muscarium (Petch) R. Zare et W. Gams		
Scoliopteryx libatrix	72^{c} = **CCF 3297**, 76^{c}, 78^{c}, 112^{c}, 113^{c}	5
Inachis io	138	1
Lecanicillium sp.		
unidentified *Culicidae*	79, 134, 140, 141	4
Mortierella sp.		
Heleomyza sp.	95	1
Mucor sp.		
Diphyus quadripunctorius	lost	1
Paecilomyces farinosus (Holmsk.) A. H. S. Br. et G. Sm.		
Scoliopteryx libatrix	63^{c}, 70^{c}, 71^{c}, 72^{c}, 73, 74, 76^{c}, 77^{c} = **CCF 3542**, 78^{c}, 97^{c}, 98^{c}, 100^{c}, 101^{c}, 102^{c}, 105^{c}, 106^{c}, 110^{c}, 111^{c}, 113, 114^{c}, 133^{c}, 135, 136^{c}, 137^{c}, 142^{c}	25
Diphyus quadripunctorius	64, 65^{c}	2
unidentified *Culicidae*	79^{c}, 84^{c}, 86^{c}, 99^{c}	4
Triphosa dubitata	103^{c}	1
Inachis io	80^{c}, 132^{c}	2
Paecilomyces fumosoroseus (Wize) A. H. S. Br. et G. Sm.		
Scoliopteryx libatrix	63^{c} = **CCF 3272**	1
Simplicillium cf. *lamellicola* (F. E. V. Sm.) R. Zare et W. Gams		
Triphosa dubitata	69, 108^{c} = **CCF 3524**, 131^{c} = **CCF 3525**	3
Scoliopteryx libatrix	71	1

Tab. 3. Observed microscopic fungi and their association with insect species – continued.
Notes: c = successful cultivation.

Fungus – insect association	**PRC Herbarium specimens**	**Number of samples**
sterile white mycelium with sterile synnemata		
Triphosa dubitata	66, 116, 117, 120, 121, 122, 123, 124, 126, 127, 143, 149	12
sterile white mycelium		
Heleomyza sp.	88, 89, 90, 91	4
Scoliopteryx libatrix	96, 115	2
Triphosa dubitata	58, 59, 61, 62, 68, 118, 144[c], 146, 147	9
unidentified *Culicidae*	104	1
sterile light sparse mycelium		
unidentified *Culicidae*	82	1
sterile non-septate light mycelium		
Scoliopteryx libatrix	92	1
total number of samples		**94**

In Tab. 4, associations of micromycetes with insect species are given. Each of the most frequent insect species (the moths *Triphosa dubitata* and *Scoliopteryx libatryx*, and an unidentified mosquito) hosted seven micromycetes. On three other less frequent insect species, only 2–4 microfungal species were recorded. These data correlate with the number of collected dead bodies. Thus, for more exact results on host – parasite specificity, much more collections should have had to be made.

Regarding entomopathogenic fungal species, the most frequent fungus *Paecilomyces farinosus* (Fig. 4, 6, and 8) was found as a parasite of a majority of studied insect taxa (five out of six). It occurred most frequently on *Scoliopteryx libatrix* cadavers. This corresponds with the overall knowledge about this species: a ubiquitous insect parasite, common both in temperate and tropical zones on a wide host range (Domsch et al. 1993). Tzean et al. (1997) mentioned in their comprehensive atlas that *Paecilomyces farinosus* belongs to the most often encountered *Paecilomyces* species in Taiwan. Samson et al. (1984) mentioned this species as a frequent parasite of insects in caves in the Netherlands. In the Czech Republic, Javůrková-Fassatiová (1956) found this species on members of several different insect groups; *P. farinosus* was also often recorded from soil in the Šumava Mts. (Kubátová et al. 1998, Nováková 2001) and from bark beetles (Landa et al. 2001).

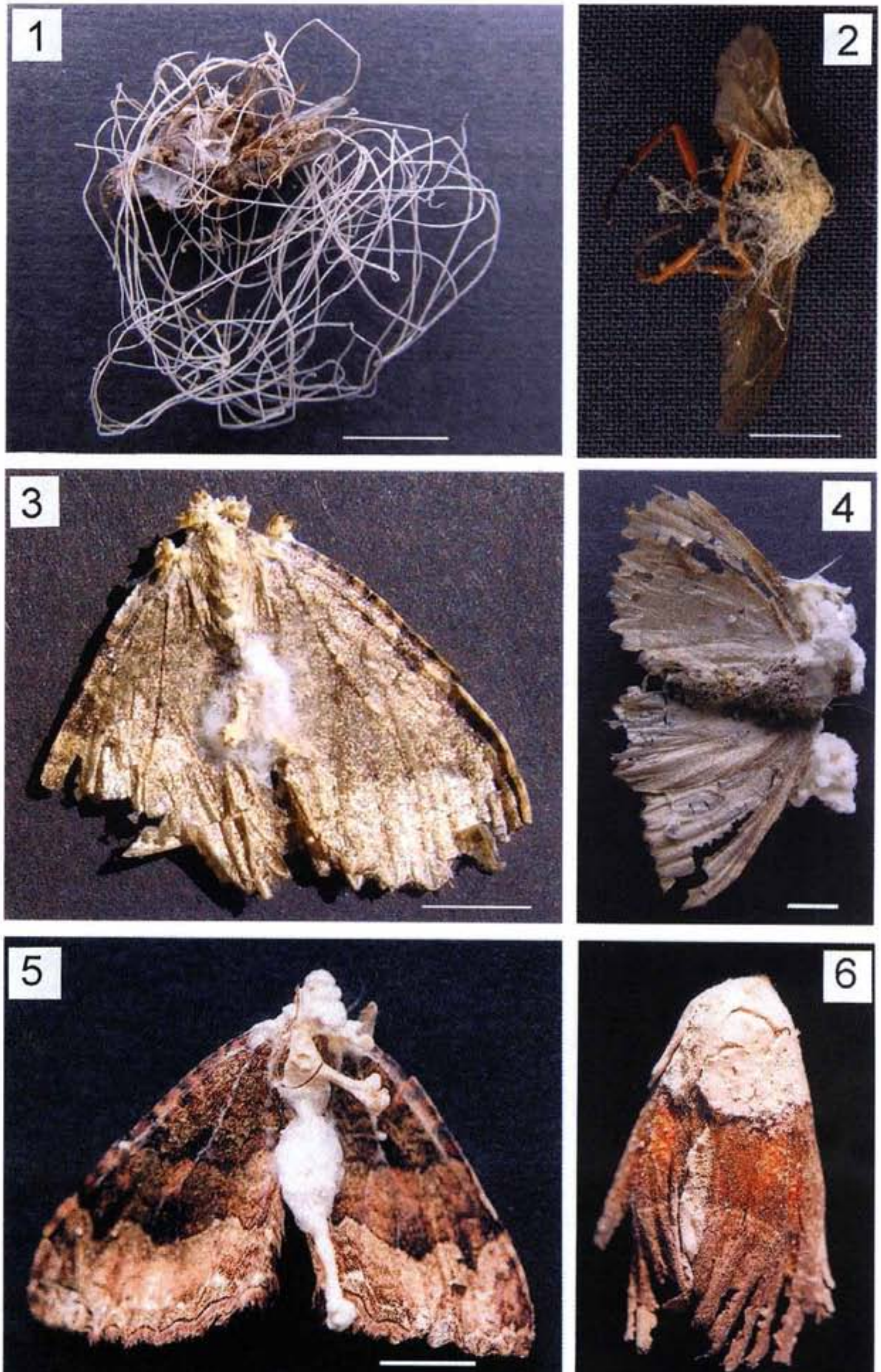
On the other hand, another frequent micromycete, unidentified *Cordyceps* sp. (Fig. 3, 5, and 7), was found associated with only one insect species, *Triphosa dubitata*. Pacioni (1978) described from this moth the morphologically similar species *Cordyceps riverae* Pacioni. Matočec and Ozimec (2001) observed *C. riverae* on *Triphosa dubitata*, too. Our collections however differ somewhat from this species (see below).

Tab. 4. Insect – fungus associations.

Insect species (No. of samples)	**Associated fungus species**	**Number of infected samples**
Triphosa dubitata	*Cordyceps* sp.	14
(37)	sterile white mycelium with sterile synnemata	12
	sterile white mycelium	9
	Simplicillium cf. *lamellicola*	3
	Aphanocladium album	1
	Engyodontium cf. *parvisporum*	1
	Paecilomyces farinosus	1
Scoliopteryx libatrix	*Paecilomyces farinosus*	25
(30)	*Lecanicillium muscarium*	4
	sterile white mycelium	2
	Engyodontium rectidentatum	1
	Paecilomyces farinosus	1
	Simplicillium cf. *lamellicola*	1
	sterile non-septate light mycelium	1
Inachis io	*Paecilomyces farinosus*	2
(3)	*Lecanicillium muscarium*	1
unidentified *Culicidae*	*Conidiobolus destruens*	4
(14)	*Acremonium bacillisporum*	4
	Lecanicillium sp.	4
	Paecilomyces farinosus	4
	Beauveria bassiana	1
	sterile white mycelium	1
	sparse sterile light mycelium	1
Heleomyza sp.	sterile white mycelium	4
(7)	*Hirsutella guignardii*	1
	Mortierella sp.	1
	sterile white mycelium	1
Diphyus quadripunctorius	*Paecilomyces farinosus*	2
(3)	*Mucor* sp.	1

Another fungal species, *Conidiobolus destruens* (Fig. 14), was also observed on only one insect species, an unidentified mosquito (*Culicidae*). According to Weiser and Batko (1966) who described this species (as *Entomophthora destruens* Weiser et A. Batko), it is a typical pathogen of mosquitoes in underground shelters. They found it in caves and cellars in Moravia and Bohemia (Czech Republic), Slovakia, England and France on *Culex pipiens* as the only host.

Lecanicillium muscarium (known formerly as *Verticillium lecanii* (Zimm.) Viégas) (Fig. 12) was found on two members of *Lepidoptera* (Table 3). It is a very frequent polyphagous species occurring mainly in temperate regions whereas the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closely related species *L. lecanii* (Zimm.) R. Zare et W. Gams prefers tropical regions (Zare and Gams 2001). The pathogenic abilities of *L. muscarium* are also utilised commercially (Zare and Gams 2001). In the Czech Republic it was reported infrequently from soil (Kubátová et al. 1998, Nováková 2001) and more frequently from bark beetles (Landa et al. 2001).

Hirsutella guignardii (Figs. 1 and 9) is known in Europe as an entomogenous fungus parasiting troglobiotic insects (dipteran and coleopteran) (Samson et al. 1984, Malloch – Internet). We found it only once on *Heleomyza* sp., a dipteran member. The find in the Czech Republic is probably the first.

Engyodontium parvisporum (Fig. 10) is known to be associated with insects from warm regions. De Hoog (1978) cites several records from Sri Lanka. Our specimen differs somewhat from the description by de Hoog (see below).

It is noteworthy that well–known entomopathogenic fungi like *Beauveria bassiana*, *B. brongniartii*, and *Paecilomyces fumosoroseus* were recorded only once. The main niche of these fungi is probably elsewhere, although Samson et al. (1984) found *Beauveria bassiana* frequently on troglobiotic insects. Another well–known entomopathogen, *Metarhizium anisopliae* (Metschn.) Sorokin, was not observed on our insect material. This species occurs only on coleopteran members (Domsch et al. 1993).

On the other hand, we found several fungi which are not typical parasites of insects. For example, *Mucor* species (Fig. 2) are generally coprophilous and "sugar" fungi. Sporadic data about its associations with insects however exist. Lagarde (1922) found *Mucor* sp. on debris of insects. Heitor (1962) experimentally demonstrated that *M. hiemalis* Wehmer can cause infection of wounded insects; the fungus penetrates through the wound. Recently, Zalar et al. (1997) described a new species, *M. troglophilus* Zalar, infecting *Troglophilus neglectus* (*Orthoptera*).

Among other microfungi with unknown association with insects are *Mortierella* sp., *Acremonium bacillisporum*, *Aphanocladium album* (Fig. 11), and *Engyodontium rectidentatum*. They are known predominantly from soil (Gams 1971, Gams et al. 1984, Domsch et al. 1993). *Acremonium bacillisporum* was found on insects by O. Constantinescu in Romania (CBS Filamentous Fungi Database 2005). *Aphanocladium album* was often recorded from myxomycetes and fungi, too. In the Czech Republic this fungus is found rarely; it was reported

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Fig. 1. Synnemata of *Hirsutella guignardii* on *Heleomyza* sp. (PRC 75).

Fig. 2. *Mucor* sp. on *Diphyus quadripunctorius*.

Fig. 3. Perithecia of *Cordyceps* sp. in the head part of *Triphosa dubitata* (PRC 139).

Fig. 4. Synnemata of *Paecilomyces farinosus* on *Triphosa dubitata* (PRC 103).

Fig. 5. Sterile mycelium and stalks of *Cordyceps* sp. on *Triphosa dubitata* (PRC 67).

Fig. 6. *Paecilomyces farinosus* on *Scoliopteryx libatrix* (PRC 74).

Scale bars: 5 mm. Photo A. Kubátová

e.g. from the air of caves (Bosák et al. 2001). *Engyodontium rectidentatum* is known predominantly from soil (Gams et al. 1984). In the Czech Republic this species is rare; it was isolated from air in caves (Marvanová et al. 1992). It is possible that these fungi contamined dead bodies of insect and grew there as saprotrophs.

Notes to the identification of some recorded fungi

Cordyceps sp. (Fig. 3, 5, and 7). We found 14 specimens with a fungus identified as *Cordyceps* sp. It formed whitish stalks varying in length (max. 5 mm long), at the end often club-shaped. Perithecia grew terminally on the stalks, sometimes also laterally; in some specimens on the surface of the stalk, in others partially embedded in white felted mycelium. Mature perithecia with ascospores were yellow. However, only four specimens were fertile (see Table 3) and formed long cylindrical asci with filiform hyaline ascospores, which fragment to 1–celled ascospores, c. 10 x 1 µm. All other specimens formed immature yellow perithecia or old brown, empty perithecia. Because of the same general habitus we assigned them also to *Cordyceps* sp. In species identification of *Cordyceps*, the host is of great importance. Our specimens are very close to *Cordyceps riverae* which was described by Pacioni (1978) on *Triphosa dubitata* from caves in Italy and Belgium and later found also by Matočec and Ozimec (2001) on *T. dubitata* and *T. sabaudiata* in Croatian caves. However, *Cordyceps riverae* differs by smaller part spores (c. 4–6.5 x 0.6–0.7 µm). Another similar species often found on lepitopteran members is *C. tuberculata* (Lebert) Maire. This species is known from many parts of the world, and was recorded also in Slovakia (Kautmanová 2002). It differs from our specimens by smaller part spores, too (2–6 x 0.5–1 µm after Mains 1958). In the Czech Republic, at least 8 species of *Cordyceps* have been recorded, six of them belonging to parasites of insects (Javůrková-Fassatiová 1955), and two of *Elaphomyces* (Holec 2001).

Sterile mycelia. This type of fungus could not mostly be identified with morphological methods. However, some morphological similarities were observed between „sterile white mycelium with sterile synnemata“ and *Cordyceps* sp., both found on *Triphosa dubitata* (Table 3). The sterile synnemata could be initials of stalks of *Cordyceps*. In this case, molecular methods could yield some results. However, for this „floristic case study“ it would be too expensive.

Hirsutella guignardii (Fig. 9). It has prominent thin long synnemata, lageniform phialides and ellipsoidal-fusiform conidia with mucus. This mucus was not observed in lactic acid mounts (Fig. 9c), only in water mounts (Fig. 9d).

Lecanicillium sp. (Fig. 13). This species was found only on cadavers of unidentified mosquitoes. It forms verticillate conidiophores with hyaline conidia of highly variable size, c. 4.5–15 x 1.2–2 µm. The longer conidia (macroconidia) are

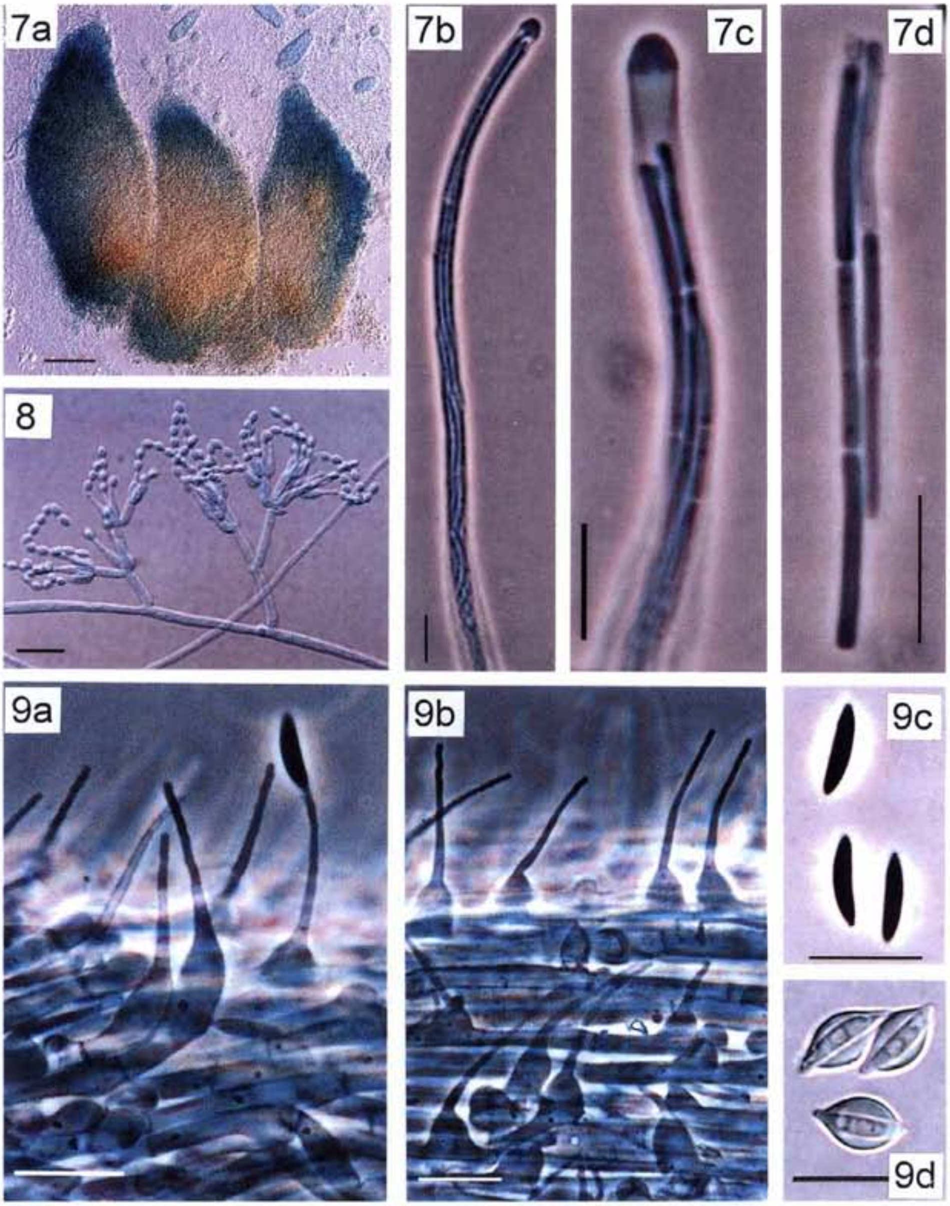

Fig. 7. *Cordyceps* sp.: a – young perithecia (PRC 144), DIC; b, c – upper part of a long cylindrical ascus with ascospores (PRC 139), Ph; d – ascospore fragments (PRC 139), Ph.

Fig. 8. *Paecilomyces farinosus* (PRC 80), conidiophores with conidia, DIC.

Fig. 9. *Hirsutella guignardii* (PRC 75): a, b – phialides with long necks, Ph; c – conidia in lactic acid mount, Ph; d – conidia in water mount, DIC.

Scale bar in Fig. 7a: 100 µm, in all other figs. 10 µm. Photo A. Kubátová

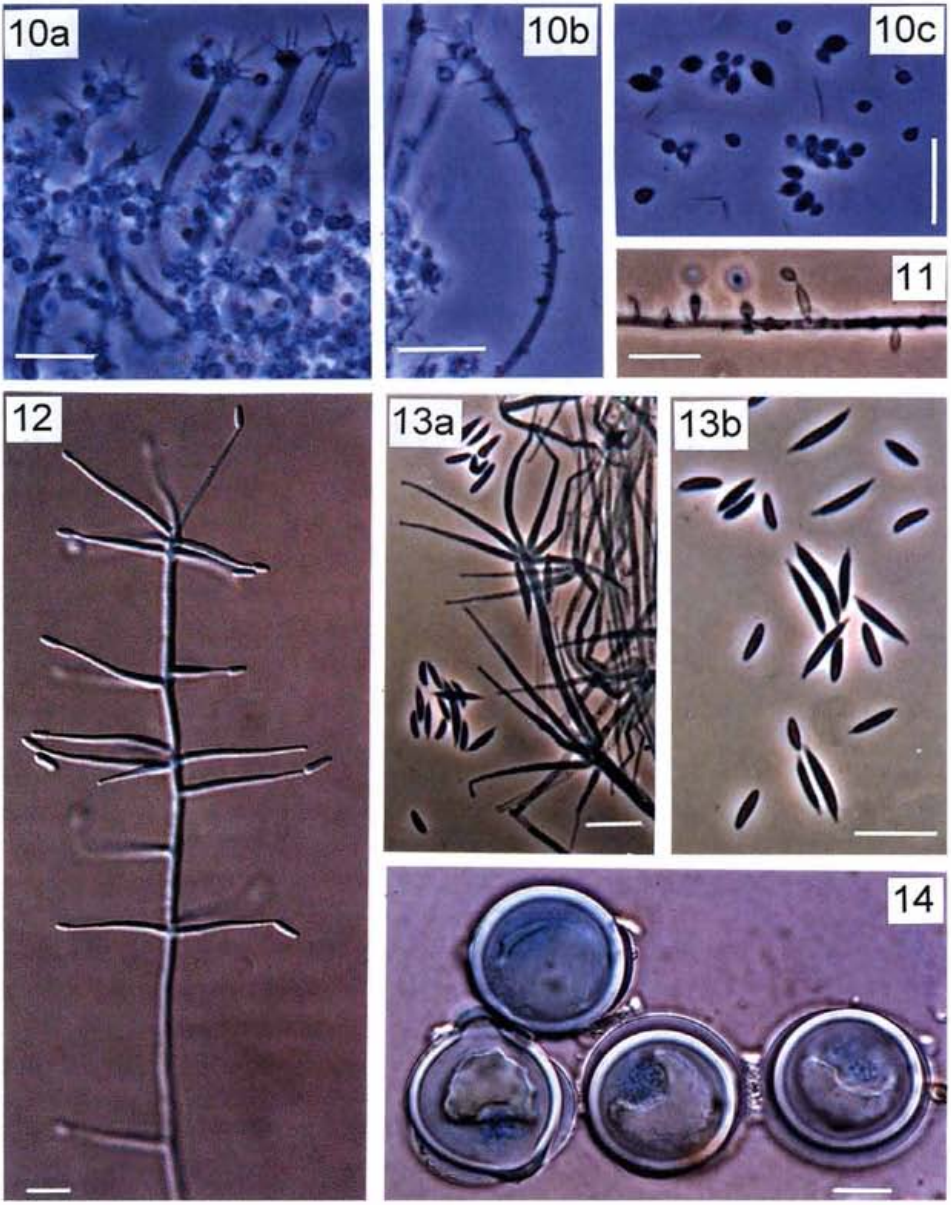

Fig. 10. *Engyodontium* cf. *parvisporum* (PRC 145): a, b – conidiophores with thin denticles and conidia, Ph; c – conidia, Ph.

Fig. 11. *Aphanocladium album* (PRC 139), conidiogenous hypha with phialides and conidia, Ph.

Fig. 12. *Lecanicillium muscarium* (PRC 138), conidiophore with conidia, DIC.

Fig. 13. *Lecanicillium* sp. (PRC 140): a – conidiophore with conidia, Ph; b – macro- and microconidia, Ph.

Fig. 14. *Conidiobolus destruens* (PRC 94), resting spores, DIC.

Scale bars: 10 µm. Photo A. Kubátová

spindle-shaped, straight or slightly curved, with acute ends, sometimes two-celled. The smaller conidia (microconidia) have rounded ends. The division between macroconidia and microconidia is not sharp. On account of the conidium sizes this species is intermediate between *Lecanicillium psalliotae* (Treschew) R. Zare et W. Gams (having shorter macroconidia) and *Lecanicillium acerosum* R. Zare et W. Gams (longer macroconidia). Whilst *L. psalliotae* is often found worldwide and in the Czech Republic predominantly in soil, *L. acerosum* was described only in 2001 from insects in Brazil and its distribution is not yet known. According to data by Zare and Gams (2001), our isolates are similar to strain CBS 171.97 isolated from insects in Spain, which has been provisionally assigned to *L. psalliotae*.

Simplicillium cf. *lamellicola*. This species is morphologically very similar to *Lecanicillium psalliotae*. According to Zare and Gams (2001) it differs by more straight conidia (in *L. psalliotae* they are more curved) and by a brown colony reverse (in *L. psalliotae* it is red). Our two isolates have more or less straight conidia but failed in pigmentation of the reverse. Thus some uncertainty remains about their identification. Both strains are maintained in the CCF, Prague.

Engyodontium cf. *parvisporum* (Fig. 10). Our specimen differs somewhat from the description by de Hoog (1978). The size of conidia in our fungus is 2–4 x 1.5–2 µm, whereas de Hoog reported 1.2–3 x 1.2–1.5 µm. Another difference was found in the shape of conidiogenous cells. They are slightly swollen at the end in our specimen, whereas de Hoog reported that they are often very slightly tapering towards the tip. The identification of our specimen thus remains open. Morphologically similar is *Aphanocladium aranearum* (Petch) W. Gams which differs from our fungus by somewhat larger conidia (2.8–4.6 x 2–3.4 µm according to Gams 1971).

Concluding, *Paecilomyces farinosus* was found to be the most frequent parasite of different insects in the explored underground shelters and thus plays probably the important role in this habitat. Two fungi were recorded in association with one insect species: *Cordyceps* sp. is the major fungal pathogen of *Triphosa dubitata* and *Conidiobolus destruens* the pathogen of an unidentified mosquito. The identification of several fungal entomopathogens found during this "case study" (especially *Cordyceps* sp., *Lecanicillium* sp., sterile mycelia) requires a more detailed (preferably molecular) study.

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CZECH MYCOL. 57(3–4): 239–248, 2005

Newly recorded *Acremonium* species from Slovakia: *Acremonium atrogriseum*, *A. roseogriseum*, *A. spinosum*, and *Acremonium* sp. (anamorph of *Neocosmospora vasinfecta* var. *africana*)

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Labuda R.: Newly recorded *Acremonium* species from Slovakia: *Acremonium atrogriseum*, *A. roseogriseum*, *A. spinosum*, and *Acremonium* sp. (anamorph of *Neocosmospora vasinfecta* var. *africana*). – Czech Mycol. 57(3–4): 239–248.

Four species of the genus *Acremonium* (Ascomycota, *Hypocreales*), namely *A. atrogriseum*, *A. roseogriseum*, *A. spinosum*, and *Acremonium* sp. (teleomorph *Neocosmospora vasinfecta* var. *africana*) hitherto not reported from Slovakia, are described and illustrated here. The former one was isolated from turkey litter, while the latter three were recovered from a soil sample. Representative strains of the fungi are deposited in the Microbiology Department Collection, SUA in Nitra.

Key words: fungi, soil, turkey litter, Slovakia

Labuda R.: Novo zaznamenané druhy z rodu *Acremonium* na Slovensku: *Acremonium atrogriseum*, *A. roseogriseum*, *A. spinosum* a *Acremonium* sp. (anamorfa druhu *Neocosmospora vasinfecta* var. *africana*). – Czech Mycol. 57(3–4): 239–248.

Práca predkladá charakteristiku a vyobrazenie štyroch druhov z rodu *Acremonium* (*A. atrogriseum*, *A. roseogriseum*, *A. spinosum* a *Acremonium* sp. (teleomorfa *Neocosmospora vasinfecta* var. *africana*), ktoré neboli doposiaľ z územia Slovenska zaznamenané. Druh *A. atrogriseum* bol izolovaný z podstielky pre morky. Ostatné tri druhy boli izolované z pôdy. Študované kmene sú uchované v Zbierke katedry mikrobiológie, SPU v Nitre.

INTRODUCTION

In the course of mycological investigations of soil and turkey litter samples carried out in March 2005 at the Department of Microbiology, Slovak University of Agriculture (SUA) in Nitra, four interesting *Acremonium* species, namely *A. atrogriseum*, *A. roseogriseum*, *A. spinosum*, and *Acremonium* sp. (teleomorph *Neocosmospora vasinfecta* var. *africana*) were encountered. Referring to the Checklist of non-vascular and vascular plants of Slovakia (Lizoň and Bacigálová 1998), these micromycetes have not previously been reported from Slovakia, and thus represent new fungi to this area.

MATERIAL AND METHODS

The micromycetes were isolated on malt extract agar with chloramphenicol by the dilution plate technique according to Gams et al. (1987). Subsequent cultivation and identification of the fungi was carried out on malt extract agar (MEA) following the species diagnosis given by Gams (1971) and de Hoog et al. (2000). *Neocosmospora vasinfecta* var. *africana* was identified according to Cannon and Hawksworth 1984 and Rossman et al. (1999). Potato dextrose agar (PDA) was used here as an additional medium. To promote perithecium formation in the *Neocosmospora*, the synthetic nutrient agar (SNA) medium was employed. All formulae are those given in de Hoog et al. (2000). The microphotographs and measurements were made by means of a light microscope (Olympus Provis AX 70) equipped with a camera system (Olympus Provis AX 70) and the software Image-Pro Plus (Media Cybernetics, Silver Spring, Maryland, USA). The macrophotographs were made by means of a digital camera (Camedia C 5000 Zoom). The drawings were made by the author.

Scanning electron microscopy (SEM) of ascospores in the *Neocosmospora* strain was performed by means of a SEM microscope (Tesla BS 301) after fixation of a small block of the colony with perithecia in a 5 % aqueous solution of glutaraldehyde (Merck, Germany) overnight (16 hours) at 5 °C, followed by three successive washings with 100, 90 and 60 % acetone (LCHM-Labochem, Bratislava, Slovak Republic) (10 min each). After dehydratation was completed, the sample was critical point dried in a critical point apparatus (Bio-Rad Polaron, Herdforshire, UK) in CO_2 and coated with gold using a Bio-Rad Polaron sputter coater. Strains of the fungi are deposited in the Microbiology Department Collection, SUA in Nitra.

RESULTS AND DISCUSSION

Acremonium atrogriseum (Panasenko) W. Gams 1971
(section *Gliomastix*, series *Murorum*)
Syn.: *Phaeoscopulariopsis atrogrisea* Panasenko 1964

A single isolate, RL Ac–1 0305, was found in litter from a turkey farm in Rišňovce, Nitra, Slovak Republic, in March 2005 by R. Labuda.

Description. Colonies on MEA slow-growing, after 10 days at 25 °C 15 mm in diam., on PDA (Fig. 5) growing somewhat faster, reaching 22 mm in diam., dark greyish brown, velutinous. Reverse dark olivaceous to almost black, on PDA violet in the central areas. Well sporulating. Phialides arising at right angles, singly or in dense groups from dark creeping hyphae, 10–25 × 2.0–3.5 µm, with moderately inflated basal part tapering into a moderately to very long neck c. 1 µm in width (Fig. 1).

Collarettes inconspicuous. Conidia one-celled, hyaline under a light microscope but greyish brown in mass, mostly ellipsoidal and slightly apiculate, 3.5–5.0 × 2.5–3.2 µm, smooth-walled, formed in false heads. Chlamydospores absent.

Outstanding traits. Slow-growing greyish-brown colonies, phialides with moderately swollen bases and long tapering necks, ellipsoidal conidia formed in heads.

Affinities. The species may micro-morphologically resemble *A. inflatum* (C.H. Dickinson) W. Gams (distinguished by subglobose conidia formed in heads only and by phialides with conspicuous collarettes) and *A. roseogriseum* (distinguished by longer awl-shaped phialides and comparatively larger, tear-shaped conidia). In addition, it may also superficially resemble *Scedosporium prolificans* (Hennebert et B.G. Desai) E. Guého et de Hoog, which is however readily distinguishable by its annellidic phialides and generally larger conidia.

Note: In Gams (1971) and de Hoog et al. (2000), the species is described as producing conidia in heads, and also in chains, especially when the cultures are young. However, no conidial chains were observed on both MEA and PDA in the isolate treated here. Chain formation was observed on the isolation medium.

Habitat and distribution. According to Gams (1971), *Acremonium atrogriseum* has been recovered from garden soil, arable soil, from the rhizosphere of an apple tree, from lesions on roots of tomato, from impregnated pine wood, and from moldy pasta. Moreover, the species has been reported as the agent of human systemic infection, from the lung of a human patient, human sputum and bronchial wash, and from infected hair of a man (de Hoog et al. 2000; CBS, 2005). In addition, a human case of keratitis is known (Read et al. 2000).

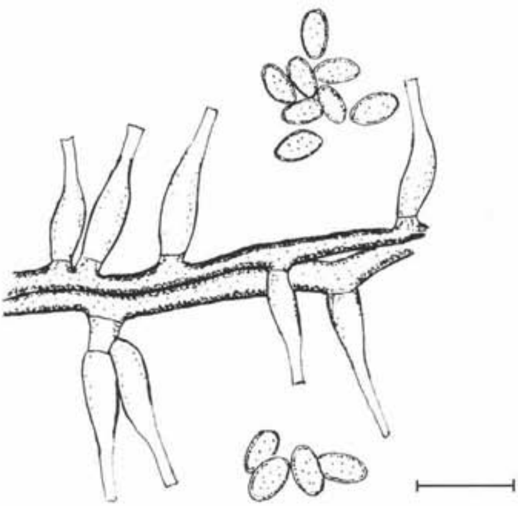

Fig 1. *Acremonium atrogriseum*, conidiophores with conidia (bar = 10 µm).

Acremonium roseogriseum (S. B. Saksena) W. Gams 1971
(section *Gliomastix*, series *Murorum*)

Syn.: *Cephalosporium roseogriseum* S. B. Saksena 1955
Gliomastix murorum var. *felina* pro parte Dickinson 1968

A single isolate, RL Ac–2 0305, was recovered from soil (Chernozem) in Borovce, Piešťany, Slovakia, in March 2005 by R. Labuda.

Description. Colonies on MEA moderately fast growing, after 10 days at 25 °C 33 mm in diam., on PDA growing somewhat faster, reaching 39 mm in diam., white at first, then reddish brown, soon becoming olivaceous-black in sporulating areas, with hyphae aggregated into rope-like strands. On PDA (Fig. 6) hyaline exudates droplets and pale reddish pigment diffusing into the substrate were observed. Reverse pale. Well sporulating. Phialides awl-shaped, erect, arising from strands of aerial hyphae, 25–35 × 2.5 µm. Conidia large, tear-shaped, greyish-black, 5.0–7.0 × 3.0–4.0 µm, smooth-walled, formed in slime heads (Fig. 2). Chlamydospores absent.

Outstanding traits. Relatively fast growing white to reddish-brown colonies with pronounced fasciculation of the aerial hyphae into rope-like strands and with greyish-black areas due to rich conidium production, awl-shaped phialides bearing slime heads of tear-shaped, dark conidia.

Affinities. The species may resemble *A. murorum* (Corda) W. Gams, which however produces broadly ellipsoidal and mostly coarsely roughened conidia.

Habitat and distribution. According to Gams (1971), *Acremonium roseogriseum* has been recovered only from grassland soil. Other soil sources of

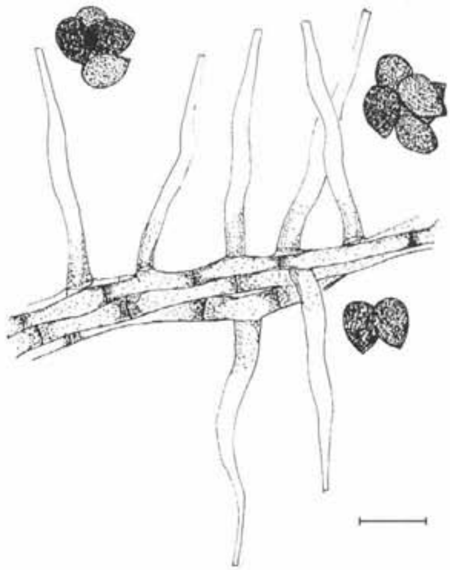

Fig. 2. *Acremonium roseogriseum* conidiophores with conidia (bar = 10 µm).

the taxon are listed in the CBS species database (CBS 2005). In 1961, the species was also reported in a case of arthritis in a knee of a human by Ward and co-workers, but it is uncertain whether that strain was correctly identified (de Hoog et al. 2000).

Acremonium spinosum (Negroni) W. Gams 1971
(section *Gliomastix*, series *Persicinum*)
Syn.: *Cephalosporium spinosum* Negroni 1933
Hyalopus spinosus (Negroni) Barbosa 1941

Two isolates, RL Ac–3 0305 and RL Ac–4 0305, were recovered from soil (Chernozem), in Borovce, Piešťany, Slovakia, in March 2005 by R. Labuda.

Description. Colonies on MEA slow-growing, after 10 days at 25 °C 15 mm in diam., on PDA (Fig. 7) growing much faster, reaching 30 mm in diam., white or nearly so, floccose. In one isolate, lemon yellow exudate droplets and diffusing pigment were produced on MEA. Reverse pale, on PDA yellowish brownish with similarly coloured pigment diffusing into the substrate. Well sporulating. Phialides awl-shaped, erect, arising from strands of aerial hyphae, 15.0–35.0 × 2.5 µm. Conidia subglobose and mostly slightly apiculate, hyaline, 3.5–4.4 × 3.0–4.0 µm, finely to distinctly verruculose or spinulose, formed in slime heads (Fig. 3). Chlamydospores absent.

Outstanding traits. Slow-growing white to pale ochre colonies, awl-shaped phialides bearing almost spherical, roughened to finely spinulose conidia cohering in slime heads.

Affinities. The species may resemble *A. persicinum* (Nicot) W. Gams, which however produces conidia in heads and chains. Furthermore, its colonies grow much faster and possess more pronounced coloration.

Note. Conidia were found to be somewhat larger (3.5–4.4 vs. 2.5–3.5 µm) than those described by Gams (1971) and by de Hoog et al. (2000).

Habitat and distribution. The species has originally been described from human onychomycosis in 1933 by Negroni (de Hoog et al. 2000). According to Gams (1971), it has been recovered from air, and in the CBS species database (CBS 2005) it is listed as being isolated from soil as well.

Neocosmospora vasinfecta var. ***africana*** (Arx) P.F. Cannon et D. Hawksw.
(order *Hypocreales*, family *Nectriaceae*)
Syn.: *Neocosmospora africana* Arx
Neocosmospora vasinfecta forma *conidiifera* Kamyschko
Anamorph: *Acremonium* sp.

A single isolate, RL Neo–1 0305, was recovered from soil (Chernozem), in Borovce, Piešťany, Slovakia, in March 2005 by R. Labuda.

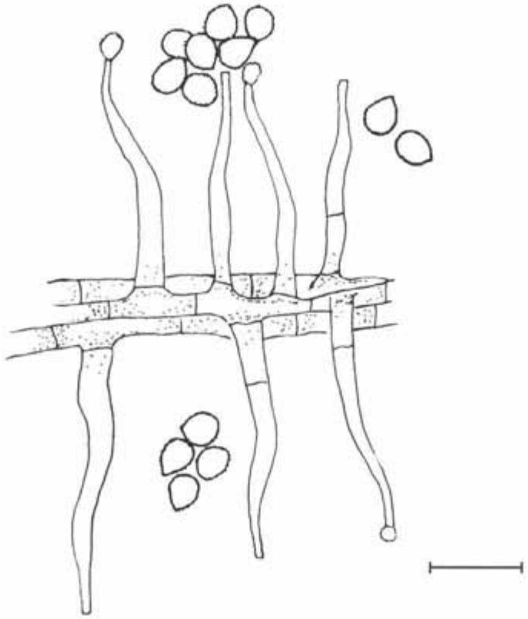

Fig. 3. *Acremonium spinosum*, conidiophores with conidia (bar = 10 µm).

Description. Colonies on MEA moderately fast growing, after 10 days at 25 °C 30 mm in diam., on PDA (Fig. 8) growing much faster, reaching 55 mm in diam., pinkish-red, floccose, reverse pinkish-red with similarly coloured pigment being diffused into the substrate on MEA. No ascomata observed on this medium. On PDA, white floccose colonies with violet to very dark violet aerial mycelium in the central areas, with numerous immature orange ascomata scattered mainly towards the centre, reverse pale with violet-brown centres. Poorly sporulating. Phialides awl-shaped, erect, 25.0–80.0 × 2.5–4.0 µm long, with distinct collarette. Conidia large, 1–2–celled, hyaline, cylindrical to reniform, 5.0–13.0 (17.0) × 3.0–3.5 µm, smooth-walled, formed in false heads (Fig. 4). Chlamydospores present.

Colonies on SNA moderately fast growing, after 10 days at 25 °C 35 mm in diam., white, translucent with sparse aerial mycelium and orange perithecia scattered over the entire colony. Perithecia (Fig. 9) almost spherical, orange becoming brownish, with apical pore, 300–500 µm, peridial walls of a textura angularis. Asci cylindrical, 8-spored, 80.0–100.0 × 12.0–15.0 µm. Paraphyses absent. Ascospores 1-celled, pale brown, spherical to broadly ellipsoidal, 15.0–17.8 × 14.0–16.0 µm. Ascospore walls with a cerebriform ornamentation under SEM (Fig. 11), appearing nearly smooth under low magnifications (Fig. 10).

Outstanding traits. Poorly sporulating, brightly coloured colonies on MEA and PDA, long and robust phialides forming cylindrical to slightly curved conidia with

0–1 septum. Orange-brown perithecia producing cylindrical, 8-spored asci. Ascospores large, 1-celled, almost spherical and distinctly cerebriform.

Affinities. The anamorphic state may somewhat resemble poorly differentiated *Fusarium* strains, especially those of *F. solani* (Mart.) Sacc., yet the morphology of the macroconidia as well as distinct teleomorphs set the two genera unambiguously apart.

Note. Two varieties are currently accepted within the species (Rossman et al. 1999), namely *Neocosmospora vasinfecta* var. *vasinfecta* and var. *africana* (Arx) P.F. Cannon et D. Hawksw. They are morphologically distinguishable on account of the ascospore ornamentation. Conspicuously rugose ascospores are formed in var. *vasinfecta*, while those with a cerebriform ornamentation are characteristic of var. *africana* (Cannon and Hawksworth 1984, Rossman et al. 1999). As it can be seen on the scanning electron micrograph (Fig. 11), ascospores of the isolate studied here clearly show an ornamentation pattern identical with that of *Neocosmospora vasinfecta* var. *africana* (strain IMI 172482, page 678, Fig. 11) used in the study of Cannon and Hawksworth (1984).

Habitat and distribution. The fungus is widely distributed throughout the tropics and warm temperate regions. Usually it is isolated from soil, often associated with leguminous crops (Cannon and Hawksworth 1984, Rossman et al. 1999). In the CBS species database (CBS 2005) it is listed, apart from soil, also from a leaf of *Pisum sativum* and dung of cow and burro.

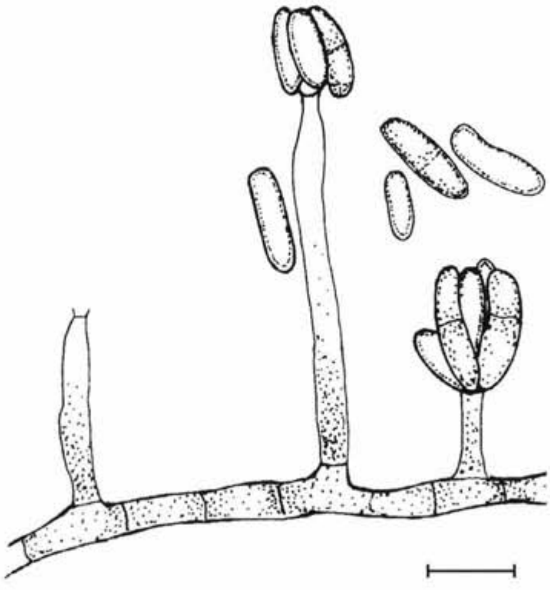

Fig. 4. *Acremonium* sp. (anamorph of *Neocosmospora vasinfecta* var. *africana*) (bar = 10 µm).

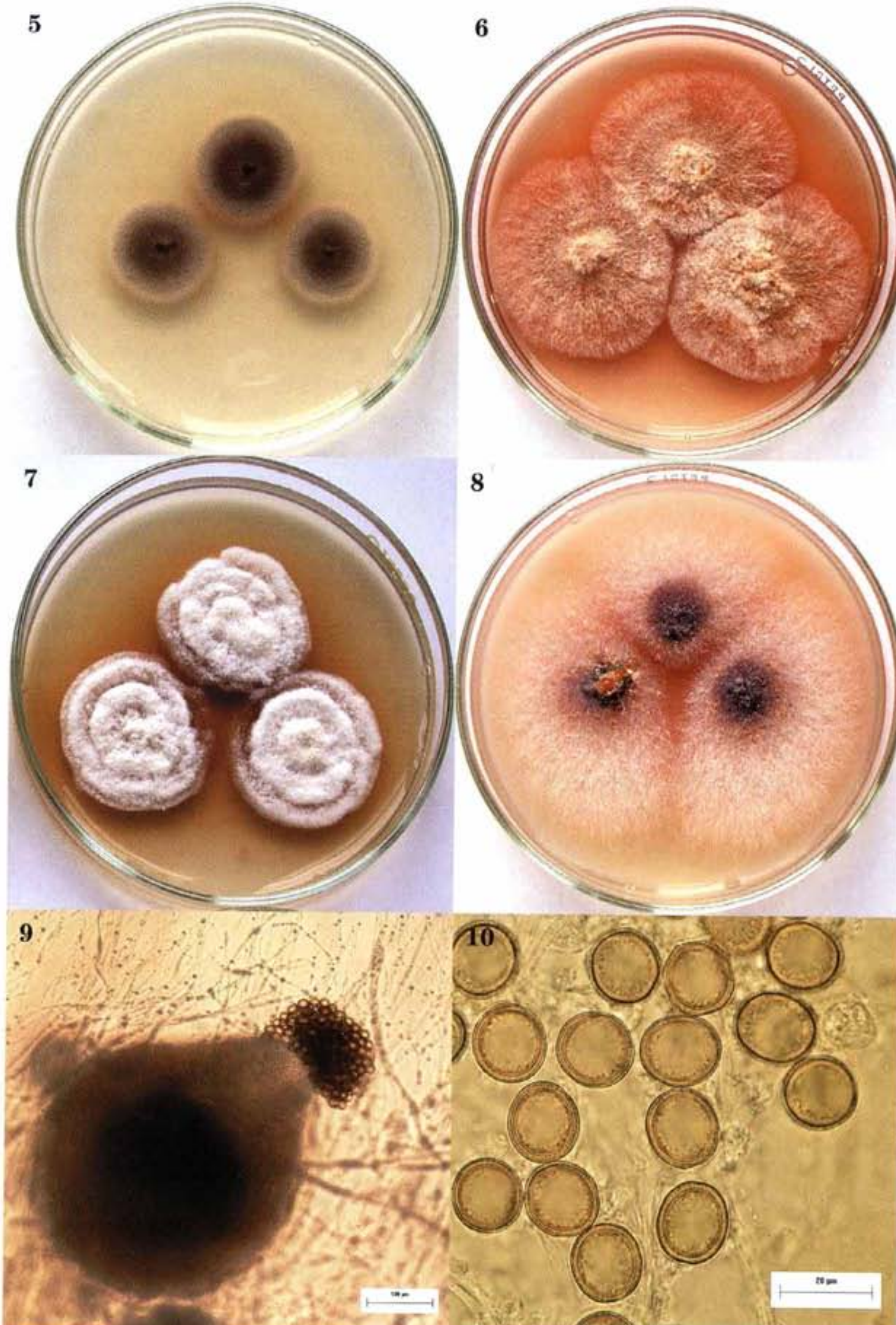
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Fig. 11. *Neocosmospora vasinfecta* var. *africana*; scanning electron micrograph showing a cerebriform ornamentation of ascospores (bar = 5μm)

ACKNOWLEDGEMENTS

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Fig. 5. *Acremonium atrogriseum.*

Fig. 6. *Acremonium roseogriseum.*

Fig. 7. *Acremonium spinosum.*

Fig. 8. *Acremonium* sp. (anamorph of *Neocosmospora vasinfecta* var. *africana*); colonies on PDA, 25 °C, 10 days, darkness.

Fig. 9. *Neocosmospora vasinfecta* var. *africana*; mature perithecium with ascospores, on SNA, 25 °C, 10 days, darkness.

Fig. 10. *Neocosmospora vasinfecta* var. *africana*; ascospores.

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CZECH MYCOL. 57(3–4): 249–256, 2005

Daleomyces phillipsii (Ascomycota, *Pezizaceae*), new Moravian finds and its distribution in the Czech Republic

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Antonín V. (2005): *Daleomyces phillipsii* (Ascomycota, *Pezizaceae*), new Moravian finds and its distribution in the Czech Republic. – Czech Mycol. 57(3–4): 249–256.

Three new localities of *Daleomyces phillipsii* in Moravia are reported, the distribution of this fungus in the Czech Republic and in Europe is summarised and its systematic position commented. The fungus is considered a well-delimited species of the separate genus *Daleomyces*, not only a sparassoid form of *Peziza proteana* (commonly treated as "f. *sparassoides*").

Key words: *Daleomyces phillipsii*, description, taxonomy, Europe.

Antonín V. (2005): *Daleomyces phillipsii* (Ascomycota, *Pezizaceae*), nové moravské lokality a jeho rozšíření v České republice. – Czech Mycol. 57(3–4): 249–256.

Jsou publikovány tři nové lokality vřeckovýtrusé houby *Daleomyces phillipsii* na Moravě, její celkové rozšíření v ČR a v Evropě a je krátce diskutováno její systematické zařazení. Houba je považována za dobře ohraničený druh samostatného rodu *Daleomyces*, nikoliv za pouhou sparassoidní formu kustřebky *Peziza proteana* (v pojetí většiny současných autorů jako „f. *sparassoides*").

INTRODUCTION

During the past years, large and distinct fruitbodies of the ascomycetous fungus *Daleomyces phillipsii* (Massee) Seaver have been found on several rather fresh bonfire sites in southern and south-eastern Moravia (Czech Republic). As the fungus is very rare in the Czech Republic (four records until 2000), new collections are reported here. The aim of the paper also is to discuss the systematic position of this fungus.

MATERIAL AND METHODS

Microscopic features are described from material mounted in Melzer's reagent and Cotton Blue. For the ascospores the following factors are used: E (quotient of length and width in any one spore) and Q (mean of E-values). Authors of fungal names are cited according to Kirk and Ansell (1992), colour abbreviations according to Kornerup and Wanscher (1983), herbarium abbreviations follow Holmgren (2003), and literature citations Bridson (2004).

RESULTS

DESCRIPTION OF COLLECTED FRUITBODIES

Daleomyces phillipsii (Massee) Seaver, N. Amer. Cup Fungi, p. 242. 1942.

Ascomata 100–250 mm broad, 80–150 mm high, irregularly globose, sparassoid, attenuated and radicate at base. Surface with numerous morchelloid ribs and caverns (sponge-like structure), whitish, light yellowish to pale violaceous. Thecium smooth, glabrous, white when young, then violaceous brown (9E9), sterile lobes finely white pubescent.

Ascospores 9.7–12.5 x 5.7–7.0 µm, E = 1.7–2.0, Q = 1.8, ellipsoid, thin-walled, cyanophilous, ornamented with ± large, up to 1.25(–1.5) µm high, irregularly shaped, rarely anastomosed cyanophilous warts and crests which are usually enlarged at the poles. Asci up to c. 200 x 8.5–12 µm, cylindrical, operculate, eight-spored. Paraphyses cylindrical, straight, septate, hyaline, 3.0–4.5 µm wide, more or less clavate-dilated at apex, apex 6.5–9.0 µm wide.

Ecology. *Daleomyces phillipsii* mostly grows on rather fresh bonfire sites, or at least on places with coal dust.

Phenology. According to Dennis (1978) the species fructifies in September and October, Jahn and Wiegand (1977) found it in November and December. The Czech finds were made from September to December, but it was also collected in June (Jazevčí) and July (Slavkov).

Material studied. BOHEMIA: Dalovice near Mladá Boleslav, in a garden, coord. N 50°25'34", E 14°53'08", 28 Sept. 1992 leg. K. Kopecký, R. Knížek and J. Herink, det. J. Herink and Z. Pouzar (PRM 892095). – Třeboň, in the town, coord. N 49°00'23", E 14°45'42", 6 Dec. 1992 leg. et det. F. Kotlaba (PRM 876869). – MORAVIA: Dolní Věstonice, site called "Na pískách", on a bonfire sites, alt. c. 150 m, coord. N 48°53'30", E 16°38'10", 19 Nov. 1978 leg. J. Moravec and A. Vágner, det. J. Moravec (BRNM 339753). – Bílé Karpaty (White Carpathian) Mts., Tvarožná Lhota, Čertoryje National Nature Reserve, on a bonfire sites, alt. c. 370 m, coord. N 48°51'15", E 17°25'00", 27 Oct. 2000 leg. et det. V. Antonín and A. Vágner (BRNM 667654). – Ibid., 14 Nov. 2000 leg. I. Jongepierová, det. J.W. Jongepier (herb. Jongepier, as *Peziza proteana* f. *sparassoides*). – Bílé Karpaty (White Carpathian) Mts., Javorník nad Veličkou, Jazevčí National Nature Reserve, on a bonfire sites, alt. c. 360 m, coord. N 48°52'15", E 17°33'55", 18 June 2004 leg. et det. V. Antonín 04.67 (BRNM 691313). – Miroslav, Miroslavské kopce National Nature Monument, part called "U kamene", on a bonfire sites, alt. 240–250 m, coord. N 48°55'53, E 16°18'13", 7 Nov. 2004 leg. et det. V. Antonín 04.327 (BRNM 695450).

Fig. 1. *Daleomyces phillipsii* (Dalovice near Mladá Boleslav, 28 Sept. 1992): carpophore. Photo R. Knížek.

Fig. 2. *Daleomyces phillipsii* (Miroslav, Miroslavské kopce, 7 Nov. 2004): carpophore. Photo V. Antonín.

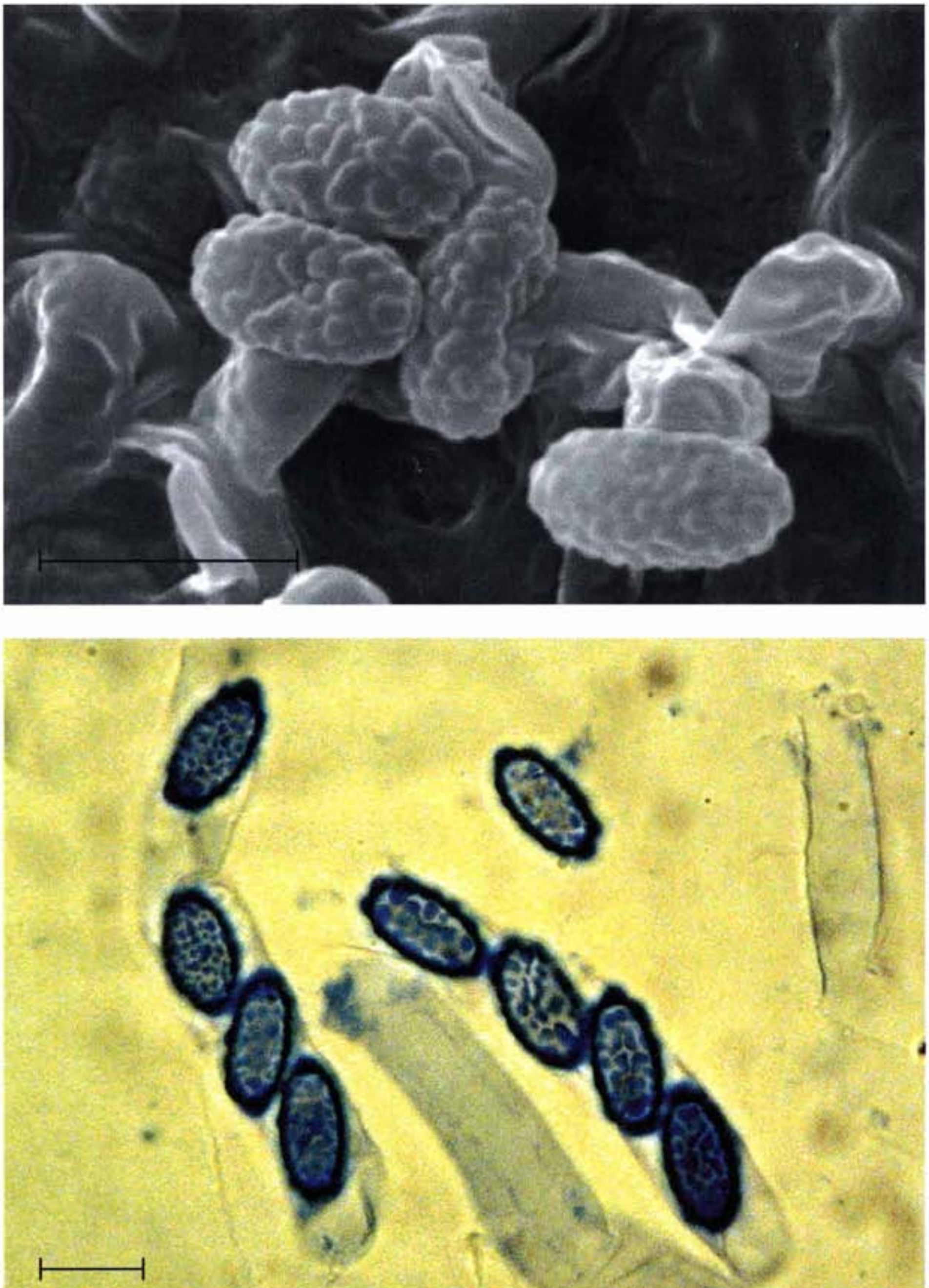

Fig. 3. Ascospores of *Daleomyces phillipsii* (Dolní Věstonice, "Na pískách") in SEM photomicrograph (photo V. Procházka) and under light microscope (coloured with Cotton Blue, photo V. Antonín). Scale bars = 10 µm.

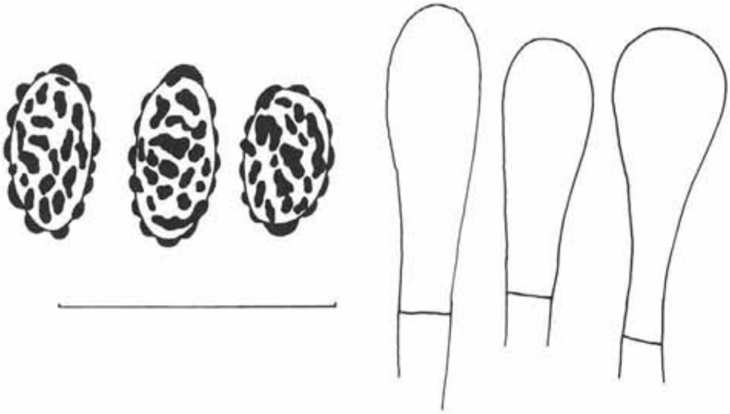

Fig. 4. *Daleomyces phillipsii* (Dolní Věstonice, "Na pískách"). Ascospores and tops of paraphyses. Scale bar = 20 µm. Del. V. Antonín.

DISCUSSION

Taxonomic remarks

The taxonomic position of *Daleomyces phillipsii* has changed since its description by Massee (1895). Originally it was described as *Gyromitra* by Massee and since that, it has been placed into many genera (for a detailed synonymy see Moravec 1982). In recent literature, the name *Peziza proteana* (Boud.) Seaver f. *sparassoides* (Boud.) Korf is often used. This concept was introduced by Korf (1956, 1973) based on the similar microscopic characters (especially amyloid asci, ascospore size and ornamentation) of *P. proteana* and Massee´s fungus. This concept was followed by Dennis (1978), Rifai (1968) and some other authors, but was not accepted by Moravec (1982). I also consider this fungus different from the genus *Peziza*. The size of ascomata, their semihypogeous development and internal structure are unusual for *Peziza*. Moreover, this opinion is supported by the facts that (1) neither simple shaped apothecia of *P. proteana* "f. *proteana*" nor a transient form have been found together (or at the same place) with the sparassoid form, (2) sparassoid forms of other *Peziza* species growing on burnt places (e.g. *P. echinospora*) look quite different concerning internal structure (Glejdura pers. comm.), and (3) the sparassoid fungus is more common than the typical *Peziza proteana* which has never been found in the Czech Republic. These observations correspond well with those by Moravec (1982 and pers. comm.).

Hansen et al. (2001) included only *P. proteana* f. *proteana* in their extensive anatomic-morphological and phylogenetic studies of the *Pezizaceae*. The conspecificity of *P. proteana* and *Daleomyces phillipsii* should be tested in future using molecular taxonomic methods.

Distribution in Europe

In Europe, *Daleomyces phillipsii* is known from Belgium (Wuilbaut 1999), the Czech Republic (see below), Denmark (Dissing et al. 2000), Estonia (Kalamees 2001), France (e.g. Crozes 1999, Van Vooren 2003), Germany (e.g. Jahn and Wiegand 1977), Great Britain (e.g. Dennis 1978), Italy (Cetto 1989, Zuccherelli 1993), Hungary (Bánhegy 1937), the Netherlands (Arnolds et al. 1995), Slovakia (Škubla 2003), Spain (Balearic Islands: Siquier et al. 1998), Sweden (e.g. Dissing et al. 2000, Jaederfeldt 1997), and Switzerland (Ciana 1987).

Distribution in the Czech Republic

The first collection of *Daleomyces phillipsii* was made 19 July 1943 by L. Maláč, who found it in a service yard of a factory in the town of Slavkov (Southern Moravia, near the city of Brno, Neuwirth 1946). Neuwirth (l. c.) made a detailed description of it and took a black-and-white photograph and described it as *Aleuria proteana* (Boud.) Seaver var. *slavkoviensis* Neuwirth; its type specimen is not preserved. The second Moravian collection was made by J. Moravec and A. Vágner in 1978 (see Material studied) and published by Moravec (1982).

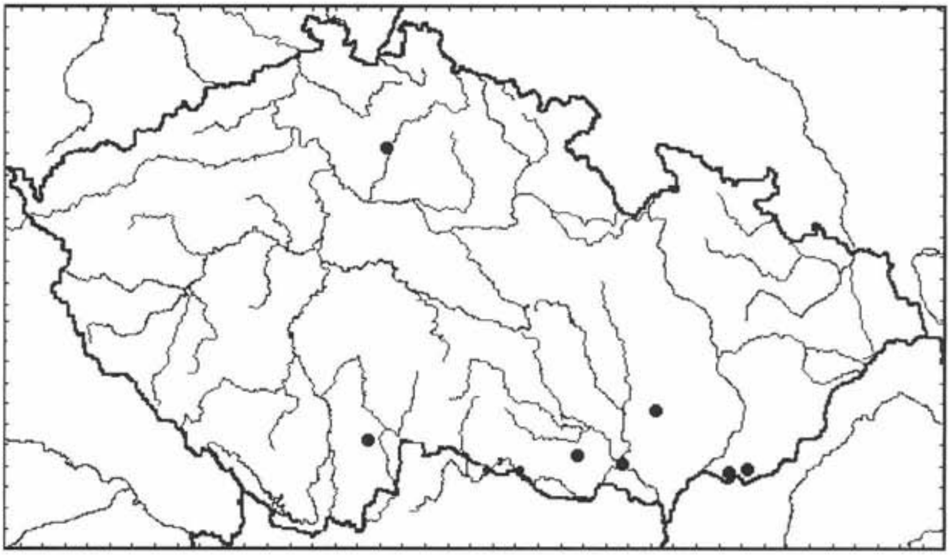

Fig. 5. Distribution map of *Daleomyces phillipsii* in the Czech Republic (generated from the Fungi 3 programme by J. Slavíček).

In Bohemia (western part of the Czech Republic), this fungus has been collected twice. Both collections were made in the early 1990s in southern Bohemia and the north part of central Bohemia (see Material studied and map – Fig. 5). Near Dalovice it has been found on a fresh (from this year) bonfire sites and weighed about 4 kg. Next year (1993), only a small ascoma (about 3 cm in diam.) was found there 27 July, then it stopped its growth and 12 August it had disappeared. No other ascomata have been found since that time there (Knížek in litt.). In the town of Třeboň, it was found on the place of a former waste dump where not fully carbonised remnants from a boiler room and coal dust were deposited.

Therefore, finds reported here represent the fifth to seventh locality in the Czech Republic.

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CZECH MYCOL. 57(3–4): 257–273, 2005

Die Rost-, Brand- und Falschen Mehltaupilze des tschechischen Teiles des Erzgebirges (Krušné hory): erster Nachtrag

WOLFGANG DIETRICH

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Dietrich W. (2005): The rust fungi, smut fungi and downy mildews in the Czech part of Krušné hory (Erzgebirge): first supplement. – Czech Mycol. 57(3–4): 257–273.

In the years 2000-2004 several species of Urediniomycetes, Ustilaginomycetes and *Peronosporales* were found that are new to the Czech part of the Krušné hory Mts. A total of 57 taxa had not been published before. In this region 227 species, subspecies and varieties are known to date. The distribution of selected species is shortly discussed and compared with the literature. Characteristic species of the more arid and warmer area of the south-east as well as the highest altitudes of the Krušné hory Mts. are enumerated. New hosts in the Czech Republic are the following: *Caltha palustris* subsp. *procumbens* for *Puccinia calthae*, *Chaerophyllum hirsutum* for *Puccinia bistortae*, *Pinus* ×*pseudopumilio* for *Coleosporium senecionis*, *Poa chaixii* for *Puccinia graminis* and *Phyteuma nigrum* for *Uromyces phyteumatum*. The western and eastern parts of the Krušné hory Mts. have so far been investigated only to a minor extent.

Key words: *Peronosporales*, Urediniomycetes, Ustilaginomycetes, Czech Republic, Krušné hory

Dietrich W. (2005): Rzi, sněti a fytopatogenní plísně české části Krušných hor, první dodatek. – Czech Mycol. 57(3–4): 257–273.

V letech 2000 až 2004 objevil autor další rzi (Urediniomycetes), sněti (Ustilaginomycetes) a fytopatogenní plísně (*Peronosporales*) v české části Krušných hor, z toho 57 dosud odtud nepublikovaných druhů a variet. Nyní je známo z tohoto území 227 druhů, subspecií a variet. Stručně je diskutováno rozšíření některých těchto taxonů a srovnáváno s literárními údaji. Jsou uvedeny typické druhy sušší a teplejší jihovýchodní strany, rovněž i další charakteristické druhy nejvyšší vrchoviny v Krušných horách. Nové hostitelské rostliny pro Českou republiku jsou *Caltha palustris* subsp. *procumbens* pro *Puccinia calthae*, *Chaerophyllum hirsutum* pro *Puccinia bistortae*, *Pinus* ×*pseudopumilio* pro - *Coleosporium* senecionis, *Poa chaixii* pro *Puccinia graminis* a *Phyteuma nigrum* pro *Uromyces phyteumatum*. Západní a východní část Krušných hor zůstávají nadále málo prozkoumány.

EINLEITUNG

Bei der Bearbeitung der Falschen Mehltau-, Rost– und Brandpilze des tschechischen Teiles vom Erzgebirge (Krušné hory) stellten Dietrich and Müller (2001) fest, dass relativ wenig Daten über diese Phytoparasiten von den Krušné hory aus der Vergangenheit vorliegen. So gab es vom Gebiet westlich und südlich des Velké jeřábí jezero keine Angaben. Aber auch andere Regionen des ca. 130 km langen Gebirges blieben nahezu unerforscht. Um einige dieser Lücken zu schließen, sammelte der Autor in den Jahren 2000 bis 2004 gezielt in einigen Regionen der Krušné hory nach Phytoparasiten. In diesem Bericht, der auch als weiterer Teil einer geplanten Übersicht über die Phytoparasiten des gesamten Erzgebirges zu verstehen ist, wurden die bisher für dieses Gebiet nicht publizierten Pilz- und Wirtsarten aufgenommen sowie Arten, von denen bisher wenig Nachweise vorlagen. Da das Gebiet bezüglich der phytoparasitischen Kleinpilze wenig erforscht war, gehören auch recht häufige Arten wie z.B. *Peronopsora alsinearum*, *Peronospora chenopodii*, *Puccinia hieracii*, *Puccinia punctata* und *Puccinia violae* zu den neu festgestellten Arten.

Die systematische Einordnung der Rost- und Brandpilze erfolgt nach Vánky (1999). Die Wirtspflanzen wurden nach Rothmaler et al. (1999) sowie Hardtke and Ihl (2000) benannt, die Falschen Mehltaupilze nach Constantinescu (1991) sowie Kochman and Majewski (1970), die Rostpilze nach Brandenburger (1984) sowie Poelt and Zwetko (1997), die Brandpilze nach Zwetko and Blanz (2004) und die *Exobasidium*-Arten nach Nannfeldt (1981) und Karatygin (2002). Alle Funde stammen vom Verfasser und sind in seinem Privatherbarium belegt. Einige Duplikate befinden sich im Herbarium von RNDr. J. Müller. Der in Černý Potok gefundene Rostpilz *Puccinia thlaspeos* (Dietrich and Müller 2000) ist im Exsikkatenwerk von Triebel (2003) unter der Nummer 521 enthalten.

Abkürzungen und Erläuterungen zum Text

Dem Artnamen folgen die Sammelmonate, Wirtspflanzen, Fundorte mit Meter über dem Meeresspiegel und die Sammeljahre, bei denen nur die beiden letzten Ziffern angegeben werden. Bei Rostpilzen werden die beobachteten Entwicklungsstadien angegeben: 0 = Pyknidien, I = Aezien, II = Uredien und III = Telien.

Beleg im Herbarium von RNDr. J. Müller (Brno, Tschechische Republik): Mü.

Himmelsrichtungen: N = nördlich, S = südlich, W = westlich, Ö = östlich, NW = nordwestlich usw.

Das untersuchte Gebiet

Der Autor sammelte im westlichen und mittleren Teil der Krušné hory. Da besonders die kleineren Orte und Landschaftsteile weniger bekannt sein dürften, werden alle vom Verfasser aufgesuchten Gebiete von West nach Ost geordnet genannt: Berg Třislová N Horní Luby, Rolava, Velký močál, Malé jeřábí jezero, Jelení, Potůčky, Podlesí, Wiesen bei ehemals Mílov ca. 2 km SÖ Podlesí, Hřebečná, Rýžovna, Zlatý Kopec, Myslivny, Boží Dar und Umgebung, Horní Žďár, Klínovec, Loučná, SÖ Háj incl. Macecha, Meluzína sowie Křížová hora, České Hamry, Nové Zvolání, Vejprty, Kovářská, bei Dolní Halže, Měděnec, Kamenné, N Petlery, Domašín, Výsluní, Pohraniční, SW Načetín, Nový dům, Křimov, Suchdol, Domina, Krásná Lípa, Bezručovo údolí, Berg Hradiště, Černovice, Chomutov, Brandov und Hora Svaté Kateřiny. Der Berg Třískolová liegt im Grenzbereich zum Elstergebirge (Halštrovská vrchovina).

ZUSAMMENSTELLUNG DER FALSCHEN MEHLTAUPILZE, ROSTPILZE UND BRANDPILZE DES BÖHMISCHEN TEILES VOM ERZGEBIRGE

PERONOSPORALES

Albugo candida (Pers.) Kuntze. V., VI., X. *Cardaminopsis halleri* (L.) Hayek: Potůčky, 715 m, 00. Zwischen Potůčky und Podlesí, 740 m, 00. Hřebečná, 920 m, 00.

Albugo tragopogonis Gray. VI. *Tragopogon pratensis* L.: Hora Svaté Kateřiny, 580 m, 01.

Peronospora agrestis Gäum. IV. *Veronica arvensis* L.: Chomutov, 360 m, 01.

Peronospora alchemillae G.H. Otth. VI., VII. *Alchemilla monticola* Opiz: Jelení, 860 m, 00. *Alchemilla subcrenata* Buser: Kovářská, Kalkgrube am NW-Hang des Na vrchu, 890 m, 00. *Alchemilla vulgaris* L.: Rolava, 900 m, 01.

Peronospora alpicola Gäum. V. *Ranunculus platanifolius* L.: ca. 2,5 km NW Gipfel des Klínovec, Bergwiese, 1090 m ü. M., 01.

Peronospora alsinearum Caspary. IV., VI. *Stellaria media* (L.) Vill.: Loučná, 900 m, 00. Chomutov, 360 m, 01.

Peronospora aparines (de Bary) Gäum. VI., VII. *Galium aparine* L.: Horní Žďár, 490 m, 00. N Vejprty, Tal der Polava, 700 m, 00. Vejprty, 730 m, 02. Ca. 400 m W Domašín, 560 m, 02.

Peronospora barbareae Gäum. IX. *Barbarea vulgaris* R. Br.: 2,5 km W Boží Dar, Myslivny, 970 m, 00.

Peronospora boni-henrici Gäum. VII., VIII. *Chenopodium bonus-henricus* L.: Loučná, 900 m, 00. České Hamry, 750 m, 01.

Peronospora calotheca de Bary. VII. *Galium odoratum* (L.) Scop.: 1 km SW Suchdol, 600 m, 01.

Peronospora chenopodii Schltdl. VI. *Chenopodium album* L.: České Hamry, 720 m, 01. Brandov, 550 m, 00.

Peronospora conglomerata Fuckel. IV., VI. *Geranium pusillum* Burm. fil.: 500 m W Domašín, 570 m, 02. Chomutov, 360 m, 01.

Peronospora dentariae Rabenh. VII. *Cardamine impatiens* L.: NÖ Suchdol, Bezručovo údolí, nahe Druhý mlýn, 500 m, 01.

Peronospora digitalidis Gäum. VIII. *Digitalis purpurea* L.: bei Černovice, Hradiště, 550 m, 00.

Peronospora ervi A. Gust. VIII. *Vicia tetrasperma* (L.) Schreber: Černovice, Teichufer NW des Bahnhofs, 420 m, 00.

Peronospora ficariae Tul. ex de Bary. IV., V. *Ranunculus ficaria* L.: SÖ Dolní Halže, Wiese am Malodolský p., 750 m, 04. 1,5 km NW Chomutov, Bezručovo údolí, 400 m, 01.

Peronospora galii Fuckel. X. *Galium palustre* L.: 500 m SW Boží Dar, mooriger Wassergraben im Božídarské rašeliniště, geringer Befall, 1000 m, 00.

Peronospora grisea (Unger) Unger. V.–VII. *Veronica beccabunga* L.: Kovářská, 820 m, 00. Brandov, 540 m, 00. *Veronica serpyllifolia* L.: 500 m S Malé jeřábí jezero, 900 m, 00. Jelení, 850 m und zwischen Jelení und Rolava, 930 m, 01. Potůčky, 750 m, 00.

Peronospora hesperidis Gäum. V. *Hesperis matronalis* L.: Potůčky, 720 m, 00.

Peronospora hiemalis Gäum. VI. *Ranunculus acris* L.: Potůčky, an Straße nach Pila, 700 m, 00.

Peronospora lamii A. Braun. IV. *Lamium purpureum* L.: Chomutov, 360 m, 01.

Peronospora lotorum Syd. VI. *Lotus corniculatus* L.: Hora Svaté Kateřiny, 600 m, 01.

Peronospora lunariae Gäum. VII. *Lunaria rediviva* L.: ca. 1 km N Křimov, Křimovský potok, 630 m, 01.

Peronospora meliloti Syd. VIII. *Melilotus albus* Med.: Pohraniční, 770 m, 00.

Peronospora phyteumatis Fuckel. VI. *Phyteuma spicatum* L.: Potůčky, 700 m, 00.

Peronospora polygoni (Thümen) A. Fischer. VI. *Polygonum aviculare* L.: Potůčky, 710 m, 00.

Peronospora rumicis Corda. V.,VI. *Rumex acetosa* L.: Potůčky, 720 m, 00. Bei Boží Dar, 1060 m, 01. Zwischen Loučná und České Hamry, 800 m, 01. České Hamry, 820 m, 04. Bei Vejprty, 700 m, 01. 1,5 km SW Kovářská, 850 m, 02.

Peronospora thlaspeos-alpestris Gäum. VI. *Thlaspi caerulescens* J. et C. Presl: Hora Svaté Kateřiny, 580 m, 01.

Peronospora thlaspeos-arvensis Gäum. VI. *Thlaspi arvense* L.: 5,5 km SW Kovářská, am Wanderweg in Richtung Křížová hora, 1010 m, 02.

Peronospora trifoliorum de Bary. VIII. *Trifolium medium* L.: Boží Dar, 1020 m, 00.

Peronospora verbasci Gäum. VII. *Verbascum thapsus* L.: 2,5 km NW Výsluní, nahe Bahnhof, 795 m, 00.

Peronospora violae de Bary ex J. Schröt. IV.–VI. *Viola arvensis* Murray: Krásná Lípa, 580 m, 01. *Viola tricolor* L.: Jelení, 860 m, 00. Nahe Hora Svaté Kateřiny, 570 m, 01.

Plasmopara densa (Rab.) J. Schröt. VI.–VIII. *Euphrasia stricta* D. Wolff ex J. F. Lehmann: Meluzína, 1030 m, 01. *Odontites vernus* (Bellardi) Dum.: Černovice, 420 m, 00. *Rhinanthus minor* L.: SÖ Podlesí, Mílov, 920 m, 00. *Plasmopara densa* an *Pedicularis sylvatica* L., die Felix von Thümen in Cínovec gesammelt hat, ist zu streichen (Dietrich and Müller 2001: 97). Hier handelt es sich um einen Hyphomyceten (briefliche Mitteilung J. Müller).

Plasmopara mei-foeniculi Săvul. VI.–VIII. *Meum athamanticum* Jacq.: Rolava, 910 m, 01. Potůčky, 710 m, 00. Nahe Grenzübergang Reitzenhain, 700 m, 00.

Plasmopara pusilla (de Bary) J. Schröt. VI.–X. *Geranium palustre* L.: 2,5 km NW Křimov, nahe Talsperre, 600 m, 01. *Geranium sylvaticum* L.: Potůčky, 710 m, 00. Hřebečná, 920 m, 00. W Boží Dar, Myslivny, 960 m, 00. České Hamry, 800 m, 01. Kovářská, 850 m, 00.

Plasmopara pygmaea (Unger) J. Schröt. VI. *Anemone nemorosa* L.: zwischen Hora Svaté Kateřiny und Brandov, 580 m, 01.

UREDINIOMYCETES

Coleosporium campanulae (F. Strauss) Tul. II im VI., VII. *Campanula patula* L.: zwischen Jelení und Rolava, nahe Velký močál, 940 m, 01. Loučná, 870 m, 01. 1,5 km NÖ Měděnec, 750 m, 02.

Coleosporium euphrasiae G. Winter. II im VIII. *Odontites vernus* (Bellardi) Dum.: Černovice, Rand eines *Pinus sylvestris*-Bestandes, 420 m, 00. *Rhinanthus angustifolius* C.C. Gmelin: S Loučná, 900 m, 00.

Coleosporium petasitis Cooke. II im VIII. *Petasites hybridus* (L.) G. M. Sch.: SW Krásná Lípa, Aue im Bezručovo údolí, 400 m, 00.

Coleosporium senecionis (Pers.) J. Kickx f. I im VI., VII. *Pinus ×pseudopumilio* (Willk.) Beck: N-Hang der Meluzína, 1040 m, 00, 02; am 25. VI. 02 dort auch II an *Senecio hercynicus* unter befallener *Pinus ×pseudopumilio*. II, III im VI.–X. *Senecio hercynicus* Herborg: zwischen Jelení und Rolava, 940 m, 00. W Boží Dar, Myslivny, 960 m, 00. Křížová hora, 1020 m, 02. *Senecio vulgaris* L.: Loučná, 870 m, 00.

Cronartium ribicola J. C. Fisch. II, III im VI., VIII. *Ribes nigrum* L.: Loučná, 900 m, 00. Brandov, 550 m, 00.

Cumminsiella mirabilissima (Peck) Nannf. II im VI. *Mahonia aquifolium* (Pursh) Nutt. cult.: Hora Svaté Kateřiny, in Richtung Malý Háj, 650 m, 01.

Frommeëlla tormentillae (Fuckel) Cummins et Y. Hirats. II im VIII. *Potentilla erecta* (L.) Räuschel: 1 km NW Nový dům, 820 m, 00.

Gymnosporangium sabinae G. Winter. 0, I im VI. *Pyrus communis* L. em. Gaertn. cult.: Brandov, 550 m, 00.

Melampsora amygdalinae Kleb. II im VIII. *Salix triandra* L.: Horní Žďár, Ufer Jáchymovský potok, 490 m, 00.

Melampsora helioscopiae G. Winter s. str. II im VIII. *Euphorbia helioscopia* L.: Horní Žďár, 00.

Melampsora larici-epitea Kleb., III im X. *Salix daphnoides* Vill.: Rýžovna, 960 m, 00.

Melampsora larici-populina Kleb. II im VIII. *Populus × canadensis* Moench cult.: Loučná, 880 m, 00.

Melampsoridium hiratsukanum S. Ito ex Hirats. II, III im X. *Alnus incana* (L.) Moench: Zlatý Kopec, 760 m, 03. 1,5 km SW Kovářská, 890 m, 01, Mü (Müller 2003).

Microbotryum dianthorum (Liro) H. Scholz et I. Scholz. VI., VIII. *Dianthus deltoides* L.: Jelení, 880 m, 00. NO–Hang Klínovec, 960 m, 04. 500 m NÖ Kamenné, 730 m, 02. Domina, 600 m, 00.

Microbotryum lychnidis-dioicae (DC. ex Liro) G. Deml et Oberw. VIII. *Silene latifolia* Poiret: Horní Žďár, 490 m, 00.

Microbotryum marginale (DC.) Vánky. VI., VII. *Bistorta major* Gray: 700 m SÖ Boží Dar, 1070 m, 00. Hora Svaté Kateřiny, 580 m, 01.

Microbotryum pustulatum (DC.) R. Bauer et Oberw. V. *Bistorta major* Gray: Boží Dar, östlicher Ortsrand, Sumpfwiese, 1030 m, 01.

Microbotryum scabiosae Vánky. VI.–VIII. *Knautia arvensis* (L.) Coulter: SW Kovářská, 880 m, 00. Bei Domašín, 560 m, 02. Výsluní, 760 m, 00. Suchdol, 670 m, 01. Domina, 600 m, 00. Černovice, 410 m, 00.

Microbotryum silenes–inflatae (DC. ex Liro) G. Deml et Oberw. V., VII.,VIII. *Lychnis viscaria* L.: 700 m Ö Domašín, 04. *Silene vulgaris* (Moench) Garcke: SÖ Boží Dar, S exponierte Gebirgswiese auf dem Neklid, mit *Dianthus deltoides* und *Silene nutans*, die beide keinen Pilzbefall aufwiesen, 1060 m, 00. Domina, 600 m, 00.

Microbotryum stellariae (Liro) G. Deml et Oberw. VI.–VIII. *Stellaria alsine* Grimm: Jelení, 860 m, 00. Hora Svaté Kateřiny, 600 m, 01. *Stellaria aquatica* (L.) Scop.: Horní Žďár, an Straße nach Arnoldov, 500 m, 00. *Stellaria graminea* L.: Rolava, 900 m, 01. 300 m SÖ Grenzübergang Oberwildenthal in Richtung Jelení, 900 m, 00. SW Kovářská, 870 m, 00. Brandov, 600 m, 00.

Microbotryum stygium (Liro) Vánky. V., VI. *Rumex acetosa* L.: Potůčky, 710 m, 00. SÖ Podlesí, ehemals Mílov, 920 m, 00, 04. Domašín, 500 m, 04. Hora Svaté Kateřiny, 580 m, 01.

Microbotryum tragopogonis-pratensis (Pers.) R. Bauer et Oberw. VII. *Tragopogon pratensis* L.: ca. 1,5 km SÖ České Hamry, 870 m, 01. Vejprty, nahe Bahnhof, 730 m, 00. Křimov, 700 m, 01.

Nyssopsora echinata (Lév.) Arthur. III im V.–VII. *Meum athamanticum* Jacq.: Jelení, 890 m, 00. Potůčky, 730 m, 00. SÖ Podlesí, Mílov, 920 m, 00, 04. 600 m NW Výsluní, 770 m, 00. Brandov, 600 m, 00. Hora Svaté Kateřiny, 600–650 m, 01.

Phragmidium rubi-idaei (DC.) P. Karst. III im X. *Rubus idaeus* L.: 2 km SW Kovářská, 900 m, 01.

Phragmidium tuberculatum Jul. Müll. II, III im VIII. *Rosa dumalis* Bechst.: Černovice, 410 m, 00.

Puccinia absinthii (R. Hedw. ex DC.) DC. III im VIII. *Artemisia absinthium* L.: Domina, Straßenrand, 600 m, 00.

Puccinia acetosae Koern. II im VIII. *Rumex arifolius* All.: Křížová hora, 1000 m, 02. *Rumex thyrsiflorus* Fingerh.: Domina, Bahnhof, 600 m, 02. Černovice, Bahnhof, 410 m, 00.

Puccinia adoxae R. Hedw. ex DC. III im IV. *Adoxa moschatellina* L.: NW Chomutov, 800 m SÖ Krásná Lípa, Bezručovo údolí, Laubmischwald, 550 m, 01, 02.

Puccinia angelicae-mamillata Kleb. II, III im VI. *Bistorta major* Gray: Potůčky, Ortsausgang in Richtung Pila, Feuchtwiese mit *Angelica sylvestris* L., 710 m, 00. Brandov, Ortsausgang in Richtung Hora Svaté Kateřiny, Sumpfwiese mit *Angelica sylvestris*, 580 m, 00.

Puccinia arenariae (Schumach.) G. Winter. III im VI., X. *Sagina procumbens* L.: ca. 750 m S Malé jeřábí jezero, Wegrand, 900 m, 00. *Stellaria alsine* Grimm.: bei Zlatý Kopec, 770 m, 03.

Puccinia argentata (Schultz) G. Winter. II, III im VII. *Impatiens noli-tangere* L.: N Suchdol, Křimovský potok, zwischen Talsperre und Fluss Chomutovka, 500 m, 01.

Puccinia arrhenathericola E. Fisch. II im IX. *Arrhenatherum elatius* (L.) J. et C. Presl: Loučná, Tal der Polava, Mähwiese am Ortsrand, 880 m, 00, rev. J. Müller, Mü.

Puccinia artemisiella P. Syd. et Syd. III im IX. *Artemisia vulgaris* L.: Vejprty, 740 m, 00.

Puccinia bardanae (Wallr.) Corda. II, III im X. *Arctium minus* Bernh.: ca. 1,5 km Ö Zlatý Kopec, Wildfütterung zwischen Waldweg und Fichtenwald, 900 m, 03.

Puccinia bistortae (F. Strauss) DC. I im V. *Chaerophyllum hirsutum* L.: Potůčky, Tal Blatenský potok, Frischwiese, 710 m, 00, Mü. 1,5 km SW Kovářská, artenreiche Gebirgswiese, 850 m, 02. *Meum athamanticum* Jacq.: Jelení, 880 m, 00. Potůčky, Mähwiese bei Kirche, 730 m, 00. An allen Standorten auch Telien an *Bistorta major* nachgewiesen.

Puccinia calthae Link. II, III im VII. *Caltha palustris* subsp. *procumbens* (Beck) Neumayer: Mílov, Quellflur, 900 m, 04.

Puccinia centaureae DC. II, III im VIII. *Centaurea jacea* L. s. l.: Domina, 600 m, 00.

Puccinia chaerophylli Purton. II, III im VI.–X. *Anthriscus sylvestris* (L.) Hoffm.: Potůčky, 740 m, 00. Rýžovna, 970 m, 00. Bei Kovářská, 890 m, 00. Brandov, 740 m, 00.

Puccinia chondrillae Corda. II, III im VII.–X. *Mycelis muralis* (L.) Dum.: zwischen Jelení und Rolava, 930 m, 01. N Vejprty, 720 m, 00. N Černovice, Ostseite Hradiště, 450 m, 00.

Puccinia cnici Mart. II, III im VI.–VIII. *Cirsium vulgare* (Savi) Ten.: ca. 600 m S Malé jeřábí jezero, 900 m, 00. Zwischen Podlesí und Mílov, 900 m, 00. SW Kovářská, zwischen Bahnhof und stillgelegtem Kalkbruch, 860 m, 00. Vejprty, 720 m, 00. 1,5 km SW Načetín, 825 m, 00. 1 km N Petlery, 570 m, 02.

Puccinia coronata Corda. I im VI. *Frangula alnus* Mill.: bei Hora Svaté Kateřiny, 590 m, 01. 2 km SÖ Brandov, 600 m, 01. II, III im VII., X. *Festuca gigantea* (L.) Vill.: NÖ Suchdol, Bezručovo údolí, nahe Druhý mlýn, 500 m, 01. *Holcus mollis* L.: 300 m SW Měděnec, 780 m, 00. *Phalaris arundinacea* L.: Vejprty, 730 m, 00.

Puccinia deschampsiae Arthur. II, III im VI.–X. *Deschampsia cespitosa* (L.) P. B.: Malé jeřábí jezero, Moorwiese, 920 m, 00. Zwischen Podlesí und Mílov, 890 m, 00. Rýžovna, 980 m, 00. 600 m SW Boží Dar, Moorwiese, 1000 m, 00. Berg Měděnec und SW Měděnec, 780 m, 00.

Puccinia distincta Mc. Alp. I im VIII. *Bellis perennis* L. cult.: Vejprty, Garten, 700 m, 00, rev. J. Müller, Müller (2000), Mü. Diese Art wird von einigen Mykologen zu *Puccinia lagenophorae* gestellt.

Puccinia echinopis DC. II im VIII. *Echinops sphaerocephalus* L.: Černovice, nahe Bahnhof, 410 m, 00.

Puccinia epilobii DC. III im VIII. *Epilobium obscurum* Schreber: Mílov, Quellflur, 910 m, 04. *Epilobium palustre* L.: 500 m S Malé jeřábí jezero, am Bukový potok, 900 m, 00. 1 km NW Nový dům, 825 m, 00.

Puccinia festucae Plowr. II, III im VI.–X. *Festuca nigrescens* Lam.: Potůčky, 720 m, 00. Mílov, 930 m, 00. 600 m SW Boží Dar, Moorwiese, 1000 m, 00. 1 km NW Nový dům, 820 m, 00. 300 m SW Měděnec, 780 m, 00. Zwischen Výsluní und Bahnhof, 780 m, 00.

Puccinia galii-verni Ces. III im VII.–IX. *Galium saxatile* L.: NW Boží Dar, Wiese im Tal der Černá, nahe Grenze, 1020 m, 00. 1,8 km SÖ Boží Dar, Pod Klínovcem, Fichtenwald, 1070 m, 00. 600 m SW Boží Dar, Moorwiese im Božídarské rašeliniště, 1000 m, 00. *Galium uliginosum* L.: Rolava, 900 m, 01. Ca. 1 km NW Boží Dar, Hubertky, 1000 m, 03. Bei Boží Dar: Na Neklidu, 1100 m und NO–Hang Špičák, 1030 m, 00. Bei Loučná, Klínovec, NÖ Zámeček, 1000 m, 00. 1,8 km SW Kovářská, 890 m, 00, (Triebel 2003: Exsikkat Nr. 512). NW Nový dům, 825 m, 00.

Puccinia glechomatis DC. III im VIII. *Glechoma hederacea* L.: N Vejprty, Tal der Polava, 700 m, 00.

Puccinia graminis Pers. II, III im X., XI. *Elytrigia repens* (L.) Desv.: Hřebečná, 920 m, 00. Loučná, 900 m, 00. Vejprty, 730 m, 00. *Poa chaixii* Vill.: Loučná, 900 m, 00.

Puccinia hieracii H. Mart. II, III im VI., VII. *Hieracium laevigatum* Willd.: 1 km SÖ Boží Dar, Bergwiesen auf dem Neklid, 1070 m, 00. Bei Loučná, 940 m, 04. *Hieracium sabaudum* L.: Černovice, Bahnhofsgelände, 410 m, 00.

Puccinia holcina Erikss. II im VII. *Holcus mollis* L.: Rolava, 900 m, 01.

Puccinia hypochoeridis Oudem. II, III im V. *Hypochaeris radicata* L.: Vejprty, Nad Pivovarem, 780 m, 01.

Puccinia jaceae G.H. Otth. II, III im VIII. *Centaurea stoebe* L.: Černovice, Bahnhofsgelände, 410 m, 00.

Puccinia komarovii Tranz. II im VII. *Impatiens parviflora* DC.: NÖ Suchdol, Bezručovo údolí, Druhý mlýn, 500 m, 01.

Puccinia lagenophorae Cooke. I, III im VIII., X. *Senecio vulgaris* L.: bei Boží Dar, nahe Grenzübergang, 1070 m, 00. Loučná, 900 m, 00. Vejprty, 770 m, 00.

Puccinia laschii Lagerh. II, III im VII., VIII. *Cirsium heterophyllum* (L.) Hill: N Vejprty, Tal der Polava, 700 m, 00.

Puccinia luzulae-maximae Dietel. II im VII., X. *Luzula sylvatica* (Huds.) Gaudin: bei Rýžovna, Nad Rýžovnou, 1000 m, 00. Zlatý Kopec, 770 m, 03. NW–Hang Meluzína, 1040 m, 00. 1,5 km SW Kovářská, stillgelegter Kalkbruch, 900 m, 01.

Puccinia maculosa (F. Strauss) Röhl. s. str. I, II, III im VI.–VIII. *Prenanthes purpurea* L.: 600 m NW Suchdol, 600 m, 01. SW Krásná Lípa, Bezručovo údolí, 400 m, 00. Zwischen Hora Svaté Kateřiny und Brandov, 570 m, 01.

Puccinia magelhaenica Peyr. ex Magnus. II im X. *Arrhenatherum elatius* (L.) J. et C. Presl: Vejprty, 730 m, 00.

Puccinia major (Dietel) Dietel. II, III im VIII, X. *Crepis paludosa* (L.) Moench: Klínovec, 970 m, 00. Loučná, 950 m, 01.

Puccinia malvacearum Bertero ex Mont. III im VII. *Malva neglecta* Wallr.: Suchdol, 670 m, 01.

Puccinia menthae Pers. III im X. *Mentha longifolia* (L.) L.: Hřebečná, Straßengraben, 915 m, 00.

Puccinia mulgedii P. Syd. et Syd. II, III im VIII. *Cicerbita alpina* (L.) Wallr.: Klínovec, Nordhang, 1100 m, 00.

Puccinia obscura J. Schröt. II im VI., IX. *Luzula multiflora* (Ehrh.) Lej.: bei Hora Svaté Kateřiny, 600 m, 01. *Luzula pilosa* (L.) Willd.: zwischen Boží Dar und Myslivny, Fuß des Špičák, 980 m, 04.

Puccinia paludosa Plowr. II, III im VII., VIII. *Carex nigra* (L.) Reichard: 1,5 km NW Jelení, 880 m, 00. Malé jeřábí jezero, Moorwiese, 920 m, 00. 2 km SW Načetín, 800 m, 00. Loučná, 910 m, 00. Zwischen Výsluní und Bahnhof, Moorwald, 770 m, 00.

Puccinia perplexans Plowr. II, III im VI., IX. *Alopecurus pratensis* L.: W Boží Dar, Myslivny, 970 m, 00. Brandov, 600 m, 00.

Puccinia poae-nemoralis G.H. Otth. II im VIII., IX. *Poa chaixii* Vill.: Rolava, 900 m, 01. 1,5 km NW Jelení, 900 m, 00. *Poa nemoralis* L.: Hradiště, 590 m, 00.

Puccinia praecox Bubák. II im V. *Crepis biennis* L.: Kamenné, 650 m, 04.

Puccinia pulverulenta Grev. II, III im VIII. *Epilobium hirsutum* L.: Černovice, nahe Bahnhof, 410 m, 00.

Puccinia punctata Link. II, III im VII.–X. *Galium album* Mill.: Vejprty, 720 m, 00. Bei Kovářská, 840 m, 00. NW–Seite des Mědĕnec, 870 m, 00. *Galium pumilum* Murray: Kovářská, Bahnhofsgelände, 850 m, 00. *Galium verum* L.: Černovice, Bahnhofsgelände, 410 m, 00.

Puccinia pygmaea Erikss. II im VIII.–X. *Calamagrostis arundinacea* (L.) Roth: Bezručovo údolí, nahe Domina, 520 m, 00. *Calamagrostis epigejos* (L.) Roth: 1,5 km SW Načetín, 825 m, 00. *Calamagrostis villosa* (Chaix) J. F. Gmelin: N Horní Luby, Třislová, 640 m, 01. Velký močál, 940 m, 00. Bei Rýžovna, Nad Rýžovnou, 1000 m, 00. Bezručovo údolí, nahe Domina, 540 m, 00. Hradiště, 590 m, 00. SW Krásná Lípa, Bezručovo údolí, 450 m, 00.

Puccinia recondita Roberge ex Desm. II, III im X., XI. *Elytrigia repens* (L.) Desv: 600 m SW Boží Dar, 1000 m, 00. Loučná, 880 m, 00.

Puccinia retifera Lindr. II, III im VIII. *Chaerophyllum aureum* L.: Horní Žďár, 490 m, 00. Bei Krásná Lípa, 500 m, 00.

Puccinia sessilis Schneider. I im VI. *Polygonatum verticillatum* (L.) All.: ca. 1,5 km NW Hora Svaté Kateřiny, Mischwald, am Standort *Phalaris arundinacea*, 580 m, 01.

Puccinia silvatica J. Schröt. I im VI. *Senecio hercynicus* Herborg: bei Meluzína, 1030 m, 00.

Puccinia striiformis Westend. II im XI. *Dactylis glomerata* L.: Loučná, 880 m, 00. Uredosporenmaße: 20–25 × 15–22,5 µm. II im VI. *Elytrigia repens* (L.) Desv.: 1,5 km Ö des Berges Mědĕnec, Wiese an Straße nach Venkov, 800 m, 02. Uredosporenmaße: 22,5–26,5 × 18,8,–23,8 µm.

Puccinia tanaceti DC. II, III im VIII. *Tanacetum vulgare* L.: Vejprty, Bahnhofsgelände, 730 m, 00. Pohraniční, unweit Grenzübergang Reitzenhain, 770 m, 00. Černovice, 410 m, 00.

Puccinia taraxaci Plowr. II, III im VII., VIII. *Taraxacum officinale* Wiggers: 1 km NW Jelení, 900 m, 00. Horní Žďár, 490 m, 00. 1 km NW Meluzína, 1030 m, 00. Domina, 600 m, 00.

Puccinia triseti Erikss. II im X. *Trisetum flavescens* (L.) P. Beauv.: Vejprty, 790 m, 00.

Puccinia urticata Kern. 0, I im V., VI. *Urtica dioica* L.: Jelení, 850 m, 00. 500 m SÖ Boží Dar, 1050 m, 00. S Macecha, 1050 m, 02. SÖ Dolní Halže, 660 m, 04. Hora Svaté Kateřiny, 600 m, 01.

Puccinia urticata Kern. var. *urticae-acutae* (Kleb.) Zwetko. II, III im VII. *Carex acuta* L.: České Hamry, 790 m, 01.

Puccinia urticata Kern. var. *urticae-hirtae* (Kleb.) Zwetko. II, III im VIII. *Carex hirta* L.: SO–Hang Hradiště, 500 m, 00.

Puccinia urticata Kern. var. *urticae-inflatae* (Hasler) Zwetko. II, III im VIII. *Carex rostrata* Stokes: 500 m SW Boží Dar, mooriger Wassergraben, 1010 m, 00. Bei Loučná, Bachtal am NO–Hang des Klínovec, 900 m, 00. Ca. 1,2 km SÖ České Hamry, moorige Stelle, 850 m, 01.

Puccinia violae DC. I, II, III im V., VII., X. *Viola canina* L. s. l.: Křimov, 700 m, 01. *Viola reichenbachiana* Jordan ex Bor.: 2 km SW Kovářská, 925 m, 01. Bei Domašín, 580 m, 04.

Pucciniastrum circaeae (G. Winter) Speg. ex De Toni. II im VII. *Circaea intermedia* Ehrh.: 500 m N Křimov, Křimovský potok, 600 m, 01.

Pucciniastrum epilobii G. H. Otth. II im VI.–X. *Epilobium angustifolium* L.: bei Boží Dar, nahe Grenzübergang, 1070 m, 00. *Epilobium ciliatum* Rafin.: Rýžovna, 970 m, 00. Horní Žďár, 490 m, 00. 1,5 km S Načetín, 820 m, 00. Brandov, 540 m, 00. *Epilobium tetragonum* L.: Výsluní, Bahnhofsgelände, Wassergraben, 795 m, 00.

Thekopsora areolata (Fr.) Magnus. II im VIII., IX. *Padus avium* Mill.: W Loučná, Tal der Polava, 880 m, 00. N Vejprty, Tal der Polava, 700 m, 00.

Thekopsora guttata (J. Schröt.) P. Syd. et Syd. II im VIII.–X. *Galium saxatile* L.: N Horní Luby, Třislová, 640 m, 01. NÖ Jelení, Liščí hůrka, 920 m, 00. Bei Rýžovna, Nad Rýžovnou, 1000 m, 00. Bei Hřebečná, 940 m, 00. Zlatý Kopec, 760 m, 03. Bei Boží Dar, NO–Hang Špičák, 1060 m, 00. 1 km NW Boží Dar, Hubertky, 1025 m, 03. Klínovec, 970 m, 00. NÖ Vejprty, 760 m, 00. Bei Domina, 550 m, 00.

Thekopsora symphyti (Bubák) Berndt. II im VI., IX. *Symphytum officinale* L.: Loučná, 900 m, 00. Hora Svaté Kateřiny, 600 m, 01.

Thekopsora vaccinii (G. Winter) Hirats. f. II im VIII.–X. An *Vaccinium myrtillus* L.: N Horní Luby, Třislová, 640 m, 01. Zwischen Jelení und Rolava, Velký močál, 920 m, 00. Hřebečná, 940 m, 00. Bei Rýžovna, 1000 m, 00. Berg Měděnec, 900 m, 00. Bei Černovice, Hradiště, 500 m, 00. *Vaccinium uliginosum* L.: ca. 2 km SW Načetín, 825 m, 00. *Vaccinium vitis-idaea* L.: ca. 2 km SW Načetín, Moorwald, 825 m, geringer Befall, 00.

Trachyspora intrusa (Grev.) Arth. II, III im V.–X. *Alchemilla monticola* Opiz: Jelení, 860 m, 00. *Alchemilla subcrenata* Buser: SW Kovářská, Wiese in Kalkgrube, 890 m, 00. *Alchemilla vulgaris* L.: Jelení, 860 m, 00. Potůčky, 700–750 m, 00. 300 m SW Měděnec, 790 m, 00. Domašín, 570 m, 02.

Tranzschelia fusca Dietel. 0 im IV. *Anemone nemorosa* L.: 1,5 km NW Chomutov, Bezručovo údolí, 400 m, 01.

Triphragmium ulmariae (DC.) Link. II im VI., VII. *Filipendula ulmaria* (L.) Maxim.: SÖ Potůčky, Mílov, 910 m, 00. 500 m NW Suchdol, 640 m, 01.

Uredinopsis filicina Magnus. II im VI. *Phegopteris connectilis* (F. Michx.) Watt: zwischen Potůčky und Podlesí, Tal des Podleský potok, Fichtenwald, 750 m, 01.

Uromyces airae-flexuosae Ferd. et Winge. II im VI.–VIII. *Avenella flexuosa* (L.) Drejer: 400 m S Malé jeřábí jezero, 900 m, 00. N–Hang Meluzína, 1060 m, 00. Křížová hora, 1020 m, 02.

Uromyces anthyllidis J. Schröt. s. str. II im VII. *Anthyllis vulneraria* L.: Vejprty, Bahnhofsgelände, 730 m, 00.

Uromyces dactylidis G. H. Otth s. str.. II, III im VI.–VIII. *Dactylis glomerata* L.: Potůčky, daneben *Ranunculus repens* mit Aezien, 700 m, 00. Rýžovna, 970 m, 00. 600 m SW Boží Dar, 1000 m, 00. Horní Žďár, 490 m, 00. Bei Křížová hora, 1020 m, 02. N Vejprty, Tal der Polava, 680 m, 00.

Uromyces ervi Westend. II, III im VIII. *Vicia hirsuta* (L.) Gray: bei Horní Žďár, 510 m, 00.

Uromyces euphorbiae-corniculati Jordi. II im VIII. *Lotus corniculatus* L.: Černovice, Bahnhofsgelände, 410 m, 00.

Uromyces fallens (Desm.) Kern. Syn.: *U. trifolii-repentis* (Cast.) Liro var. *fallens* (Arthur) Cummins. II im IX., X. *Trifolium pratense* L.: W Boží Dar, Myslivny, 970 m, 00. Vejprty, Bahnhofsgelände, 730 m, 00. Ort Měděnec, 820 m, 00.

Uromyces ficariae Tul. III im IV., V. *Ranunculus ficaria* L.: SÖ Dolní Halže, 660 m, 04. Chomutov, 360 m, 01.

Uromyces gageae Beck. III im V. *Gagea pratensis* (Pers.) Dum.: Domašín, Hügel ca. 600 m Ö des Ortes, 590 m, 04.

Uromyces genistae Fuckel. II, III im VIII. *Genista tinctoria* L.: Domina, 600 m, 00.

Uromyces geranii (DC.) Fr. s. str. 0, I, II, III im V.–X. *Geranium sylvaticum* L.: Potůčky, 710 m, 00. Hřebečná, 920 m, 00. Zlatý Kopec, 760 m, 03. Horní Žďár, 490 m, 00. Loučná, 940 m, 03. České Hamry, 800 m, 01. Kovářská, 850 m, 00. Měděnec, 840 m, 00. Bei Kamenné, 720 m, 02.

Uromyces phyteumatum (DC.) Unger. III im V. *Phyteuma nigrum* F. W. Schmidt: 1,5 km SW Kovářská, artenreiche Gebirgswiese, 880 m, 02. *Phyteuma spicatum* L.: SÖ Loučná, 700 m NW Macecha, 1000 m, 02.

Uromyces pisi (DC.) G. H. Otth. Formenkreis (= *Aecidium euphorbiae* Gmel.). 0, I im IV.–VI. *Euphorbia cyparissias* L.: Kamenné, 710 m, 02. Bei Domašín, 580 m, 04. Domina, 600 m, 01. *Euphorbia esula* L.: bei Domašín, 580 m, 04.

Uromyces polygoni-avicularis (Pers.) P. Karst. II im VIII. *Polygonum aviculare* L.: Horní Žďár, 490 m, 00. Klínovec, NO–Hang, 1000 m, 00. Domina, 600 m, 00. Černovice, 410 m, 00.

Uromyces rumicis (Schumach.) G. Winter. III im VII. *Rumex aquaticus* L.: České Hamry, Tal der Polava, 740 m, 01.

Uromyces trifolii-repentis Liro var. *trifolii-repentis* s. Cummins. II, III im VIII. *Trifolium repens* L.: Loučná, 910 m, 00.

Uromyces valerianae Fuckel. II im VI., IX. *Valeriana dioica* L.: SÖ Potůčky, Wiesen bei ehemals Mílov, 910 m, 00. 1 km NW Boží Dar, Sumpfwiese am Hubertky, 1000 m, 03.

Uromyces viciae-fabae (Pers.) J. Schröt. s. str. II im VIII. *Vicia sepium* L.: N Vejprty, 680 m, 00. Ort Měděnec, 840 m, 00.

Ustilentyloma brefeldii (K. Krieg.) Vánky. VII. *Holcus mollis* L.: 700 m SÖ Boží Dar, 1070 m, 00.

Ustilaginomycetes

Anthracoidea paniceae Kukkonen. VIII. *Carex panicea* L.: ca. 400 m S Loučná, NO–Hang Klínovec, Moorwiese, 970 m, 04, unweit des Standortes von *Urocystis fischeri* (Dietrich and Müller 2001).

Entyloma calendulae (Oudem.) de Bary. VII. *Calendula officinalis* L. cult.: Vejprty, Garten, 750 m, 01.

Exobasidium pachysporum Nannf. VIII., IX. *Vaccinium uliginosum* L.: bei Boží Dar: Špičák, 1997 und Hochmoor Reißzeche, 1998 (Dietrich 2003).

Exobasidium rostrupii Nannf. VIII., IX. *Oxycoccus palustris* Pers.: zwischen Jelení und Rolava, Reservat Velký močál, 00 (Dietrich 2003). 1,2 km NW Boží Dar, Quellgebiet der Černá, Hubertky, 1000 m, 03. Bei Boží Dar: Špičák, 1997 (Dietrich 2003).

Thecaphora trailii Cooke. VII., IX. *Cirsium heterophyllum* (L.) Hill: ca. 2,5 km W Boží Dar, Myslivny, 970 m, 00. SW Kovářská, 880 m, 00 (Triebel 2003: Exsikkat Nr. 523).

Urocystis agropyri (Preuss) A. A. Fisch. Waldh. VII. *Elytrigia repens* (L.) Desv.: S Háj, 1,5 km NW Meluzína, 1020 m, 00.

Urocystis ranunculi (Lib.) Moesz. X. *Ranunculus repens* L.: Vejprty, 730 m, 00.

Ustilago filiformis (Schrank) Rostrup. VI., VII. *Glyceria fluitans* (L.) R. Br.: Potůčky, 710 m, 00. SÖ Háj, 1 km NW Meluzína, 1030 m, 00. 1 km NW Výsluní, 770 m, 00.

Ustilago striiformis (Westend.) Niessl. VII., X. *Dactylis glomerata* L.: S Háj, 600 m NW Macecha, 1020 m, 00. An *Holcus mollis* L. 300 m SW des Ortes Měděnec, 780 m, 00.

AUSWERTUNG

In diesem Nachtrag werden die Fundorte von 36 Arten der *Peronosporales*, 112 Arten der Urediniomycetes und 9 Arten der Ustilaginomycetes, die im Zeitraum von 2000 bis 2004 vom Autor in den Krušné hory gesammelt worden sind, genannt. Vom tschechischen Teil des Erzgebirges sind nunmehr 59 Arten *Peronosporales*, 152 Arten, Unterarten und Varietäten Urediniomycetes und 16 Arten Ustilaginomycetes bekannt, insgesamt unter Einbeziehung der Exobasidium-Arten 227 Sippen. *Caltha palustris* subsp. *procumbens* für *Puccinia calthae*, *Chaerophyllum hirsutum* für *Puccinia bistortae*, *Phyteuma nigrum* für *Uromyces phyteumatum*, *Pinus* ×*pseudopumilio* für *Coleosporium senecionis* und *Poa chaixii* für *Puccinia graminis* sind neue Wirtspflanzen für die Tschechische Republik.

Melampsora hiratsukanum und *Puccinia komarovii* gehören zu den Neomyceten. Beide Rostpilze wurden 2001 in den Krušné hory vom Verfasser erstmalig gesammelt. Auf der sächsischen Seite des Erzgebirges beobachtet der Autor *Puccinia komarovii* und *Melampsora hiratsukanum* seit 1999. Dagegen wurde der Neomycet *Puccinia lagenophorae* nach 2000 in den Krušné hory vom Verfasser nicht mehr gefunden. Möglicherweise wird dieser Rostpilz wieder seltener.

Puccinia galii-verni parasitiert auf *Galium uliginosum* in den Krušné hory häufiger als bisher bekannt. Auf *Galium saxatile* konnte diese Art bisher nur in den obersten Lagen nachgewiesen werden. Dies trifft auch für den sächsischen Teil des Erzgebirges zu. Im angrenzenden Elstergebirge (Halštrovská vrchovina) sammelte der Verfasser *Puccinia galii-verni* auf *Galium album* auf sächsischer Seite in Bad Brambach und Hohendorf sowie auf böhmischen Gebiet in Plesná und *Galium uliginosum* bei Horní Paseky, Plesná und in Vernéřov in der Aue der Bílý Halštrov.

Der Nachweis von *Puccinia adoxae* ist höchstwahrscheinlich der bisher einzige im gesamten Erzgebirge. Diese Art hat vermutlich im unteren montanen Bereich ihre Verbreitungsgrenze. Wiesbaur sammelte *Puccinia adoxae* unweit der Krušné hory westlich von Osek in Dolní Háj (Bubák 1908). Die heterözische *Puccinia argentata*, deren Zwischenwirt *Adoxa moschatellina* ist, steigt im sächsischen Teil des Erzgebiges etwas höher. In den Krušné hory ist diese Art allerdings noch unvollständig erfasst. Interessant sind die Beobachtungen zum Wirtswechsel von *Puccinia bistortae*. Auf den montanen Gebirgswiesen dürfte *Meum athamanticum* der häufigste Zwischenwirt sein. An feuchteren Wiesenstandorten findet auch Wirtswechsel mit *Chaerophyllum hirsutum* und *Angelica sylvestris* statt. Als weitere Wirtspflanzen sind *Pimpinella major* und *Peucedanum ostruthium* (Dietrich 2005) zu erwarten. Die Zwischenwirte von *Puccinia bistortae* können je nach Witterungsverhältnissen nur von etwa Mitte Mai bis Anfang Juni nachgewiesen werden. *Puccinia angelicae-mamillata* zeigt in Krušné hory eine ähnliche Verbreitung wie im sächsischen Teil. Sie kommt nach dem gegenwärtigen Kenntnisstand zerstreut über das gesamte Gebiet auf Feuchtwiesen mit dem Aecien-Wirt *Angelica sylvestris* vor. Kokeš and Müller (2004) stellen für Mähren und tschechisch Schlesien ähnliche Häufigkeitsunterschiede dieser zwei *Puccinia*-Arten auf Bistorta major fest. Auf Wiesen mit ausschließlich *Meum athamanticum* wurde *Puccinia angelicae-mamillata* im Erzgebirge nicht gesammelt.

Überrascht hat der Fund von *Puccinia arrhenathericola*, die bisher nur aus wesentlich tieferen Lagen der Tschechischen Republik bekannt war (J. Müller, briefliche Mitteilung). Nach langer Suche fand der Autor mit *Uredinopsis filicina* endlich den ersten Farnrost in den Krušné hory. Vermutlich kommen weitere Farnroste im Gebiet vor. Das schon von Wagner nachgewiesene *Microbotryum pustulatum* an *Bistorta major* (Bubák 1916) entdeckte der Verfasser 2001 erstmalig im tschechischen Teil des Erzgebirges. Es ist nicht ausgeschlossen, dass Wagner den Pilz um 1900 am gleichen Fundort sammelte, denn diese Art ist standortstreu. *Microbotryum pustulatum* ist im obersten Erzgebirge nach den bisherigen Beobachtungen selten, ganz im Gegensatz zu *Microbotryum marginale*. Der auf *Stellaria nemorum* und *Moehringia trinervia* verbreitete Rostpilz *Puccinia arenariae* kommt mit Sicherheit auf *Stellaria alsine* häufiger vor, während *Sagina procumbens* in den Krušné hory wohl selten befallen wird. Weiterhin rätselhaft bleibt das Fehlen des letztmalig von Dietel um 1930 nachgewiesenen Rostpilzes *Melampsora hypericorum* (Baudyš 1924). Trotz gezielter Suche gelang dem Verfasser wiederum kein Nachweis. Über das gesamte bisher untersuchte Gebiet bis in das oberste Bergland verbreitet sind folgende Rostpilze: *Coleosporium senecionis* an *Senecio ovatus*, *Puccinia pygmaea* an *Calamagrostis villosa*, *Thekopsora guttata* an *Galium saxatile* und *Thekopsora vaccinii* an *Vaccinium myrtillus*. Dagegen konnte der Autor *Thekopsora vaccinii* an *Vaccinium vitis-idaea* bisher nur einmal in den ausgedehnten Moorflächen zwischen Načetín und Hora Svatého Šebestiána finden.

Der Fund von *Anthracoidea paniceae* am Klínovec nährt die Hoffnung, dass weitere Blütenbrände auf den zahlreichen in den Krušné hory vorkommenden *Carex*-Arten entdeckt werden könnten. Im gleichen Jahr fand der Verfasser auch im sächsischen Teil mit *Anthracoidea heterospora* an *Carex nigra* (Dietrich 2005) erstmalig einen *Carex*-Blütenbrand im Erzgebirge. Das Verbreitungsareal von *Thecaphora trailii* in den Blütenköpfen von *Cirsium heterophyllum* ist größer als bisher bekannt und die westliche Verbreitungsgrenze von *Microbotryum marginale* hat sich mit dem Gebiet westlich von Boží Dar erhärtet. Die Arten der Gattung *Exobasidium* gehören nach Vánky (2001) zu den Ustilaginomycetes. Von den Krušné hory sind bisher meines Wissens *Exobasidium expansum* und *Exobasidium pachysporum* an *Vaccinium uliginosum* (Dietrich and Müller 2001, Dietrich 2003) sowie *E. rostrupii* an *Oxycoccus palustris* (Dietrich 2003) bekannt. Diese drei Arten gibt auch (Karatygin 2002) vom Gebiet der Tschechischen Republik an. *Exobasidium expansum* an *Vaccinium uliginosum* wurde bereits um 1875 von

Felix von Thümen in den Krušné hory in Cínovec gefunden (Thümen 1875). Kokeš and Müller (2004) geben für Mähren und tschechisch Schlesien 10 *Exobasidium*-Arten an, darunter die dort recht seltenen *Exobasidium pachysporum* und *Exobasidium rostrupii*, während *Exobasidium expansum* in diesem Teil der Tschechischen Republik noch nicht nachgwiesen worden ist.

Peronospora lotorum an *Lotus corniculatus* gehört auf jeden Fall zu den seltenen Falschen Mehltaupilzen, obwohl *Lotus corniculatus* und *L. uliginosus* weit verbreitet sind. Auf der sächsischen Seite des Erzgebirges konnte *Peronospora lotorum* bisher ebenfalls nur einmal nachgewiesen werden (Dietrich 2005). Ähnliches gilt für *Peronospora boni-henrici* an *Chenopodium bonus-henricus*. Allerdings kommt *Chenopodium bonus-henricus* im Erzgebirge nur zerstreut vor. In Mähren und tschechisch Schlesien gehören *Peronospora lotorum* ebenfalls zu den selten und *Peronospora boni-henrici* zu den zerstreut vorkommenden Arten (Kokeš and Müller 2004).

Als weitere typische Parasit-Wirt-Beziehungen für das oberste Bergland können *Plasmopara densa* an *Euphrasia stricta*, *Coleosporium euphrasiae* an *Rhinanthus angustifolius*, *Coleosporium senecionis* an *Pinus ×pseudopumilio*, *Puccinia calthae* an *Caltha palustris* subsp. *procumbens*, *P. galii-verni* an *Galium saxatile* und *Puccinia epilobii* an *Epilobium obscurum* angesehen werden. Für einen Vergleich der auf der Nord– und Südseite des Erzgebirges vorkommenden Arten ist das Erzgebirge insgesamt noch zu ungleichmäßig bearbeitet. Aber zu den typischen Arten der wärmebegünstigteren, trockneren Südostseite des Erzgebirges kristallisieren sich folgende Parasit-Wirt-Beziehungen heraus: *Albugo amaranthi* an *Amaranthus retroflexus*, *Peronospora dentariae* an *Cardamine impatiens*, *Peronospora ervi* an *Vicia tetrasperma*, *Pseudoperonospora humuli* an *Humulus lupulus*, *Coleosporium euphrasiae* an *Odontites vernus* und *Orthanta lutea*, *Melampsora vernalis* an *Saxifraga granulata*, *Puccinia absinthii* an *Artemisia absinthium*, *P. adoxae* an *Adoxa moschatellina*, *P. jaceae* an *Centaurea stoebe*, *Uromyces euphorbiae-corniculati* an *Lotus corniculatus*, *Uromyces gageae* an *Gagea pratensis*, *Uromyces genistae* an *Genista tinctoria*, *Uromyces pisi* an *Euphorbia cyparissias* und *E. esula*, *Uromyces orobi* an *Lathyrus tuberosus* und möglicherweise auch *Plasmopara densa* an *Odontites vernus*, *Microbotryum silenes-inflatae* an *Silene viscaria* und *Microbotryum stellariae* an *Stellaria aquatica*. In diese Aufzählung wurden die bei Dietrich and Müller (2001) aufgeführten Arten mit einbezogen. Viele Regionen besonders im West– und Ostteil der Krušné hory gelten auch weiterhin bezüglich der hier behandelteten Pilzparasiten als wenig erforscht, so dass mit dem Nachweis weiterer Arten zu rechnen ist.

DANKSAGUNG

Bei Herrn RNDr. J. Müller (Brno) bedanke ich mich für die Nachbestimmung einiger Rostpilze, fachlichen Hinweise sowie die Übersetzung der Zusammenfassung in die tschechische Sprache und bei Frau RNDr. J. Marková (Prag) für Informationen zu neuen Wirtspflanzen einiger Rostpilzarten für die Tschechische Republik.

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Anthracoidea vankyi, a new smut fungus for Moravia

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Kokeš P. (2005): *Anthracoidea vankyi*, a new smut fungus for Moravia. – Czech. Mycol. 57(3–4): 275–278.

Anthracoidea vankyi was found in Moravia (eastern part of Czech Republic). It is a new species for this area. This smut is rare in Europe, while the host (*Carex muricata* agg.) is common. All host plants in the specimens examined were revised. *Carex chabertii* was discovered as a new host.

Key words: *Anthracoidea vankyi*, smut fungi, Moravia, Czechia.

Kokeš P. (2005): *Anthracoidea vankyi*, nová sněť pro Moravu. – Czech. Mycol. 57(3–4): 275–278.

Anthracoidea vankyi byla nalezena na Moravě. Jedná se o nový druh pro toto území. Tato sněť je v Evropě vzácná, zatímco hostitel (*Carex muricata* agg.) je hojný. Všechny hostitelské rostliny na zkoumaných položkách byly revidovány. Jako nový hostitel byla zjištěna *Carex chabertii*.

INTRODUCTION

This article deals with a find of the rare smut fungus *Anthracoidea vankyi* Nannf. Sori of this parasite are found in ovaries as globose (rarely ovoid) bodies (2–3 mm in diameter), originally covered by a thin membrane which soon ruptures, revealing the black spore mass. We usually find this fungus in the host plant's fruiting period in the stadium without the membrane, visible as black balls scattered in the inflorescence.

In Europe *Anthracoidea vankyi* parasitises on *Carex contigua* Hoppe, *C. divulsa* Stokes, *C. leersiana* Rauschert, *C. muricata* L. s. str. and *C. pairae* F.W. Schultz (Vánky 1994: 38). Newly *Carex chabertii* F.W. Schultz was found as host on the specimen from Bohemia. The aggregate of *Carex muricata* includes the six species mentioned above. They are defined here in accordance with Kubát (2002: 807–808).

The area of Moravia is understood as the country "Země Moravskoslezská", which was effective in the periods 1928–1939 and 1945–1948. See the map in Kokeš and Müller (2004: 122).

Details on the localities where the specimens were examined are structured as follows: district [okres, powiat] (mountain range), municipality, name of the locality. The coordinates (ellipsoid WGS–84) and altitudes were calculated for the centre of the locality named by the collector. The locality „Gałązki“ by Hoffmann was situated in the central part of the valley. The localities „Smrekovica“ and „Špičák“ by Součková were situated on the summit of the mountain. My locality has precise values.

Literature data regarding the localities in Germany are structured as follows: federal country, nearby city or town, name of the locality (if mentioned).

RESULTS

Anthracoidea vankyi Nannf.

In 2004, I found *Anthracoidea vankyi* on *Carex contigua* in the military ground Březina in the district of Vyškov. The locality is situated by Eichlerka Road (leading from Hanácká cesta path to the road in the valley Prostějovičský žleb [valley of Brodečka]), 310 m SW of the place where the Napajedelský potok brook flows into the Brodečka brook. The habitat is situated by a metalled road (Eichlerka), near the edge of a young spruce wood. The smut occurs here very sparsely (2 spikelets infected only, in both spikelets 1 ball only). In 2005, I did not find this fungus at this locality. This collection is the first record of this fungus in Moravia.

Finds were also made in Poland, Bohemia and Slovakia, each with one locality. The stands in Poland and Bohemia are in the same mountain range, on the Polish side named „Góry Kamienne“, on the Czech side named „Javoří hory“. The distance between these two localities is only c. 3 km. The fungus in the specimen by Hoffmann was identified as *Ustilago caricis* Pers., and was published newly as *Anthracoidea vankyi* by Piątek (2005: 88). The fungi in the specimens by Součková were identified as *Cintractia caricis* (Pers.) Magnus, and were published under the same names by the collector (Tomková–Součková 1960: 155). *Anthracoidea vankyi* was described by Nannfeldt in 1977.

Specimens examined:

Poland:

On *Carex muricata* L. s. str.: powiat Wałbrzych (Góry Kamienne), Sokołowsko, Gałązki, 16 Aug. 1919, leg. Käthe Hoffmann, WRSL, 50°40'34.0" N, 16°14'45.5" E, 601.1 m (= altitude of the central part of the valley, exact altitude not given by the collector).

Bohemia (western part of Czechia):

On *Carex chabertii* F.W. Schultz: okres Náchod (Javoří hory), Ruprechtice, Mt. Špičák, 29 May 1947, leg. Milada Součková, BRNM, 50°39'42.8" N, 16°16'51.1" E, 880.5 m (= altitude of the mountaintop, exact altitude not given by the collector).

Moravia (eastern part of Czechia):

On *Carex contigua* Hoppe: okres Vyškov (Drahanská vrchovina), Osina, Napajedelský žleb, 31 July 2004, leg. Petr Kokeš, private herbarium, 49°25'15.0'' N, 16°57'50.9'' E, 415.3 m (exact altitude).

Slovakia:

On *Carex muricata* L. s. str.: okres Liptovský Mikuláš (Veľká Fatra), Liptovská Osada, Mt. Smrekovica, 12 July 1953, leg. Milada Součková, BRNM, 48°58'56.8'' N, 19°13'51.2'' E, 1530.2 m (= altitude of the mountaintop, exact altitude not given by the collector).

Literature data from Germany:

On *Carex muricata* agg. (in all cases, revision is necessary):

Niedersachen: Hannover, July 1884, leg. C. Engelke (Scholz and Scholz 1988: 75).

Brandenburg: Lenzen, Elbufer, without further data (Scholz and Scholz 1988: 75).

Sachsen: Leipzig, July 1874, leg. G. Winter [deposited in M] (Scholz and Scholz 1988: 75).

Bayern: Pfelling, Wellchenberg, 28 May 2000, leg. M. Beisenherz (Scholz and Scholz 2004: 446).

DISCUSSION

Anthracoidea vankyi occurs in the temperate zone of the Northern hemisphere. The specimens from Asia and North America as well as many from Europe need further research (host specification, fungus identification). In Europe it is known from Czechia (Bohemia and Moravia, in this paper), France, Germany, Italy, the Netherlands, Poland, Romania, Russia, Slovakia, Spain, Sweden, Switzerland and Ukraine (Piątek 2005: 91). In this article localities from Czechia, Poland and Slovakia were mentioned (examined specimens), and from Germany to illustrate the fact that it is necessary to revise the hosts of this smut from other countries. The reason of this revision is that: hosts in the specimens are often labelled with aggregate names and some species of this aggregate were formerly understood in a different way or were not distinguished. Both hosts collected by Součková were identified as *Carex pairaei* F.W. Schultz (det. M. Součková), the host collected by Hoffmann was originally named *Carex contigua* Hoppe s. lat. (det. T. Majewski). All hosts in herbarium specimens studied were identified by Radomír Řepka (Mendel University, Brno), specialist in *Carex muricata* agg.

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Bankeraceae in Central Europe. 2.

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Hrouda P. (2005): *Bankeraceae* in Central Europe. 2. – Czech. Mycol. 57(3–4): 279–297.

The paper presents the second part of a study of the genera *Bankera*, *Phellodon*, *Hydnellum*, *Sarcodon* and *Boletopsis* in selected herbaria of Central Europe (Poland and northern Germany in this part). For each species, its occurrence and distribution is described. Historical changes of the occurrence of hydnaceous fungi in the Central European area are discussed at the end of the study.

Key words: *Bankeraceae*, distribution, Central Europe.

Hrouda P. (2005): *Bankeraceae* ve střední Evropě. 2. – Czech. Mycol. 57(3–4): 279–297.

Práce představuje druhou část výsledků studia rodů *Bankera*, *Phellodon*, *Hydnellum*, *Sarcodon* a *Boletopsis* ve vybraných herbářích střední Evropy (tato část je zaměřena na Polsko a severní Německo). U jednotlivých druhů je popsán výskyt a rozšíření a závěrem jsou pak diskutovány historické změny ve výskytu lošáků v prostoru střední Evropy.

INTRODUCTION

The presented study follows the previous article summarising the knowledge of the genera *Bankera*, *Phellodon*, *Hydnellum*, *Sarcodon* and *Boletopsis* in the southern part of Central Europe (Hrouda 2005). This article represents the second part of the study, which describes the ecology, occurrence and distribution of *Bankeraceae* in Poland and northern and central Germany (all lands except Bavaria and Baden-Württemberg), and is completed with a summary of the historical and recent occurrence of this group in Central Europe.

Some general information, presented in the previous part, is not repeated here.

MATERIAL AND METHODS

The core of the work represents a revision of herbarium material deposited in selected Polish and German herbaria (KRAM, WA, LOD, WRSL, GLM, DR, LZ, JE, B, HBG, BREM and MSTR, and some material from the studied area deposited in

Czech, Austrian and south-German herbaria). Specimens of critical species (not safely distinguished by macroscopical characters) were studied microscopically, as well as unidentified or doubtfully identified specimens of other species; the studied specimens were provided with revision cards.

Where useful, some data from literature were added either to complete information or for a comparison with facts based on herbarium material. The following journals have been excerpted: Acta Mycologica, Polish Botanical Journal, Fragmenta Floristica et Geobotanica, Zeitschrift für Mykologie (formerly Zeitschrift für Pilzkunde), Boletus, Mykologisches Mitteilungsblatt, and Westfälische Pilzbriefe; besides many individual records, principal sources of literature data were Verbreitungsatlas der Großpilze Deutschlands (Krieglsteiner 1991), Die Großpilze Niedersachsens und Bremens (Wöldecke 1998) and articles by Otto (1989, 1992, 1997).

Similarly to the previous part, general information about the occurrence and distribution in particular countries and partial regions is presented for each species. In the case of very rare species, data of individual finds and collections and/or literature records are presented. Neither presents this article a complete survey of the occurrence of *Bankeraceae* in the region. As it is based on the study of material from selected herbaria, some other material certainly remains omitted, but the selection contains the largest herbarium collections and this should provide a general view of the situation in the whole region.

Short notes on the occurrence in countries surrounding northern Germany and Poland (Benelux, Denmark, Belarus, Ukraine, sometimes completed with information from other countries in northern Europe; the southern half of Europe being commented in the previous part) are only informative, based on literature (Arnolds 2003, Hansen and Knudsen 1997, Kotlaba 1984, Maas Geesteranus 1975, Otto 1992, Pegler et al. 1997; the different sources are usually not cited under every species, except in the case of rare species) and records from the Central European herbaria (see abbreviations, except specimens from Sweden and Finland, which are present in many herbaria). Herbarium collections from the other countries (except Central Europe) have not been revised. The word Fennoscandia means all three countries: Norway, Sweden, and Finland.

RESULTS

Bankera fuligineo-alba (J. C. Schmidt: Fr.) Coker et Beers ex Pouzar

Rare species occurring in *Pinus* forests. It is recently known from Rheinland-Pfalz (Kaiserslautern, 1988, KR), Niedersachsen (Scheuen, 1967, in Wöldecke 1998), Lusatia (Klitten, 2001, GLM; Cottbus, 2001, LZ; several finds in the 1990s), Brandenburg (Otto 1992), Mecklenburg (Wesenberg, 1976, GLM), northern Poland (Bory Tucholskie, 2000, LOD), northeastern Poland (Zabludow, 1977, KRAM; reserve „Perkuć", 1977, in Lisiewska 1992) and southeastern Poland (Roztocze near Zamość, 1988, KRAM).

In the surrounding countries and northern Europe the species is recently documented from Sweden, Finland, Russia (W) and Estonia (STU), and it is also known from Great Britain, Belgium, the Netherlands, Denmark and Norway.

Bankera violascens (Alb. et Schw.: Fr.) Pouzar

Due to the dominance of lowlands in Poland and northern Germany, this species (associated with *Picea* especially in mountainous areas) is rarer than *Bankera fuligineo-alba* in this area. It is known from Westfalen (Krieglsteiner 1991), Niedersachsen (Benkert et al. 1992), Thüringen (Friedebach, 1989, LZ; Schleusingen, 1981, JE and B), southwestern Sachsen (Otto 1992) and from the Carpathian Mts. (Muszyna in Beskid Sądecki, 1964, in Gumińska 1966).

The species is recently documented from Sweden and Finland, and it is also known from Great Britain, Belgium, Denmark, Norway, Estonia and Russia.

Phellodon niger (Fr.: Fr.) P. Karst.

A somewhat less common species than in the southern part of Central Europe (Hrouda 2005), known from Rheinland-Pfalz, Niedersachsen, Thüringen, Sachsen, Silesia, the Carpathians, and several localities in the northern regions of Poland and Germany, in *Pinus*, *Picea*, and *Fagus* forests.

Phellodon niger is recently documented from Denmark, Fennoscandia and Estonia (LZ), formerly from Great Britain (WU); it is also known from Belgium, the Netherlands and Russia.

Phellodon confluens (Pers.) Pouzar

This formerly rare species (associated with *Quercus* or *Fagus* in this area) has recently been recorded in some regions of Poland: Rychwald near Tarnow (1994, KRAM); Łódź, „Las Łagiewnicki" forest (1974, LOD). In Germany there are recent finds from Sachsen (Bernsdorf, 2000; Mönau, 1999, both GLM), Brandenburg (Bad Liebenweda, 1993, LZ), Mecklenburg-Vorpommern (Parkentin, 2001, GLM; surroundings of Schwerin in the 1990s), and Westfalen (Tatenhausen, 1987, MSTR); the species is reported from Thüringen, Sachsen-Anhalt, Niedersachsen and Schleswig-Holstein (Benkert et al. 1992).

Phellodon confluens is documented from the Netherlands (M, GZU) and Sweden, it is also reported from Great Britain, Belgium, Denmark, Norway and Finland.

Phellodon connatus (Schultz: Fr.) P. Karst.

As mentioned in the previous article (Hrouda 2005), this species is probably rather overlooked than really rare – recently it has been often recorded from Sachsen, but in most of the other regions there are only scattered localities. *Phellodon connatus* is accompanied by *Pinus* and *Picea*, occasionally it occurs also in deciduous forests.

In the surrounding countries, the species is documented from Denmark (M) and Russia (W), it is also known from Great Britain, Belgium, the Netherlands and Fennoscandia.

Phellodon tomentosus (L.: Fr.) Banker

Rather common species in some regions – eastern Poland, the Carpathian Mts., Sachsen, and northern Germany (up to Rügen); scattered localities in most of the other regions. *Pinus* and *Picea* are common accompanying trees.

In the other countries, *Phellodon tomentosus* has recently been documented from Norway (GLM), Sweden, Finland and Russia (W), older specimens are from Estonia (LZ), Latvia (B, JE) and Belarus (KRAM). The species is also known from Great Britain, Belgium, the Netherlands and Denmark.

Hydnellum suaveolens (Scop.: Fr.) P. Karst.

Although there are several old records (before World War II) from some other regions (Silesia, Sachsen, Thüringen, Brandenburg, Niedersachsen, Schleswig-Holstein), the recent distribution range of *Hydnellum suaveolens* is probably limited only to the Carpathian Mts. and near surroundings (mostly in *Picea* forests) – it occurs in the Tatra Mts. and the Gorce Mts., individual records are known from the Pieniny Mts. (Gumińska 1972) and Roztocze near Zamość (*Vaccinio-Pinetum*, 1973, WA).

Hydnellum suaveolens is known from Great Britain, Belgium, Denmark, Norway (JE, GZU), Sweden, Finland, Estonia, Latvia (JE, B, W), Russia and the Ukrainian Carpathians (KRAM).

Hydnellum caeruleum (Hornem.) P. Karst.

Species similarly rare as the previous one in the northern part of Central Europe, formerly occurring at scattered localities in central and eastern Germany and southern Poland, mostly in *Pinus* or *Pinus*-containing forests. Its occurrence is recently confirmed in Niedersachsen (Marwede, 1988; Scheuen, 1967, both in Wöldecke 1998), Thüringen (Nordhausen, 1999, LZ). Somewhat older records are known from Sachsen (Deschka, 1975, GLM), Schleswig (Kropp, 1966, M), Brandenburg and Rheinland-Pfalz (Benkert et al. 1992), eastern Poland (Zwierzyniec near Zamość, 1966, WA) and the Carpathian Mts. (Kowaniec near Nowy Targ, 1961, WA).

The species is recently documented from Sweden, Finland and Estonia (LZ), formerly from Russia (W), Latvia (W) and Belarus (KRAM). Besides, it is reported from Great Britain, Belgium, the Netherlands, Denmark and Norway.

Hydnellum floriforme (Schaeff.) Banker

A rare species, documented from Puszcza Augustowska in northeastern Poland (reserves „Starożyn", 1977, and „Perkuć", 1974, KRAM) and from the Carpathian region (Zarębek Średni, 1963, KRAM, cit. in Wojewoda 1964; Kowaniec, 1961, Zakopane, 1963, both WA), formerly occurring also in Silesia, Sachsen, Thüringen (see also note to *H. aurantiacum*), Sachsen-Anhalt, Brandenburg, and reported from Niedersachsen (Benkert et al. 1992), Schleswig-Holstein, Hessen and Saarland (Krieglsteiner 1991).

Hydnellum floriforme is recently documented from Denmark (STU), Fennoscandia and Russia (W), and reported also from Great Britain, Belgium, the Netherlands and Estonia.

Hydnellum aurantiacum (Batsch: Fr.) P. Karst. em. Otto 1997

Very rare species, which is recently known from Thüringen (in *Fagus* forests: Bleiderode, 2002, LZ; Bleicherode, 2002, LZ, and 1993, GLM), Sachsen-Anhalt (Allstedt, 1979, GLM), and Niedersachsen (Osterwald, Königskanzel, 1993 and 1996, in Wöldecke 1998). Some specimens from the Thuringian localities represent typical *Hydnellum aurantiacum*, whereas paler ones look somewhat like *H. floriforme* – obviously, presence of both species in the region cannot be excluded. I do not accept the opinion that *H. floriforme* is conspecific with *H. aurantiacum*. Subtle dark specimens namely from mountain areas are considerably different from more massive light specimens for example from southern Bohemia. Benkert et al. (1992) report the species also from other regions: Sachsen-Anhalt, Schleswig-Holstein, Rheinland-Pfalz and Saarland. Occurrence of this species in Poland has not been confirmed, although it is quite probable (according to its occurrence on the Slovak side of the Carpathian Mts.).

Hansen and Knudsen (1997) reported this species as *Hydnellum auratile* from Sweden and Finland.

Hydnellum peckii Banker

Hydnellum peckii is a rare species in the northern part of Central Europe, occurring in coniferous, especially *Picea* and *Pinus* forests. It is recently recorded from Thüringen (vicinity of Stadtilm, 2002, LZ, and 1997, GLM), and Puszcza Augustowska (reserve „Perkuć", 1974, KRAM); older records are known from scattered localities in central Poland and northeastern Germany (East German regions and Niedersachsen, with *Picea* as the most frequent accompanying tree).

Hydnellum peckii is recently documented from Belgium, Sweden, Finland and Russia (LZ); it is also reported from Great Britain, the Netherlands, Denmark, Norway and Estonia.

Hydnellum compactum (Pers.: Fr.) P. Karst.

A very rare species. Recently it is known from Westfalen („Paulinen-Allee" near Tatenhausen, under *Quercus*, 1987, MSTR) in Germany and from central Poland („Las Łagiewnicki" forest near Łódź, under *Quercus*, 1974, LOD). In the 1930s the species occurred also in Mecklenburg-Vorpommern, and the specimen collected in this region (Neumühler See) by Westphal in 1994 (deposited in LZ, formerly identified as *Hydnellum spongiosipes* and revised as *H.* cf. *scrobiculatum*) appears to represent an untypical basidiome of this species as well. Benkert et al. (1992) report it also from Rheinland-Pfalz and Saarland.

Hydnellum compactum is known from Belgium, the Netherlands, Fennoscandia and Estonia.

Hydnellum spongiosipes (Peck) Pouzar

A very rare species, occurring at isolated localities in Germany, associated with *Quercus* or *Fagus*: Niedersachsen („Gut Sunder" near Winsen/Aller, 2001, LZ; Forellenbachtal, 1993; Düngel, 1987, last two in Wöldecke 1998), Westfalen („Paulinen-Allee" near Tatenhausen, 1987, MSTR), Sachsen-Anhalt („Burghof" in protected area „Kyffhäuser", 1987, LZ; „Ferchauer Forst" near Salzwedel, 1981, JE), Brandenburg („Gubelpfuhe" near Buckow, 1979, JE) and rarely in Mecklenburg (Otto 1992), Thüringen and Rheinland-Pfalz (Benkert et al. 1992); also the species reported by Nespiak (1968) from *Fagus* forests in Wesergebirge as *Calodon velutinus* probably represents *Hydnellum spongiosipes*.

In surrounding countries, *Hydnellum spongiosipes* is documented from the Netherlands (M, GZU), and reported from Belgium and Great Britain.

Hydnellum ferrugineum (Fr.: Fr.) P. Karst.

A relatively rare species with scattered localities in various regions of Germany (recently in Rheinland-Pfalz, Leistadt, 2002, KR, and Sachsen, Bergen, 1996, GLM) and Poland (documented also from the northernmost part of the country: Gdańsk, Wrzeszcz, 1958, WA), mainly in *Pinus*, less in *Picea* forests.

The species is often documented from Fennoscandia, Estonia (LZ), Latvia (B, DR), Russia (W) and Belarus (KRAM); it is also reported from Great Britain, Belgium, the Netherlands and Denmark.

Hydnellum scrobiculatum (Fr.) P. Karst.

Surprisingly rare species, recently recorded in Sachsen (latest find: Kreba, under *Quercus*, 1999, GLM), at the end of the 1960s also in Niedersachsen (Dannenberg, under *Fagus*, 1968, M) and Westfalen (Kleinenbremen, under *Fagus*, 1968, M). The species is reported also from the rest of East Germany and Rheinland-Pfalz (Benkert et al. 1992), and is probably extinct from Poland (Wojewoda and Ławrynowicz 1992). Some specimens documented as *Hydnellum scrobiculatum* have been revised as *H. concrescens*.

Hydnellum scrobiculatum is documented from Great Britain (W), Sweden and Finland; it is also known from Belgium and Denmark.

Hydnellum concrescens (Pers.) Banker

Rather common species in both deciduous and coniferous forests especially in eastern Germany (almost the entire territory of the former GDR), with several recent records also in Rheinland-Pfalz, Hessen, Nordrhein-Westfalen, Niedersachsen, central Poland and the Carpathian Mts.

The species is recently documented from Great Britain, the Netherlands, Sweden and Finland; it is reported also from Belgium, Denmark, Norway, Estonia and Russia.

Hydnellum geogenium (Fr.) Banker

As predictable, the mountainous species *Hydnellum geogenium* occurs rarely only in the Carpathian region; its latest find is from Poland: Mała Roztoka in the Beskid Sądecki Mts. (Gumińska 1962, as *Calodon sulphureum*). The reported occurrence in Nordrhein-Westfalen (Benkert et al. 1992) is probably based on a wrongly identified specimen of *Hydnellum compactum* (see under that species, the specimen from Tatenhausen was originally identified as *H. geogenium*).

In the year 2005, the species was twice collected in Slovakia (supplement to Hrouda 2005, new records after 16 years!): Oravice (northern Slovakia), site

„Šatanová", 850 m, young *Picea* forest (CB), and Nízke Tatry Mts, valley of the Ľupčianka river 10 km south of Partizánska Ľupča, 800 m (BRNM).

Hydnellum geogenium is also known from Norway, Sweden and Finland (Hansen and Knudsen 1997).

Sarcodon imbricatus (L.: Fr.) P. Karst.

Although *Sarcodon imbricatus* is not such a common species in Poland and northern Germany as in the southern part of Central Europe, it occurs in forests with *Picea* in various regions. The species has recently been recorded in Thüringen and Hessen in Germany, and in the Carpathian region (common occurrence until now) in southern Poland, but it certainly occurs in other regions, too.

The species is recently documented from Sweden, Finland and formerly from Ukraine (Eastern Carpathians, B). Besides, it is known from Great Britain, the Netherlands, Denmark, Norway, Estonia and Russia.

Sarcodon squamosus (Schaeff.) Quél.

A rather common species whose occurrence corresponds with the distribution of *Pinus* forests in the studied area. The recent distribution range of *Sarcodon squamosus* covers almost the entire lowland area of Poland and eastern Germany (most of the localities mapped by Otto 1992 under *S. imbricatus* certainly belong to *S. squamosus*, except Thüringen); its occurrence has recently not been confirmed in northwestern Germany.

Sarcodon squamosus is known in Great Britain, Belgium, the Netherlands, Denmark, Fennoscandia and Latvia (W).

Sarcodon leucopus (Pers.) Maas Geest. et Nannf.

An extremely rare species recently occurring only in Sachsen (Oberlichtenau near Kamenz, 1985, GLM), with few old records from eastern Germany (according to the map in Otto 1992; Benkert et al. 1992 report it from Brandenburg, Sachsen, Sachsen-Anhalt and Thüringen).

The species is documented from Sweden; it is also reported from Iceland, Great Britain, Belgium, the Netherlands, Norway, Finland and Russia.

Sarcodon versipellis (Fr.) Quél.

S. versipellis is reported only from Thüringen (Otto 1992) and Sachsen-Anhalt (Benkert et al. 1992), and is probably missing from rest of the studied area.

The species is documented from Sweden and reported from Belgium, Norway and Finland.

Sarcodon scabrosus (Fr.) P. Karst.

A less common species recently occurring in both deciduous and coniferous forests in Rheinland-Pfalz, Niedersachsen, Mecklenburg, Brandenburg, Thüringen, Sachsen (according to Benkert et al. 1992 and Otto 1992 also in Hessen and Sachsen-Anhalt) and Poland.

Sarcodon scabrosus is documented from Great Britain (GZU), the Netherlands (M) and Sweden; it is also reported from Belgium, Denmark, Norway, Finland, Estonia and Russia.

Sarcodon glaucopus Maas Geest. et Nannf.

Very rare species, formerly known from Sachsen and Thüringen, recently occurring in Brandenburg (under *Pinus*, Krugau, 2000, LZ).

Besides Central Europe, the species is documented (and also reported in literature) only from Sweden (LZ) and Finland (KRAM).

Sarcodon lepidus Maas Geest.

Very rare species with few recent localities. Poland: Lódź, „Las Łagiewnicki" forest (under *Quercus*, 1974, LOD, originally identified as *S. laevigatus* = *S. imbricatus*). Germany: Sachsen, Mönau near Hoyerswerda, „Mönauer Teiche" (under *Quercus*, 1999 and 2001, LZ), and Thüringen, Krimderode near Nordhausen, „Gipshügel" (under *Quercus* + *Betula*, 1985, JE). Possible another German locality is Schönberg near Freiburg in Baden (during the last 15 years, not. G. Saar in letter to P. Otto – according to his information the recorded species should also be *S. lepidus*).

Besides Germany and Poland, the species is known only from Belgium, the Netherlands and Italy (Arnolds 2003, Otto 1992).

Sarcodon martioflavus (Snell) Maas Geest.

Benkert et al. (1992) report the species from Sachsen; unfortunately I have not seen the material.

Hansen and Knudsen (1997) report *S. martioflavus* from Fennoscandia.

Sarcodon joeides (Pass.) Bataille

S. joeides is also a very rare species with only several recent localities in Germany: Niederlausitz, Schlaubetal near Guben, bank of „Schulzenwasser" (mixed deciduous forest, 1987, LZ); Mecklenburg, Neumühler See and Pinnower See (both in sandy *Fagus* forest, 1994, LZ); Niedersachsen, Düngel (1987, in Wöldecke 1998); Westfalen, „Paulinen-Allee" near Tatenhausen (under *Quercus*, 1987, MSTR); Pfalzer Wald, Birkweiler near Landau (under *Castanea*, 1980, M). Otto (1992) reports the species also from central Brandenburg (Drewitz/Potsdam), Benkert et al. (1992) from Saarland and Rheinland-Pfalz.

In the surrounding countries, *Sarcodon joeides* is reported from Belgium and the Netherlands (Arnolds 2003).

Sarcodon fuligineo-violaceus (Kalchbr.) Pat.

In the year 2005, the species was found in the Strážovské vrchy Mts.: Podskalie, under the Podskalský Roháč Mt., slope of a small stream valley, *Pinus sylvestris* and *Picea abies*, on calcareous background, 500 m a.s.l. (6. X. 2005, leg. J. Lederer, det. J. Holec et al.; PRM) – it is the first record from Slovakia since Kalchbrenner's find (locus classicus) in 1870 (supplement to Hrouda 2005)!

Besides Slovakia, the recent occurrence of *S. fuligineo-violaceus* in Central Europe is very probably limited to Austria and southern Germany (see Hrouda 2005); only old localities are known from the rest of the German territory – Hessen (Darmstadt, 1936, M), Niedersachsen, Thüringen and Sachsen (Benkert et al. 1992; Otto 1992 reports the latest find in 1955).

Besides Central Europe, the species is known from Fennoscandia (Hansen and Knudsen 1997).

Boletopsis leucomelaena (Pers.) Fayod

Very rare species in non-mountainous regions, recently occurring in *Picea* forests (or forests with *Picea*) at several localities in the area of interest. Germany: Rheinland-Pfalz, Vulkaneifel near Gerolstein, near „Mürlenbach" in Remmelbachtal (1987, W); Nordrhein-Westfalen, Bielefeld, „Eckendorfer Wald" (1991, MSTR); Thüringen, Stadtilm (1987, JE and GLM); Sachsen, Görlitz-Südstadt (1980, GLM); Benkert et al. (1992) report it also from Hessen, Niedersachsen and Sachsen-Anhalt (this might be doubtful due to the common confusion of *Boletopsis* species in German herbaria). Poland: Harklowa near Nowy Targ, „Bór Harklowski" forest (1970, KRAM), and Zakopane (1963, WA).

Boletopsis leucomelaena is documented from Sweden, Finland and Russia (W); the species is also reported from Denmark and Norway.

Boletopsis grisea (Peck) Bondartsev et Singer

Boletopsis grisea has often been identified as *B. leucomelaena* (*leucomelas*) or *B. subsquamosa*; as in the previous article (Hrouda 2005), only finds identified or revised as *B. grisea* with certainty are considered. Compared to the area of *Pinus* forests in Poland and northern Germany, the species appears to be surprisingly rare. The only recorded recent localities are in northern Poland (Chojnik in „Bory Tucholskie", 1993, WA) and Sachsen (Rietschen, 1977, GLM, and Treuenbrietzen, 1974, JE), formerly (also in Benkert et al. 1992) the species was found in Brandenburg and Mecklenburg-Vorpommern. Records from Westfalen, Niedersachsen and Brandenburg (Jahn 1963, cited as *B. subsquamosa* = *B. leucomelas*) might represent *B. grisea*, but it is not certain.

Boletopsis grisea is documented from Finland; it is also known from the Netherlands, Denmark, Fennoscandia and Russia.

Besides species reported in this article, some other Central European species have been documented from northern Europe: *Hydnellum mirabile*, *Sarcodon lundellii* and *S. fennicus* from Sweden, the latter one also from Finland and Karelia in northern Russia. Hansen and Knudsen (1997) report *Hydnellum mirabile*, *Sarcodon fennicus* and *S. lundellii* from Fennoscandia and *Hydnellum cumulatum* from Denmark.

At the end of the results chapter, the summarising table shows the altitudinal range of the particular species in the whole of Central Europe (Tab. 1). It is based on complete records from the Czech Republic and Slovakia (the altitude was found for all localities) and selected records from other countries (only the localities where the altitude was mentioned). In my opinion, such records can be taken as a representative sample – the relief of the Czech Republic (mostly lowlands or hills) is comparable to Poland and northern Germany, whereas the relief of Slovakia with dominating mountains is similar to the Alpine regions, so that the sample should show the real distribution in Central Europe. (If only localities with exactly recorded altitude are taken for all countries, the total number of records would be rather low – therefore at least the Czech and Slovak localities have been included completely.)

Table 1 shows that species which are distinctly bound to low or high altitudes are not so common. It is more prominent in mountainous species (the very rare and endangered *Boletopsis leucomelaena*, *Hydnellum geogenium* and *Sarcodon versipellis*), but also distinct lowland species (*Phellodon confluens*, *Hydnellum spongiosipes*) belong to the rare ones.

Tab. 1. Numbers of recorded finds according to altitude.
Last column („char" = characteristics) shows affinity of the particular species to low or high altitudes: M = mountainous species, (M) = weakly mountainous species, 0 = species without distinct affinity to low or high altitudes, (L) = weak lowland species, L = lowland species, L+ = strong lowland species; – shows that the species has not been characterised due to low numbers of records (<5).

	number of records						% of records						char
Altitude (m)	**0–200**	**201–500**	**501–800**	**801–1100**	**1101–**	**total**	**0–200**	**201–500**	**501–800**	**801–1100**	**1101–**	**total**	
Bankera fuligineo-alba	1	23	10	1		35	3	66	29	3	0	100	L
Bankera violascens	1	15	25	13	5	59	2	25	42	22	8	100	(M)
Phellodon niger	1	44	53	21	1	120	1	37	44	18	1	100	0
Phellodon confluens	4	12	1			17	24	71	6	0	0	100	L+
Phellodon connatus	2	43	55	11	2	113	2	38	49	10	2	100	0
Phellodon tomentosus	4	46	62	24	4	140	3	33	44	17	3	100	0
Hydnellum suaveolens		24	40	19	5	88	0	27	45	22	6	100	(M)
Hydnellum caeruleum		46	34	21	2	103	0	45	33	20	2	100	0
Hydnellum floriforme	2	17	21	23	3	66	3	26	32	35	5	100	(M)
Hydnellum aurantiacum		3	3	3		9	0	33	33	33	0	100	(M)
Hydnellum peckii	1	21	26	15	1	64	2	33	41	23	2	100	0
Hydnellum mirabile		1		1		2	0	50	0	50	0	100	–
Hydnellum compactum		4		1		5	0	80	0	20	0	100	L
Hydnellum spongiosipes	1	6	1			8	12	75	12	0	0	100	L+
Hydnellum ferrugineum	1	43	46	6		96	1	45	48	6	0	100	(L)
Hydnellum tardum		1	4			5	0	20	80	0	0	100	0
Hydnellum scrobiculatum		24	9	7	2	42	0	57	21	17	5	100	(L)
Hydnellum concrescens	5	51	32	18	1	107	5	48	30	17	1	100	(L)
Hydnellum geogenium		2	13	8	1	24	0	8	54	33	4	100	M
Sarcodon imbricatus	2	50	55	41	13	161	1	31	34	25	8	100	(M)
Sarcodon squamosus	6	17	9	2		34	18	50	26	6	0	100	L
Sarcodon leucopus	2	4	7	2	1	16	12	25	44	12	6	100	0
Sarcodon versipellis		3	13	3	1	20	0	15	65	15	5	100	M
Sarcodon scabrosus		27	24	5		56	0	48	43	9	0	100	(L)
Sarcodon glaucopus		3	7	3		13	0	23	54	23	0	100	(M)
Sarcodon fennicus		4	2	1		7	0	57	29	14	0	100	(L)
Sarcodon regalis			1			1	0	0	100	0	0	100	–
Sarcodon lepidus	1					1	100	0	0	0	0	100	–
Sarcodon martioflavus		1				1	0	100	0	0	0	100	–
Sarcodon joeides		3				3	0	100	0	0	0	100	–
Sarcodon fuligineo-violaceus			2	1		3	0	0	67	33	0	100	–
Boletopsis leucomelaena		2	11	8	2	23	0	9	48	35	9	100	M
Boletopsis grisea	1	19	14	1	1	36	3	53	39	3	3	100	L
Total	**35**	**559**	**580**	**259**	**45**	**1478**	**2**	**38**	**39**	**18**	**3**	**100**	

Occurrence of *Bankeraceae* – historical overview

Compared to the southern part of Central Europe, lowlands and hills are dominating landscape types in Poland and northern Germany (except for the mountains on the Slovak and Czech borders). Also the share of deciduous and pine forests is higher than in the mountain areas. Therefore the occurrence of some species is quite different from that described in the previous article (Hrouda 2005) and also the total occurrence of *Bankeraceae* is influenced by the different conditions in the mentioned countries.

Tab. 2. Numbers of recorded finds in particular countries, completed with total numbers for the entire area of Central Europe (including the countries presented in the previous article, Hrouda 2005).

Country	–1915	1916–45	1946–60	1961–75	1976–90	1991–2005
Poland	37	19	20	91	25	14
Northern Germany	126	103	30	74	126	110
Central Europe – total	**484**	**590**	**525**	**776**	**592**	**553**

A low number of records in Germany in the post-war period (the same situation is visible in Poland) is followed by increasing numbers in next periods. However, the surprisingly high numbers of records in the last decades are certainly connected with the work of P. Otto since the 1980s (similar to the significant peak appearing in Czechia in the 1950s in connection with the work of Z. Pouzar). This is why especially eastern Germany is currently the best investigated area (concerning *Bankeraceae*), but it is hard to draw a conclusion about changes in occurrence at the end of the 20th century (compared to the previous era).

The situation in Poland is similar to the situation in Hungary (see Hrouda 2005) – also here a prominent peak is visible in the 1960s, followed by a rapid decrease in the next decades. There are two explanations for such rapid decrease – either a really decreasing occurrence of the fungi or lower mycological activity in later decades. To answer the question what is the right explanation, I utilise my data on the occurrence of the genera *Hydnum* and *Auriscalpium* in Poland and compare them with the data on *Bankeraceae*. As visible from Table 3, the truth is probably somewhere inbetween.

Tab. 3. Numbers of records of *Bankeraceae* compared with genera *Hydnum* and *Auriscalpium* (the occurrence of these genera is not elaborated elsewhere in the presented study) in Poland during the second half of the 20th century.

Period	1951–1960	1961–1970	1971–1980	1981–1990	1991–2000
Bankeraceae	19	62	37	17	11
Hydnum	15	32	32	7	13
Auriscalpium	14	34	46	17	24

Tab. 4. Numbers of recorded finds in particular countries.
Periods: **–15** = up to 1915, **–45** = 1916–1945, **–60** = 1946–1960, **–75** = 1961–1975, **–90** = 1976–1990, **–05** = 1991–2005. The last 6 columns (Central Europe – total) represent the total sums for the whole of Central Europe, together with the counts from table 2 in the previous article (Hrouda 2005).

Country	**Northern Germany**						**Poland**						**Central Europe – total**					
Period	**–15**	**–45**	**–60**	**–75**	**–90**	**–05**	**–15**	**–45**	**–60**	**–75**	**–90**	**–05**	**–15**	**–45**	**–60**	**–75**	**–90**	**–05**
Bankera fuligineo-alba	9	5	2	8	6	11	3	1		7	3	1	21	24	15	29	15	18
Bankera violascens					6		1	1		1			5	26	16	27	30	27
Phellodon niger	5	12	1	6	9	14	2	1	2	4			36	45	54	70	56	53
Phellodon confluens	3	2			7	8				2		1	7	8	4	22	10	16
Phellodon connatus	13	7		12	18	11	5		1	1	1		36	45	45	46	37	36
Phellodon tomentosus	29	13		12	11	4	4	1	2	9	3	2	70	64	43	91	46	49
Hydnellum suaveolens	7	16	21	6		1	4	5	2	15			56	53	54	57	15	12
Hydnellum caeruleum	5	12		4		2	1	2	1	2			41	61	51	46	24	17
Hydnellum ferrugipes																1		
Hydnellum floriforme	3	3			1	2	5		2	5	1		32	32	20	36	31	26
Hydnellum aurantiacum				1	1	2							3	3		6	7	4
Hydnellum peckii	7	2				4	1			1			18	23	20	34	23	33
Hydnellum mirabile														2			1	
Hydnellum compactum		2			1	1				1			1	4		2	2	4
Hydnellum spongiosipes	2	3		1	5	1							3	4	3	12	12	2
Hydnellum ferrugineum	4	3		1	3	2	3	1	1	1			17	25	41	26	37	31
Hydnellum tardum														1		6	4	1
Hydnellum scrobiculatum	2	2	2	5	2	1	1			2	2	1	10	21	19	19	15	12
Hydnellum concrescens	18	8	3	4	29	20	2			5	1		45	38	51	60	57	41
Hydnellum cumulatum															1			
Hydnellum geogenium								2		1			2	7	9	17	7	5
Sarcodon imbricatus	7	2	1	2	5	1	3	5	7	22	4	1	40	44	30	60	57	67
Sarcodon squamosus	11	5		9	11	12	1		2	9	10	7	15	9	9	22	31	39
Sarcodon leucopus													7	11	7	7	3	2
Sarcodon versipellis													6	9		17	5	6
Sarcodon scabrosus				1	3	4							1	11	20	21	17	15
Sarcodon glaucopus		2				1							1	2	7	4	8	7
Sarcodon fennicus													2	5	4	7	2	1
Sarcodon regalis						1												1
Sarcodon lepidus					1	2				1						1	1	2
Sarcodon lundellii																		1
Sarcodon martioflavus																1	1	
Sarcodon joeides					3	4										1	5	4
Sarcodon fuligineo-violaceus		1					1						2	1		4	2	
Boletopsis leucomelaena	1				3	1				2			3	3		19	25	14
Boletopsis grisea		3		2	1							1	4	9	1	5	6	7
Total	126	103	30	74	126	110	37	19	20	91	25	14	484	590	525	776	592	553

In comparison with the common saprotrophic *Auriscalpium vulgare* (which can be regarded a species with rather constant occurrence), all species show a lower number of records since 1980, but species of the common mycorrhizal genus *Hydnum* show an almost similarly rapid decrease as *Bankeraceae* (although the decrease of *Bankeraceae* is more gradual and we can expect that not all finds of *Hydnum* have been documented). Another possible factor which might have influence on the number of finds is the way of investigating – according to herbarium and literature sources, a long-term systematic investigation of some localities has taken place (which can lead to very interesting results, e.g. many finds of rare species in „Las Łagiewnicki“ forest), whereas the total number of investigated localities (per area unit) is probably lower than in Czechia or eastern Germany and therefore also the chance to find rare species is lower.

Tab. 4 shows a total summary of the records of the studied species during history and changes in their occurrence (mostly a decrease in the cases of some prominent changes) in the study area. Besides current finds of *Sarcodon joeides* and *S. lepidus*, which might be ascribed to intensive investigation in Germany since the 1980s, *Phellodon confluens* does not seem to be so endangered as in the southern regions. A similar case is *Bankera fuligineo-alba*. In general, the species are not so rare and the possible decrease in occurrence is not so striking in large areas with their natural habitats (deciduous or pine forests, as mentioned above). Another situation is represented by mountainous species (or species currently occurring mostly in mountain areas), which are really endangered or almost extinct from most of the area – *Hydnellum geogenium*, *H. caeruleum* and *H. suaveolens*.

Endangered species in national Red Data Lists

Finally, a short report about the endangered species. Tab. 5 shows a survey of the Central European species and their position in national Red Data Lists of the particular countries (Beran and Holec in prep., Lizoň 2001, Wojewoda and Ławrynowicz 1992, Benkert et al. 1992, Krisai-Greilhuber 1999, Siller and Vasas 1995).

As visible, Czech and German lists are the most complete ones and the classification of particular species generally corresponds with my investigation. In the German list, category „R“ for *Sarcodon lepidus* may be explained by some expected data deficiency; the list should be completed with two species recorded already by Maas Geesteranus (1975): *Hydnellum tardum* and *Sarcodon regalis*.

The Polish list should be completed with the very rare *Bankera violascens*, *Boletopsis grisea*, *Hydnellum compactum*, *H. peckii*, *Phellodon confluens*, *P. connatus* and newly discovered *Sarcodon lepidus*.

Tab. 5. Species included in the Red Data Lists of particular countries.
Abbreviations of the IUCN categories: EX: extinct, CR: critically endangered, EN: endangered, VU: vulnerable, NT: near threatened, LC: least concern, DD: data deficient, NE: not evaluated.

Country	Czech Rep.	Slovakia	Poland	Germany	Austria	Hungary
Bankera fuligineo-alba	CR		E (EN)	1 (CR)		
Bankera violascens	EN			1 (CR)		
Phellodon niger	NT+LC		V (VU)	2 (EN)		
Phellodon confluens	EN	LR: LC		2 (EN)		
Phellodon connatus	NT+LC			2 (EN)		
Phellodon tomentosus	NT+LC		V (VU)	2 (EN)		
Hydnellum suaveolens	CR		V (VU)	2 (EN)		
Hydnellum caeruleum	EN		E (EN)	2 (EN)	3 (VU)	
Hydnellum ferrugipes						
Hydnellum floriforme	EN		V (VU) *	1 (CR)	3 (VU) *	
Hydnellum aurantiacum	CR		*	2 (EN)	*	
Hydnellum peckii	EN	EN		2 (EN)	3 (VU)	
Hydnellum mirabile	?EX					
Hydnellum compactum				2 (EN)		
Hydnellum spongiosipes	CR			3 (VU)		
Hydnellum ferrugineum	NT+LC		E (EN)	2 (EN)		
Hydnellum tardum	CR					
Hydnellum scrobiculatum	VU		Ex (EX)	3 (VU)		
Hydnellum concrescens	NT+LC	EN	E (EN)	3 (VU)	3 (VU)	
Hydnellum cumulatum	?EX					
Hydnellum geogenium	CR	EN	E (EN)	1 (CR)		
Sarcodon imbricatus	NT+LC		V (VU)	3 (VU)	3 (VU)	EN
Sarcodon squamosus **	VU					
Sarcodon leucopus	CR			1 (CR)		
Sarcodon versipellis	?EX			2 (EN)	3 (VU)	
Sarcodon scabrosus	EN			2 (EN)	0 (EX)	EN
Sarcodon glaucopus	EN	DD	Ex (EX)	1 (CR)	3 (VU)	
Sarcodon fennicus	CR					
Sarcodon regalis						
Sarcodon lepidus				R (NT)		
Sarcodon lundellii						
Sarcodon martioflavus				1 (CR)		
Sarcodon joeides				2 (EN)	4 (NT)	
Sarcodon fuligineo-violaceus		LR: LC		1 (CR)		EN
Boletopsis leucomelaena	CR	DD	E (EN)	2 (EN)	3 (VU)	
Boletopsis grisea ***	VU	VU				

Other categories in particular countries:
– Czech Republic: ?EX= probably extinct (extinction is not 100% certain in macromycetes)
– Slovakia: LR = low risk (NT and LC fused in one category)

– Poland: Ex, E and V are compatible with EX, EN and VU
– Germany: 1 = critically endangered, 2 = strongly endangered, 3 = endangered, R = rare (possibly compatible with CR, EN, VU and NT)
– Austria: 0 = extinct or missing, 1 = endangered by extinction, 2 = strongly endangered, 3 = endangered, R = potentially endangered, very rare (possibly compatible with EX, CR, EN, VU and NT)
– Hungary: EN = species endangered by extinction, vulnerable and rare species (fused category)

Notes:
* *Hydnellum aurantiacum* cited in the list, it probably means *H. floriforme* or confused species.
** *Sarcodon squamosus* was not distinguished until 1999 – in all lists except the Czech one it has been confused with *S. imbricatus*.
*** *Boletopsis grisea* (as *B. subsquamosa* in the Slovak list) has not been usually distinguished from *B. leucomelaena* especially in Austria and Germany.

Austria has a similar number of listed species, but there the occurrence of many species is really higher (this is possibly the reason why they are not included in the Red Data List; also most of the species in Austria are listed in the low category „3“). The Austrian list should be completed with the extremely rare *Hydnellum mirabile*, *H. spongiosipes*, *H. compactum*, *Phellodon confluens*, *Sarcodon fennicus*, *S. leucopus*, *S. versipellis* and the newly discovered *Sarcodon lundellii* and *Hydnellum tardum*, whereas *Sarcodon scabrosus* is certainly not extinct from Austria (current finds after 2000).

The Slovak and Hungarian lists are rather incomplete as for *Bankeraceae* and many lacking species can be considered to be threatened (at various levels) in these countries. Except this, category „LR“ in Slovakia appears to be underestimated for the very rare *Phellodon confluens* and especially for *Sarcodon fuligineo-violaceus*, recorded in Slovakia after 135 years (the occurrence of this species in Hungary has not been confirmed in this study).

CONCLUSION

In two parts, the occurrence and distribution of 36 species of the family *Bankeraceae* in Central Europe is presented. Based on the total sums in Tab. 2, a simple conclusion might be that the occurrence of the whole group in the entire area is almost constant (with an inconspicuous peak in the period 1961–75). The result is that local fluctuations are overall almost completely equalised.

In my opinion, such simple conclusion would not be correct. Mycological activity appeared to be higher in the second half of the 20th century (which can be supported with the discovery of several new species in the Central European area during this period). In the sums, the decline of some hydnaceous fungi in the lowlands during the last decades is compensated by increasing mycological activity in mountainous regions (where the occurrence of most of the species appears to be almost constant). Changes in mycological activity in particular regions must be respected (see the above mentioned „booms" in the investigation of hydnaceous fungi in Czechia and Germany) and therefore partial conclusions – as commented in Historical overview – have a higher value than a too general conclusion.

Some species, especially those associated with certain habitats, show a different pattern. In various forest types, altitudes, etc. (typical of each species) changes in occurrence are well visible and it is possible to compare the changes of various species occurring in the same or similar habitats. As is visible from Tab. 4, really endangered species are *Hydnellum suaveolens* and *Hydnellum caeruleum*, which show a strong decline in almost the whole of Central Europe, especially in the lowlands, but also in mountainous regions. Other species which show a great decline are *Hydnellum geogenium* and *Sarcodon versipellis*, recently absent in non-mountainous regions but very rare also in the mountains – it seems that strictly mountainous species are strongly limited by their altitudinal optimum. Also some other *Sarcodon* species have become very rare – *S. leucopus*, *S. fennicus* and especially *S. fuligineo-violaceus*, which was recently recorded in Central Europe for the first time since the end of the 1970s.

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Notes on some European species of the genus *Crepidotus* (*Agaricales*)

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Pouzar Z. (2005): Notes on some European species of the genus *Crepidotus* (*Agaricales*). – Czech Mycol. 57(3–4): 299–305.

Some European species of the genus *Crepidotus* were revised with regard to their taxonomical value. *Crepidotus applanatus* var. *subglobiger* sensu Senn-Irlet is described as the new species *C. stenocystis* Pouzar, *C. acerinus* Vacek is included in *C. mollis* (Schaeff.: Fr.) Staude, *Agaricus zahlbruckneri* Beck is confirmed as a synonym of *C. cesatii* (Rabenh.) Sacc., *C. caspari* Velen. is merged with *C. lundellii* Pilát (a younger synonym) and *C. lundellii* var. *subglobisporus* (Pilát) Pilát is hence combined as *C. caspari* var. *subglobisporus* (Pilát) Pouzar. *C. sambuci* Velen. is considered a dubious name.

Key words: *Agaricales*, *Crepidotus*, taxonomy, nomenclature

Pouzar Z. (2005): Poznámky k některým evropským druhům rodu *Crepidotus* (*Agaricales*). – Czech Mycol. 57(3–4): 299–305.

Některé evropské druhy rodu *Crepidotus* byly revidovány z taxonomického a nomenklatorického pohledu. *C. applanatus* var. *subglobiger* sensu Senn-Irlet je popisován jako nový druh *C. stenocystis* Pouzar, *C. acerinus* Vacek je ztotožněn s *C. mollis* (Schaeff.: Fr.) Staude, *Agaricus zahlbruckneri* Beck je potvrzen jako synonymum druhu *C. cesatii* (Rabenh.) Sacc., *C. caspari* Velen. je ztotožněn s *C. lundellii* Pilát (mladší synonymum) a pro *C. lundellii* var. *subglobisporus* (Pilát) Pilát je navržena kombinace *C. caspari* var. *subglobisporus* (Pilát) Pouzar. *C. sambuci* Velen. je pokládán za pochybný druh.

INTRODUCTION

During the preparation of a key to the identification of the species of the genus *Crepidotus* (Fr.) Staude of the Czech Republic (Pouzar 2005) some taxonomic problems appeared and a solution was proposed. A part of these results is published here. The collection of the Mycological Department of the National Museum in Prague (PRM) and partly also the collection of the Department of Botany of Charles University in Prague (PRC) was the main source of the material, together with a new collecting made in autumn 2004 in Prague. Particularly useful was the material collected in the Šumava Mountains and perfectly dried by J. Holec (preserved in PRM).

MATERIAL AND METHODS

The spore ornamentation is described from material mounted in Melzer's reagent. Herbarium specimens are those of the Mycological Department of the National Museum in Prague (PRM) and the Department of Botany of Charles University in Prague (PRC).

RESULTS AND DISCUSSION

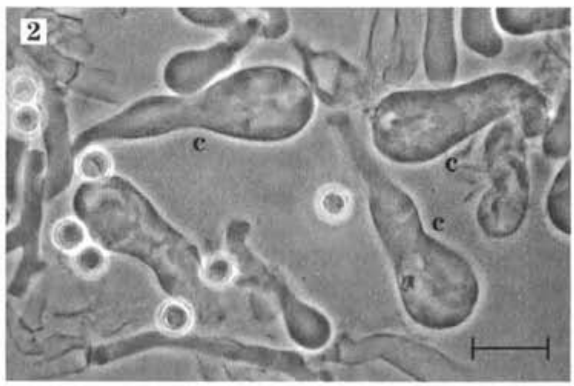
Crepidotus stenocystis Pouzar spec. nov. Figs. 4–7

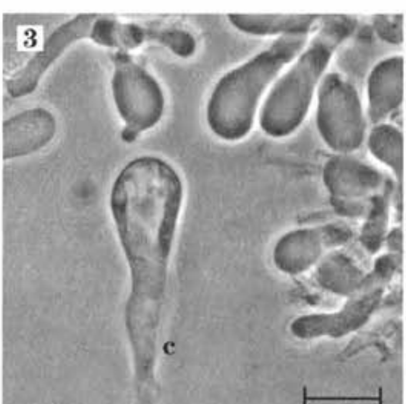
Diagnosis latina: Carposomata in inventute cum stipite brevi, laterali, maturitate pileus (0,5–)1–3 cm latus cum margine primo involuto, consinstentia carposomatum molliter subceracea; superficies pilei hygrophana, alba vel griseo-alba usque lutea vel ochraceo-lutea, glabra vel leviter pubescens. Lamellae sparsae, usque 3 mm latae, primo albidae, postea griseo-brunneae, nonnumquam tinctu roseolo. Sporae (5–)6–7,5(–8) µm, globosae, ad apiculum abrupte contractae, luteo-umbrinae. Basidia 22–35 × 8–10 µm, basim 3–4 µm lata, breviter clavata, cum sterigmatibus quatuoribus 6,5 × 2 µm. Cheilocystidia 35–78 µm longa, in parte distante 6–8 µm lata et in parte inferiore 8–12,5 µm lata, lageniformia seu cylindrica ex parte majore haud clavata (prorsus singulariter clavata), tenuiter tunicata, hyalina, glabra. Pleurocystidia absunt. Pileocystidia (25–)35–70 µm longa, 5–7 µm (raro 9,5–11 µm) lata in parte distale, 5–11 µm lata in parte inferiore, prorsus singulariter clavata, hyalina, raro cum tinctu leviter brunneolo, pariete haud incressata. Omnes hyphae fibulatae.

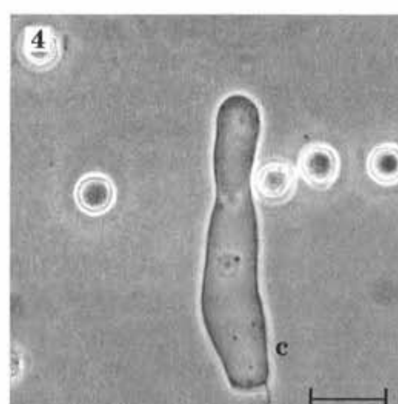
Holotypus: Bohemia, montes Šumava, ap. ostio rivuli Slatinný potok prope Modrava, ad truncum iacentem: *Picea abies*, 1. X. 1994, leg. Z. Pouzar, in herbario Musei Nationalis Pragae asservatur (PRM 902018).

Detailed description in English: see Senn-Irlet (1995), p. 41 (as *C. applanatus* var. *subglobiger* Singer).

Specimens studied (all from Bohemia: western part of the Czech Republic): montes Šumava, mons „Smrčina" prope Nová Pec, in colle situ sept.-or., silva mixta, 1130 m s. m., *Abies alba*: ad truncum iacentem, 25. IX. 1997, leg. J. Holec, PRM 891358. – Šumava, Plechý, prope Nová Pec, 0,5 km sept.-occid. ab culmine, 1330 m s. m., *Picetum*, ad truncum putridum *Piceae abietis*, 26. VIII. 1996, leg. J. Holec, PRM 889104. – Šumava, Žlebský kopec, mer.-occid. versus České Žleby, 1000 m s. m., silva mixta, *Abies alba*: ad truncum putridum, 13. IX. 1999, leg. J. Holec, PRM 898008. – Šumava, ap. ostio Slatinný potok prope Modrava, ad truncum iacentem *Piceae abietis*, cca 1000 m s. m., 1. X. 1994, leg. Z. Pouzar, PRM 902018, holotypus. – Šumava, Povydří, inter Horní Hrádky et Rokyta, 1,3 km sept.-occid. versus Antýgl, *Picea abies*, ad truncum iacentem 17. IX. 1998, leg. J. Holec, PRM 897232. – Šumava, in valle rivi Vydra inter Čeňkova Pila et Rejštejn, in codice: *Picea abies*, 5. IX. 1970, leg. M. Svrček (1945/70), PRM 716226. – Český les, area tuta „Bystřice" ap. Pec pr. Domažlice, cca 730 m s. m., *Picea abies*: ad codicem, 27. IX. 1989, leg. Z. Pouzar, PRM 869600. – Brdy, prope domum „Amerika" ap. Strašice, *Abies alba*: in codice, 23. IX. 1925, leg. K. Kavina, PRM 665171.



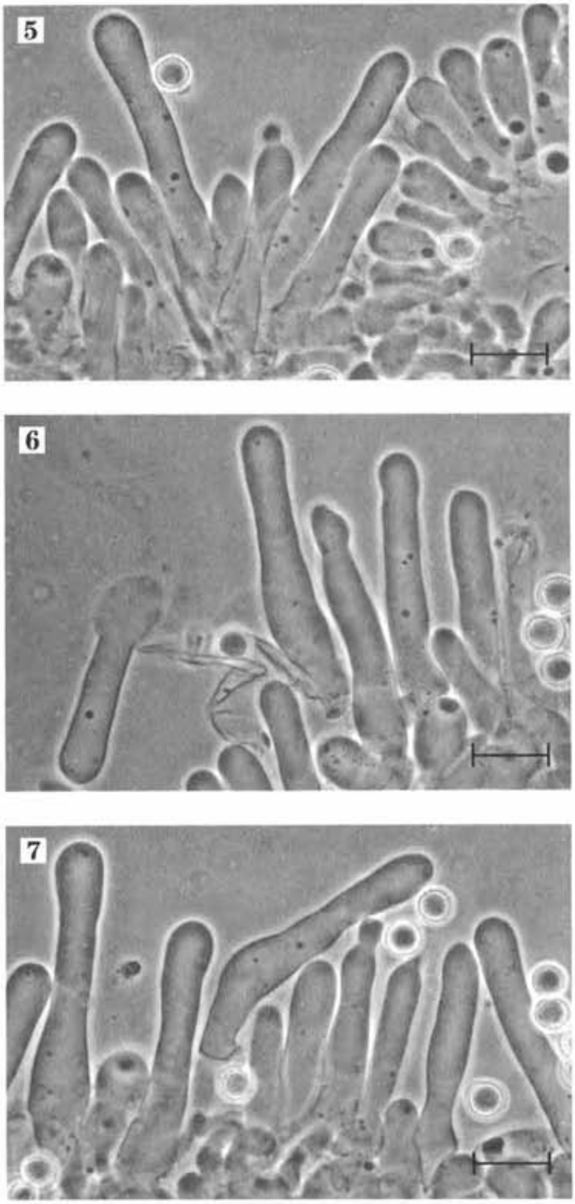




Figs. 1–3. *Crepidotus applanatus*, cheilocystidia (Bohemia, Šumava, Ždanidla, *Fagus sylvatica*, 9. VII. 1998, leg. J. Holec, PRM 896977).

Fig. 4. *Crepidotus stenocystis*, cheilocystidium (Bohemia, Šumava, inter Horní Hrádky et Rokyta, *Picea abies*, 17. IX. 1998, leg. J. Holec, PRM 897232).

c: cheilocystidia. Scale bars = 10 µm. Photographed by Jan Holec.



Figs. 5–7. *Crepidotus stenocystis*, cheilocystidia (Bohemia, Šumava, inter Horní Hrádky et Rokyta, *Picea abies*, 17. IX. 1998, leg. J. Holec, PRM 897232).

Scale bars = 10 µm. Photographed by Jan Holec.

Notes: *Crepidotus stenocystis* is closely related to *Crepidotus applanatus* (Pers.) P. Kumm., but differs not only in anatomical characters, but also ecologically. The principal difference is in the shape of the cheilocystidia, which are mostly attenuated in their upper half (Figs. 4–7), whereas in *C. applanatus* most of them are broadened towards the end (Figs. 1–3), here being mostly capitate. The same relates to the cystidia present in some parts of the pileus cuticle. *C. stenocystis* occurs solely on wood of *Picea* and *Abies* in the Czech Republic (in other countries also on *Pinus*), especially on prostrate trunks and on stumps. It is so far known in the Czech Republic only from the mountains and has not been collected at lower altitudes. Nevertheless it is known in the Netherlands from a low altitude and it is probable that its occurrence is rather dependent on humid climatic conditions. This fungus is well described with a delineation of its microscopic structures by Senn-Irlet (1995) on p. 39 and 41, where it is named *C. applanatus* var. *subglobiger* Singer. This name, however, cannot be applied to our fungus. In the original description (Singer 1973) its cheilocystidia are characterised as „clavate ventricose and with a slight constriction between the upper and lower ventricosity...“, whereas in our fungus they are narrower in their upper part and broadened in their basal part. Moreover, *C. applanatus* var. *subglobiger* was described according to material from Mexico where it was collected on wood of oak. Therefore it can be concluded that our European fungus is different from the Mexican one. As our material from Bohemian mountains displayed a fairly high level of stability in the character of the cystidia, it appears that it represents rather a separate species than a mere variety.

Crepidotus acerinus Vacek, Studia Bot. Čechoslovaca 10: 132, 1949.

Holotype: Bohemia, Karlštejn, ad truncum (*Acer pseudoplatanus*) inter muscos, 30. VI. 1945, leg. V. Vacek, PRM 149001.

The type specimen of *Crepidotus acerinus* Vacek agrees microscopically well with *Crepidotus mollis* (Schaeff: Fr.) Staude. Spores are entirely smooth, clamps on hyphal septa absent and a gelatinous layer is present. Carpophores are smaller than usual, but such a form rarely occurs in Central Bohemia. *C. acerinus* is certainly not *C. calolepis* (Fr.) P. Karst., as the surface of the pileus lacks brownish scales. Hence *C. acerinus* is a synonym of *C. mollis*.

Agaricus zahlbruckneri Beck, Verh. Zool.-Bot. Gesellsch. Wien 39: 613, 1889.

Holotype: Austria, NÖ, Sonntagsberg, IX. 1888, leg. A. Zahlbruckner (herb. Beck 964), PRM 197705 (depon. ut *Claudopus zahlbruckneri*).

The holotype is quite a typical *Crepidotus cesatii* (Rabenh.) Sacc. Especially important is the form of the spores, which are mostly subglobose (up to 7.2 µm wide). The identity of this fungus was already indicated by Pilát (1948a, 1948b).

Crepidotus caspari Velenovský, Mykologia, Praha, 3: 70, 1926.

Holotype: Praha, Petřín, ad terram in horto publico, XI. 1925, leg. Antonín Kašpar*), PRM 149109.

The type specimen represents an average form of *Crepidotus lundellii* Pilát 1935, a fungus which is rather common in Prague and its close vicinity. The cheilocystidia of the type specimen are broadly lageniform, clamps on the hyphal septa are richly present and the spores are 8–9 × 5–6 µm, ellipsoidal or amygdaliform in side view, irregularly and faintly rugulose.

The name *Crepidotus caspari* Velen. should be used as the correct name for *C. lundellii* Pilát, as this is the oldest name for this rather common fungus. *C. caspari* is not related to *C. autochthonus* J. E. Lange, as has been supposed so far (Pilát 1948a, 1948b). *C. autochthonus* is characterised by an entirely glabrous spore-wall.

Crepidotus caspari var. ***subglobisporus*** (Pilát) Pouzar comb. nov.

Basionym: *Crepidotus versutus* var. *subglobisporus* Pilát, Sborník Nár. Musea v Praze, vol. 2 B, no. 3: 74, 1940.

Syn.: *Crepidotus lundellii* var. *subglobisporus* (Pilát) Pilát, Atlas champ. Europe 6: 50, 1948.

This is a rare fungus described originally from Ukraine (Transcarpathian region) known now also from Slovakia (Dobroč virgin forest, PRM 583548). Spores of this variety are distinctly shorter (in the original diagnosis 6–7.5 × 4.5 µm) than in the typical *Crepidotus caspari* – hence shortly ellipsoidal. *Crepidotus versutus* (Peck) Sacc., under which Pilát originally placed his var. *subglobisporus*, is a completely different species, characteristic i.e. by the absence of clamps.

Crepidotus sambuci Velenovský, České houby 4–5: 919, 1922.

Holotype: Bohemia, Slivenec, X. 1921, leg. J. Velenovský, PRC (bottle no. 117).

The type is preserved in conservation liquid (alcohol + formaldehyde) and a study of the anatomy of the carpophores is rather difficult, as all their parts are hard due to the influence of the preservation liquid. The spores are completely glabrous, without any ornamentation, which is rather surprising; it cannot be excluded that the ornamentation has been destroyed by the liquid. For the time being *Crepidotus sambuci* should be considered an unidentifiable species due to the bad state of the holotype. Interpretations of *C. sambuci* in literature were commented by Senn-Irlet (1995, p. 59, 73).

* The epithet "*caspari*" is derived from the latinised form of the personal name Kašpar (= Casparus). The name was dedicated by J. Velenovský to Antonín Kašpar (1864–1940), a school principal in Prague, who contributed some collections to Velenovský's study of fungi (Cejp, Věda Přírodní 20: 95, 1940).

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CZECH MYCOL. 57(3–4): 307–323, 2005

Colloquium „Fungi as Model Organisms in Research and Biotechnology – III" Olomouc, Czech Republic, 2 September 2005

The colloquium was a continuation of the previous scientific meetings that took place in Olomouc in 1999 and 2002 (Czech Mycology 52: 139–178, 2000 and 55: 103–149, 2003). It was organised by the Commission for Experimental Mycology of the Czechoslovak Microbiological Society and the Czech Scientific Society for Mycology together with the Institute of Biology, Faculty of Medicine of Palacký University, Olomouc. The aim of the colloquium was to provide a platform for a broad discussion on experimental mycology in all branches of basic and applied research. Besides two plenary lectures, 8 short communications and 8 posters were presented. In total 32 researchers from the Czech and Slovak Republics took part in the colloquium and discussed various topics important for the further development of experimental mycology. Abstracts of the contributions are given below.

Jiří Kunert and Vladislav Raclavský

Occurrence of *Fusarium* in food and feed

Plísně rodu *Fusarium* v potravinách a krmivech

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Two PCR methods were evaluated for the successful identification of *Fusarium* species. The PCR was performed using a primer specifically targeted to Tri5 gene. The DNA extraction technique by Cenis (1992) and the PCR procedure according to Edwards et al. (2001) were compared with the DNA isolation and amplification using the Plant PCR Kit. The sensitivity of the latter method was determined using the reference strain of *Fusarium graminearum* CCM F–683 and the selectivity was examined using reference cultures of different genera of fungi naturally occurring in food and feed. Fifty food and feed samples were examined for the presence of trichothecenes-producing *Fusarium* species. In total, seven *Fusarium* species were isolated, five of which reacted positively with the primer, resulting in an expected size amplicon of 260 pb. Macroscopic and microscopic features of pure cultures of *Fusarium* and of other isolated fungi were observed during growth in different laboratory media. Morphological features are important for species identification whereas the PCR can distinguish between toxigenic and non-toxigenic species of *Fusarium*. These fungi could be detected within 2 days, while their identification using macroscopic and microscopic features takes 2–3 weeks. Thus the PCR technique proved to be a reliable and rapid method for the detection of toxigenic *Fusarium* species.

This work was supported by GA ČR Grant no. 203/05/2106 and the Ministry of Education, Youth and Sports of the Czech Republic, project no. 0021627502.

Identification of *Aspergillus niger* isolates (with the PCR method) and their catalase production as a response to pollutant stress by metals

Identifikácia izolátov *Aspergillus niger* (pomocou PCR metódy) a ich katalázová aktivita ako odpoveď na stres prostredia znečisteného kovmi

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For this particular study, four isolates of *Aspergillus niger* were used. *A. niger* strain 1 was taken from a collection and was used as a reference. *A. niger* strain 2 was isolated from coal dust near a mine (As 400 mg/kg). *A. niger* strain 3 was an isolate from river sediments near the same mine (As 1651 mg/kg, Sb 362 mg/kg) and *A. niger* strain 4 was adapted on Sabouraud medium supplemented with As^{5+} (5 mg/l).

Morphological and biochemical identification was confirmed by the PCR method. PCR uses small differences in chromosomal DNA for 5.8S rRNA (coding sequence and two intergenic spacers ITS1 and ITS2) of two strains of *A. niger* and *A. tubingensis*, major species in the *A. niger* aggregate. PCR showed that all cultures belonged to the same species *Aspergillus niger*. For a negative check, *Aspergillus niger* var. *tubingensis* (Mosseray) Kozakiewicz CCF 2818 was used.

The isolates of *Aspergillus niger* isolated from coal dust of a mine containing arsenic and from river sediments of mine surroundings growing in a minimal nitrate medium and developing hyphae and spores, exhibited much higher levels of total catalase activity than the strain of the same species from the culture collection and the culture adapted to medium supplemented with As. Electrophoretic separation of catalases from cell-free extracts revealed three isozymes of catalases. Production of individual isozymes was not significantly affected by stress environments. Exogenously added stressors (As^{5+}, Cd^{2+}, Cu^{2+}) at final concentrations of 25 and 50 mg/l and H_2O_2 (20 or 40 mM) mostly stimulated production of catalases only in isolates from mine surroundings. H_2O_2 and Hg^{2+} caused the disappearance of catalases with the smallest molecular weight. Isolates from the mine environment exhibited a higher tolerance to toxic effects of heavy metals and H_2O_2 (monitored by growth) than the strain from the culture collection did.

The study was supported by grant VEGA no. 2/5069/25 and APVT project 51–024804.

Control strains of filamentous fungi and yeasts in the Czech collection of microorganisms

Kontrolní kmeny vláknitých hub a kvasinek v České sbírce mikroorganismů

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The Czech Collection of Microorganisms (CCM) is a non-profit organisation established in 1963. At present, the CCM holds well over 3,000 strains of more than 810 species of bacteria and about 700 strains of more than 500 species of fungi in pure cultures, covering a very wide range of applications. The CCM provides specialised collections of 144 quality control strains for microbiological laboratories. These control strains are especially intended for diagnostic laboratories in human and veterinary microbiology as well as microbiological laboratories of quality control of food and water. The control strains of filamentous fungi belong to the hyphomycetes and yeast cultures to the saccharomycetes. The quality control strains are supplied freeze-dried in sealed glass ampoules and in the form of gelatin discs. Actual information about cultures is available on our web site (http:/www.sci.muni.cz/ccm/).

List of control strains of filamentous fungi and yeasts:

CCM	Strains	Applications
8186	*Candida albicans*	media, sterility and disinfectants testing
8189	*Aspergillus niger*	media, fungus resistance and wood preservation testing
8191	*Saccharomyces cerevisiae*	media testing, assay of antibiotics
8215	*Candida albicans*	media, sterility and antimicrobial preservative testing
8222	*Aspergillus niger*	media, antimicrobial preservative testing
8223	*Candida tropicalis*	media testing, assay of antibiotics
8224	*Zygosaccharomyces rouxii*	antimicrobial preservative testing

CCM	Strains	Applications
8226	*Candida albicans*	media, sterility and fungicides testing
8260	*Candida parapsilosis* (ATCC 22019)	antifungal susceptibility testing
8261	*Candida albicans* (ATCC 90028)	antifungal susceptibility testing
8359	*Penicillium hirsutum*	media testing
8363	*Aspergillus flavus*	media testing
F–108	*Aspergillus parasiticus*	media testing
F–550	*Aspergillus parasiticus* var. *globosus*	media testing

Heavy metal contents in fruit bodies of wood-rotting fungi collected in the Kłódzko region, Poland

Obsahy těžkých kovů v plodnicích dřevokazných hub z oblasti Kłódzka (Polsko)

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Fruit bodies of *Fomes fomentarius*, *Fomitopsis pinicola*, *Stereum sanguinolentum*, *Gloeophyllum sepiarium* and *Osmoporus odoratus* were collected in June 2005 in an area delimited by Międzylesie, Międzigórze, Králický Sněžník and Klecienko. A total amount of 28 samples was collected. Dried fruit bodies were mineralised in a microwave digestion unit (nitric acid / hydrogen peroxide 5:1) and contents of Cd, Cu, Mn, Pb and Zn was determined with atomic absorption spectrometry. Average contents in all samples were 14.04 ± 12.02 ppm Cu, 2.17 ± 1.11 ppm Cd, 93.49 ± 136.82 ppm Mn, 6.00 ± 2.69 ppm Pb and 73.85 ± 50.01 ppm Zn. The samples were then divided into four groups, corresponding to the collection regions. The highest Cu and Cd contents was found in the area of Jodlów, while Mn, Zn and Pb content reached maximum in samples from Králický Sněžník. Average metal contents in the samples of *Fomes fomentarius* were 14.67 ± 8.20 ppm Cu, 2.31 ± 1.03 ppm Cd, 89.45 ± 176.76 ppm Mn, 5.45 ± 2.45 ppm Pb and 60.50 ± 59.48 ppm Zn. The results for *Fomitopsis pinicola* were 7.07 ± 2.09 ppm Cu, 2.20 ± 1.22 ppm Cd, 54.50 ± 65.90 ppm Mn, 7.63 ± 2.02 ppm Pb and 82.23 ± 33.47 ppm Zn. Cadmium and lead contents in samples collected in Poland were higher than those in samples collected in the nearby Jeseníky Mts. in the Czech Republic in 1995.

The use of fungi in folk and official medicine

Využití hub v lidové i oficiální medicíně

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This introductory lecture described the use of fungal fruit bodies in folk and official medicine. At first, attention was paid to hallucinogenic properties. Differences in the use of fungal species in Europe, Northern Asia (*Amanita* sp.) and Central America (*Psilocybe* sp., *Panaeolus* sp.) were mentioned. Toxic properties of fungi, especially *Amanita phalloides* were discussed and examples of well-known intoxications (Euripides, Tiberius Claudius, pope Clemens VII etc.) were given. Then a short survey was given of fungal species used in folk medicine. Among others, *Laricifomes officinalis*, *Fomes fomentarius*, *Phallus impudicus*, *Elaphomyces granulatus*, *Calvatia utriformis*, *Langermannia gigantea* and *Inonotus obliquus* were discussed. Attention was also paid to fungal species used in folk medicine in Asia (e.g. *Ganoderma lucidum*, *Trametes versicolor*, *Hirneola auricula-judae*, *Lentinus edodes*). Examples of fungal preparations used in homeopathy (*Russula emetica*, *Boletus satanas*, *Amanita muscaria*) were given and then examples of fungal metabolites with antibacterial, antifungal, virostatic and immunomodulatory effects were given. *Oudemansiella mucida*, the fungus from which mucidin (the only antibiotic used in human medicine, discovered in the former Czechoslovakia) was isolated, was also discussed.

Testing of the virulence of *Cryphonectria parasitica*

Testovanie virulencie huby *Cryphonectria parasitica*

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Cryphonectria parasitica, chestnut blight fungus, occurs in nature in two forms: virulent and hypovirulent. These strains have different physiological and morphological properties (Grente 1965). Hypovirulent isolates are discoloured (paler orange mycelia in cultures), practically without reproduction organs (lowered sporulation), and with significantly lesser virulence to *Castanea sativa*, compared to the virulent isolates. The trees respond to the hypovirulent strains by promoting callus formation and healing of the cankers. Abnormal cankers from which the hypovirulent strains of the fungus are isolated consist of exposed sapwood bordered by a vigorous callus, with superficial infections radiating from the margins of the openings (Elliston 1985). Cytoplasmic hypovirulent strains consistently contain dsRNA (Anagnostakis and Day 1979). The final effect of the hypovirulent agent (dsRNA hypovirus) is a reduction of mortality of infected trees. Chestnut blight has recently been controlled by means of a biological method based on the use of these hypovirulent strains of *Cryphonectria parasitica*.

No hypovirulent isolates were detected in Slovakia. Slovak virulent isolates were transformed into hypovirulent forms with French hypovirulent isolates and were used for biological control of chestnut blight in Slovakia. In 2004, 53 isolates with morphological properties of hypovirulent strains were obtained from naturally healing cankers. Presence of dsRNA using a molecular method was confirmed in eight of them. This means that the hypovirus spread to normal cankers in a natural way, and an important success in chestnut protection against chestnut blight has been achieved.

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Endophytic fungi on European Horse-chestnut

Endofytické huby na pagaštane konskom

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Endophytic fungi are a group of fungi which live asymptomatically inside plant tissues. The endophytic fungi *Phyllosticta sphaeropsoidea* Ellis et Everh., *Asteromella* *aesculicola* (Sacc.) Petr., *Phomopsis carposchiza* Fairm., its teleomorph *Diaporthe padi* Otth, *Alternaria alternata* (Fr.) Keissl., *Colletotrichum gloeosporioides* Penz., *Epicoccum nigrum* Link ex Wallr., *Botrytis cinerea* Pers. and *Chaetomium* sp. were isolated from symptomatic and healthy-looking leaves, flowers and seeds of European Horse-chestnut. In the study of leaf-inhabiting endophytes, coelomycetes form a dominant group. The three most frequent species were *Phyllosticta sphaeropsoidea*, *Phomopsis carposchiza* and *Colletotrichum gloeosporioides*. In general, coelomycetous anamorphs are widespread colonisers of plant tissues, in which they can be present either as pathogens or endophytes (Sutton 1980, Petrini 1986). According to Espinosa-Garcia and Langenheim (1990) leaf endophytes are ubiquitous and their distribution patterns within and among plants, as well as the possible consequences of their presence, reinforce the idea that not only single endophyte species but whole endophytic communities may be very important for the plants that harbour them.

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Effect of light and temperature on tomato powdery mildew (*Oidium neolycopersici*)

Vliv světla a teploty na padlí rajčat (*Oidium neolycopersici*)

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Tomato powdery mildew (*Oidium neolycopersici*) affects the leaves and stems of tomatoes where the white superficial mycelium causes characteristic powdery mildew symptoms. The purpose of the present research was to determine the effect of temperature and light (spectrum, intensity and photoperiod) on germination, development and sporulation of this pathogen. Considering the temperature, development and intensive sporulation occurred within the range

15–25 °C and was the most intensive between 20 and 25 °C. At temperatures slightly below the optimum, mycelial development and appearance of the first conidiophores was delayed. The temperature range for conidia germination was wider than that for mycelium development and sporulation. Some conidia germinated at each of tested temperatures – 10, 15, 20, 25, 30, 35 °C, however at marginal temperatures (10 °C and 35 °C, resp.) the germination was strongly limited. Light influenced the pathogen development also markedly; a maximum sporulation and mycelium development was recorded at light intensities between 60–100 $\mu mol \cdot m^{-2} \cdot s^{-1}$. At lower light intensity the pathogen development was delayed, and finally in the dark the sporulation was completely restricted. The results of the effect of light wavelength on *O. neolycopersici* were more controversial. The pathogen development was more rapid under red, blue and green plastic foil than under white light. The slightly delaying effect of white light compared with colour foils can be caused either by the effect of selected wavelengths on the pathogen or by reduced light intensity under the colour foils, because shading appeared to be more suitable for powdery mildews than direct light. The obtained information about the effect of environmental conditions on *O. neolycopersici* can help improve the strategy of plant protection and can also contribute to general knowledge on the biology and ecology of powdery mildews.

This research was supported by grant MSM 6198959215.

Ascomycetes as causal agens of economically important crop diseases

Vreckaté huby ako pôvodcovia ochorení ekonomicky zaujímavých plodín

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The leaves, ears and seeds of cereals, including wheat, are liable to be attacked by different organisms during harvest and storage. About 72 % of organisms which attack the wheat seeds and leaves are microscopic fungi. Diseases of winter wheat (leaf spot, head blight, take-all) are frequent and economically important in Slovakia. They are caused by different species of ascomycetes. The aim of this study was to investigate the occurrence and distribution of these fungi on winter wheat fields. These fungi caused necrotic lesions on leaves, stems and ears during plant development and many of them were seed-borne. Most of these fungi were found also as fungi sporulating on glumes of ears.

In 2005, the major components of the leaf spot disease complex were two fungi: *Pyrenophora tritici-repentis*, the cause of tan spot, and *Leptosphaeria* *nodorum*, the cause of *Septoria nodorum* blotch. Two minor components were *Cochliobolus sativus*, the cause of spot blotch, and another *Septoria* disease caused by *Septoria avenae* f. sp. *triticea*. All three species of the genus *Septoria* were found on wheat leaves, but only *S. nodorum* (teleomorph stage *Leptosphaeria nodorum*) and *S. avenae* (*L. avenae*) occurred frequently also on ears of winter wheat. The species *S. tritici* (teleomorph *Mycosphaerella graminicola*) was found on ears and leaves of wheat.

The species of the genus *Fusarium* belong to the most frequent species of parasitic mycoflora. *F. graminearum* (teleomorph stage *Gibberella zeae*) was isolated as the dominant species. The perithecia were often found on stalks and ears glumes of wheat at the end of the season.

On wheat debris we also found *Gaeumannomyces graminis* var. *tritici* as the fungus causing take-all of wheat, and further *Cochliobolus sativus*.

All ascomycetous stages of the mentioned fungi persist and spread from infested wheat residues to wheat and weed grasses in the following years.

This work was supported by the Science and Technology Assistance Agency under contract no. APVT–27–009904.

Spread of introduced powdery mildew species on ornamental woody plants and their partial control by the hyperparasite *Ampelomyces quisqualis*

Šírenie introdukovaných druhov múčnatiek na okrasných drevinách a ich čiastočná bioregulácia hyperparazitom *Ampelomyces quisqualis*

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Powdery mildew infections remain among the most important plant pathological problems world-wide, despite extensive research on their pathogenesis, epidemiology and control. An epidemic spread of the North American powdery mildew *Erysiphe flexuosa* on *Aesculus* spp. in Europe has been observed since 1999. *Erysiphe elevata* is a powdery mildew common on *Catalpa bignonioides* and *C. speciosa* in North America and was recently introduced in Europe. We have recorded massive occurrence of this powdery mildew diseases in Slovakia since 2003. The spread of both powdery mildew species in other European countries has also been recorded. *E. flexuosa* and *E. elevata* have adapted to ecological conditions of Central Europe. The hyperparasite *Ampelomyces quisqualis* was also observed. A total of 35 samples of *E. flexuosa*-infected Horse-chestnut leaves and 222 samples of *Erysiphe elevata*-infected *Catalpa* leaves were examined in 2004. Abundant pycnidia of *A. quisqualis* were found. The incidence of *Ampelomyces* in *Erysiphe flexuosa* was 41 %. Very obvious mycoparasitism was found in *Erysiphe elevata*. The incidence of *Ampelomyces quisqualis* in *Erysiphe elevata* ranged from 20 to 100 %. Pycnidia of *Ampelomyces* were found in approximately 79 % of samples. This parasite reduces growth and may eventually kill the powdery mildew colony. According to Kiss et al. (2004) the effect of *Ampelomyces* in the control of powdery mildew infections is weak, however, it is still important because it suppresses the sporulation rate of its fungal hosts, and the infected plants recover after *Ampelomyces* has killed the pathogens. No *Ampelomyces* product is registered in Slovakia. Application of the hyperparasite *A. quisqualis* may in the future become an alternative to the use of fungicides for the control of powdery mildews in our country.

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Molecular-genetic approaches to the identification of pathogenic fungi

Molekulárně-genetické přístupy k detekci a identifikaci houbových patogenů

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Generally, identification of pathogenic fungi can rely on the examination of either phenotype or genotype characteristics. Although significant progress has recently been made in standardisation of phenotyping systems, ultimate identification can be complex and time-consuming in some species. Therefore, a vast array of genotyping methods has been developed to provide rapid and accurate species identification. Many of these techniques are based on PCR-amplification of fungal DNA and enable not only accurate identification of isolates, but in many cases also rapid and sensitive direct detection of fungal DNA in clinical samples. We summarise the most promising approaches to the detection and identification of pathogenic fungi by molecular-genetic techniques including nested PCR, PCR combined with species-specific probes (ELISA or real-time qPCR), PCR followed by other special techniques (capillary electrophoresis for accurate length examination, SSCP, or sequencing) and PCR-fingerprinting. We also present our experience with different nested multiplex PCR-techniques and elucidate the potential of the McRAPD approach newly developed by our group. In our opinion, high-resolution melting analysis of amplified duplex DNA represents the most promising post-PCR technique suitable for rapid and accurate identification of pathogenic fungi. To conclude, molecular-genetic approaches to the identification of pathogenic fungi represent a promising field of applied science. Although it has not yielded any gold standard technique yet, it is already firmly established in the diagnostics of human diseases caused by pathogenic yeasts.

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Fungicide resistance in cucurbit powdery mildew populations on the territory of the Czech Republic

Resistence k fungicidům v populaci padlí tykvovitých na území České republiky

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A survey was conducted on possible fungicide resistance or tolerance of cucurbit powdery mildews, *Golovinomyces cichoracearum* (*Gc*) and *Podosphaera xanthii* (*Px*), using 85 (62 *Gc*, 23 *Px*) Czech isolates dating from the years 2000–2003. The effectiveness of three frequently used fungicides, Rubigan 12 EC (fenarimol), Karathane LC (dinocap), and Fundazol 50 WP (benomyl), at five concentrations, was observed using a modified leaf-disc bioassay. Discs were prepared from adult plants of *Cucumis sativus* cv. Stela F_1. Significant differences among fungicides and even among years were found. Occurrence of resistant and/or tolerant isolates of both powdery mildew species in different locations were observed. Rubigan 12 EC showed a high level of effectiveness and control of powdery mildew at a dosage of 36 μg a.i./ml (optimal concentration). Karathane LC was less effective in 2001–2002, when 5 % of the isolates overcame the registered concentration (105 μg a.i./ml), but 100 % effective in 2003. Fundazol 50 WP was the least effective of the fungicides, as 94 % of the isolates sporulated at every tested concentration and 75 of the isolates were resistant.

This research was supported by grants QD 1357, MSM 153100010, MSM 6198959215 and by the National Programme of Genepool Conservation of Microorganisms and Small Animals of Economic Importance.

Aspergillus niger as a model organism in the bioaccumulation of arsenic

Aspergillus niger ako modelový organizmus v procese bioakumulácie arzénu

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In the present study, an alternative procedure has been examined based on bioaccumulation using the fungus *Aspergillus niger* strain 1 and 2 as a biosorbent for the removal of both trivalent and pentavalent arsenic compounds from arsenic-contaminated groundwater running through an abandoned mining area. The fungus *A. niger* strain 1 was isolated from eutric fluvisols FMm (Gabčíkovo region), pH H_2O/KCl = 7.7/7.4 and *A.niger* strain 2 was isolated from stream sediment of the Blatina river (Pezinok-Kolársky vrch region), pH H_2O/KCl = 5.2/4.8; As = 363 mg/kg; Sb = 93 mg/kg.

The toxic and carcinogenic properties of inorganic and organic arsenic compounds make their determination in waters particularly important. The toxicity, reactivity and bioavailability of elements depend on their chemical forms. In general, trivalent forms of arsenic are more toxic than pentavalent forms, and their inorganic forms are more toxic than the organic ones. Due to the physiological and chemical properties of arsenic compounds, the quantification of individual species is required, not simply the determination of the total arsenic concentration. The problem of arsenic contamination in groundwaters has been subjected to extensive study because of its adverse effects on human health, primarily due to the consumption of arsenic-contaminated drinking water. As(V) can replace phosphate in several biochemical reactions whereas As(III) may react with critical thiols in proteins and inhibit their reactivity.

Several treatment technologies, such as coagulation, filtration, ion exchange and adsorption, have been applied to remove excess arsenic from water. The application of fungi to solve the problem of water contaminated with toxic compounds has received increasing attention, as fungi are often dominant organisms in soils.

This work was supported by grants VEGA 1/2352/05, 1/2466/05 and UK 109/2005.

Mechanism of biologic methylation of arsenic and its possible application in bioremediation

Mechanizmus biologickej metylácie arzénu a možnosti jej využitia v bioremediácii

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Biological transformation and formation of organometallic compounds are part of the biogeochemical cycle of metals (metaloids). A specific mechanism of biological transformation is biomethylation. This is a natural intracellular enzymatic mechanism, which was theoretically described by Challenger in the first half of the 20th century. Challenger identified trimethylated species of arsenic and antimony and dimethylated species of tellurium and selenium produced by the fungus *Scopulariopsis brevicaulis*. The mechanism of biomethylation is not related only to a metal(loid) metabolic pathway, but is also a part of further physiological processes in prokaryotic and eukaryotic cells. Challenger's mechanistic theory of biomethylation of arsenic interprets biomethylation as a redox reaction which transforms trivalent arsenic to its pentavalent form. The rationale for this reaction is the potential toxicity of trivalent arsenic. Through biomethylation the cell probably manages to eliminate or transform free trivalent arsenic in the cytosol into stable or relatively non-toxic macromolecules, or to exclude arsenic from the cell.

Later on, other fungal species that were able to biomethylate arsenic into mono-, di- or tri-methylated species were isolated. The formation of each arsenic species depends on specific As(III)-methyltransferases that are present in the cell. Production of dimethylarsine and trimethylarsine is important for bioremediation, because these arsenic metabolites are volatile. Gas that contains trimethylarsine is called Gosio gas and is characterised by a garlic odour. In our research we have quantified the volatilisation of inorganic arsenic under laboratory conditions by microscopic filamentous fungi, originally isolated from the locality Pezinok – Kolársky vrch. Along with biomethylation we investigated biosorption as a possible method of application of living mycelia for bioremediation.

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Occurrence of potentially toxigenic fungi in foodstuffs

Výskyt potenciálně toxinogenních plísní v potravinách

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The occurrence of fungal spores, especially those of potentially toxigenic species, was monitored in different cereals and bakery products. Consumption of such a food could affect the human health due to presumptive mycotoxin production. The air is a significant reservoir of fungal spores and may be responsible for their transmission to foods being contaminated during processing, transporting and storing. Although cleaning procedures with common disinfectants could successfully avoid bacterial contamination, fungal spores resist. Hence food products are supplemented with chemical substances which could suppress the growth of fungi.

The objective of this study was to isolate and identify fungi from bakery products and cereals. When potentially toxigenic fungi belonging to the genera *Aspergillus* and *Fusarium* were found, an optimised PCR technique was applied to detect the presence of genes coding for aflatoxin B1 and trichothecenes. Primers specifically targeted to apa–2, ver–1 (*Aspergillus* sp.) and Tri–5 (*Fusarium* sp.) were used. Different chemical substances were also evaluated for their fungicidal properties. *Cladosporium* sp. and *Aspergillus niger* were the most frequently isolated species, followed by members of the genera *Penicillium* and *Acremonium*. *Aspergillus flavus* and a variety of xerophilic fungi (especially *Eurotium* sp.) were also isolated. From all conservation substances tested, propionic acid and potassium sorbate were found to be the most effective inhibitors of growth of the isolated fungi. A pH dependence of antifungal properties was observed. Results indicate that occurrence of potentially toxigenic fungi in bakery products represents an issue which should be routinely investigated.

This work was supported by the Ministry of Education, Youth and Sports of the Czech Republic (project no. MSM0021627502) and the Czech Science Foundation (project no. 03/05/2106).

A new cryopreservation method for the maintenance of filamentous fungi

Nová kryoprezervační metoda uchovávání vláknitých hub

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A new alternative method using perlite as a particulate solid carrier in the growth medium with a cryoprotectant was developed for cryopreservation of several basidiomycete species after several partially or completely unsuccessful attempts to preserve them by routinely used cryopreservation procedures. Expanded perlite is a unique volcanic aluminosilicate mineral holding and retaining substantial amounts of water, which can be released as needed. Fungal cultures are grown directly in sterile plastic cryovials with perlite moistened with growth medium, enriched with glycerol as a cryoprotectant and inoculated with an agar plug. The cryovials with perlite overgrown by the mycelium are frozen in a programmable freezer and then placed in liquid nitrogen. Frozen strains are kept in cryovials submerged in liquid nitrogen and when needed they are thawed and checked for viability, purity and changes in growth, morphology and biochemical characteristics. All tested cultures survived the cryopreservation procedure and no negative effects were observed after 6 months of their storage in liquid nitrogen (Homolka et al., J. Microbiol. Methods 47: 307–313, 2001). The improved cryopreservation procedure has several additional advantages. One cultivation step is saved by using the cryovials directly for the cultivation of cultures; the transparency of the cryovials makes it possible to check the growth of the culture inside and to prevent problems with insufficient inoculation and contamination. The mycelium grows continuously on perlite and its damage caused by punching it from the agar plate and by subsequent handling is prevented. Specific mycelial structures (rhizomorphs etc.) can be preserved more easily. The described method is evidently suitable for different fungal strains requiring special treatment and seems to be generally applicable to most fungal cultures. This expectation is supported by the promising results of preliminary tests on another 351 basidiomycete strains from 80 different genera and 173 species. Moreover, 40 micromycete (Ascomycota and Zygomycota) strains were at least able to grow on perlite and survive the process of freezing and thawing (at present under further study).

This work was supported by grant B3.8 from the Ministry of Agriculture of the Czech Republic.

Evaluation of antibody response in suspected candidosis

Hodnocení protilátkové odezvy u suspektních kandidóz

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In a set of 546 patients (287 with infections of the upper respiratory tract, 102 with alveolitis, 76 with infections of the digestive tract and 76 patients with leukaemia or other malign diseases) the level of antibodies against *Candida albicans* was determined. Four serologic methods were used, namely immunodiffusion (ID), countercurrent immunoelectrophoresis (CIE), agglutination (AGL) and complement fixation (CF). The non-corpuscular antigen was used for ID, CIE and CF. The corpuscular antigen was used for AGL. The greatest percentage of *Candida*–specific antibodies were found in all four groups of patients by AGL, lower amounts using CF, still lower with CIE (29.4 %) and only negligible amounts with ID (1.2 %). In complement fixing and agglutinating antibodies the titres could be estimated. The highest titres found were 1: 8,192 in the agglutination reaction and 1: 96 in complement fixation.

Candida albicans is an opportunistic pathogen, often present among the normal flora of the mucous membranes. Therefore the finding of this yeast by microscopic examination or cultivation is no proof of a pathogenic process. More significant is the specific humoral response of the host, however, a moderate antibody level can be probably elicited even by mere colonisation. Consequently, it is necessary to employ for each specimen several serologic reactions with antigens prepared with different methods and the patient has to be sampled repeatedly.

Contemporary trends in antimycotic vaccine preparation

Současné trendy v přípravě antimykotických vakcín

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In the world, more than two hundred thousand different species of fungi exist. However, only several tens of them are considered to be pathogenic to man and animals and only a few species can be regarded as primary pathogens. The remaining species are opportunistic pathogens which invade only immunologically altered hosts. With respect to problems with antimycotic therapies, the preparation of different effective vaccines is a great challenge for the mycologist and immunologist.

Intensive experimental work on vaccine preparation is focused on *Candida albicans*, *Cryptococcus neoformans*, *Coccidioides immitis*, *Histoplasma capsulatum*, and *Blastomyces dermatitidis*. The new trends in vaccine construction are aimed at a preparation of subunit vaccines exploiting recombinant proteins or purified cell-wall extracts. Most widely used candidate antigens with immunological protective potential for the construction of subunit vaccines are glucuronoxylomannan in *Cryptococcus neoformans*, the mannan complex, Hsp 90 protein and the receptor for the *Pichia anomala* toxin in *Candida albicans*, the Hsp 65 protein in *Histoplasma capsulatum*, the 42 kDa protein of the soluble conidial cell wall fraction in *Coccidioides immitis* and the 43 kDa protein (exo-β-1,3-D-glucanase) in *Paracoccidioides brasiliensis*.

Completely new and very promising seems to be the construction of DNA vaccines. Some aspects of experimental antimycotic DNA vaccines prepared in our laboratory were discussed in detail.

Two DNA vaccines were prepared in our laboratory: the heat shock protein Hsp 60 kDa expressing DNA vaccine from *Trichophyton mentagrophytes* and the Hsp 90 kDa expressing DNA vaccine from *Candida albicans*. Both vaccines were compared with recombinant Hsp 60 kDa or Hsp 90 kDa protein vaccines in experimental animals (guinea pigs and calves) as models. The results indicated that immunological effects of the DNA vaccines are dose-dependent. In higher doses, DNA vaccines could induce humoral as well as cellular immune response. Protective effects of the prepared DNA vaccines are to be evaluated.

CZECH MYCOL. 57(3–4): 325–326, 2005

Book review

ANNAROSA BERNICCHIA

***Polyporaceae* s.l.** – In: Fungi Europaei, vol. 10: 808 p., 343 colour photographs, 292 line drawings. – Edizioni Candusso (http://edizionicandusso.it), Italia, 2005. ISBN: 88-901057-5-5. Price: 67 Euro.

Fifteen years after the first complex work on polypores of Italy was published (Bernicchia 1990), the well-known Italian mycologist Annarosa Bernicchia comes with a second book dealing with this subject, significantly contributing to the knowledge of this interesting and often studied group of higher fungi by a clear arrangement of data. This voluminous work of 808 pages, excellently printed on coated paper, presents a comprehensive survey of information on polypores occurring in Italy and hence it is important for the study of the Mediterranean as well as Central-European mycoflora. After introductory chapters, devoted to a characterisation of the territory, the macro– and microfeatures of polypores and their classification, keys to the identification of families and genera follow. The major part of the book is devoted to detailed descriptions of the species. In this work, 271 species of polypores are treated with descriptions supplemented by drawings of microcharacters true to nature. About 250 species (carpophores) are presented as colour photographs. Even if the book is written in Italian, foreign mycologists will appreciate the easy to digest diagnoses of species, containing the most important macro– as well as microcharacters in English. Also the identification keys translated into English are useful. An important feature are the original descriptions relating to the first publishing of the name, reproduced in the language in which they were originally published (added to most of the species). As a matter of course the book includes a short glossary of technical terms, a bibliography of the most important works on polypores and an index of generic and species names.

In the book, the new combination *Oligoporus alni* (Niemelä et Vampola) Bernicchia is proposed, two new species are described (*Antrodia citrina* Bernicchia et Ryvarden and *Antrodiella ichnusana* Bernicchia, Renvall et Arras) and about 10 species are reported for the first time from Italy. As we cannot analyse this whole book in detail here, we will confine ourselves to a few comments. As regards the new combination *Oligoporus alni*, the real priority belongs to the name *Oligoporus alni* (Niemelä et Vampola) Piątek, published two years earlier (Piątek 2003). This fungus of the complex of *Oligoporus caesius* has only recently been described (Niemelä et al. 2001) and is often confused with *Oligoporus subcaesius* (A. David) Ryvarden et Gilb. It undoubtedly also occurs in Italy and the photo on p. 705 (above) most probably represents this species.

Concerning the species *Antrodia citrina* Bernicchia et Ryvarden, according to its authors differing from *Antrodia radiculosa* (Peck) Gilb. et Ryvarden only in the size of pores and spores, we feel that a more detailed study of this problem is necessary in the future. Since 1991, when *Antrodia radiculosa* was collected for the first time in our country (Vampola 1992), we have had the opportunity to study in detail rather rich material of this species from several other localities in the Czech Republic besides the specimens from North America and also one collection from Italy (Roncegno, reg. Trentino – Alto Adige). When studying the carpophores in various stages of development, we observed a rather great variability in the size and form of spores as well as in the size of pores. In our opinion, all specimens studied by us represent only one, though rather variable species.

The new species *Antrodiella ichnusana* Bernicchia, Renvall et Arras, occurring on *Alnus glutinosa* and *Populus alba* in Sardinia, is very interesting and a unique species in the genus *Antrodiella*. This polypore is an impulse for us to revise in detail several collections of a similar resupinate species from broad-leaved trees in warm regions of Moravia, in the field preliminary considered to be *Diplomitoporus lindbladii* (Berk.) Gilb. et Ryvarden.

As already mentioned, a precise drawing of microcharacters is added to every species. A comment on one drawing is necessary here: the drawing of *Junghuhnia lacera* on page 306 is evidently erroneous (as it was also in the first edition of 1990) and represents in reality a species of the genus *Oxyporus*, probably *O. obducens*.

Some other errors or mistakes have been made in the identification of the photographs. For instance, *Albatrellus subrubescens* (p. 591) is evidently *A. ovinus*. Nevertheless, the photo on p. 592 is certainly correctly identified. The picture of *Fomitopsis rosea* (p. 646, below) is in reality *Fomitopsis pinicola* (no trace of rose tint on pores). The figure of *Grifola frondosa* on p. 663 (above) certainly represents *Polyporus umbellatus*. It also seems that the photo of *Ganoderma australe* on p. 650 represents another species (slightly lustrous crust in older parts – never present in *G. australe*). We suppose that the figure on p. 606 (above) of *Antrodiella genistae* must be that of some *Postia* species. Almost certainly the figure on p. 624 does not represent *Ceriporiopsis resinascens* (distinct pilei with large pores – never observed by us in this species). In our opinion it could represent a very rare form of *Ceriporiopsis aneirina* with broad pseudopilei. As regards the figure on p. 643 (above) we can only state that such a form of *Fomitopsis iberica* has never been seen by us. Generally, however, we could confirm the exact identification of the great majority of photographs which are of the highest quality and faithfully illustrate the species in their natural environment.

As regards the keys and descriptions a few remarks can be made. In the key to the genus *Coltricia* (p. 184), the sentence „Hymenophore poroid or with concentric lamellae" relates to North American populations of *C. montagnei* – in Europe only poroid carpophores have been observed so far. *Polyporus varius* (p. 474–475) is much more variable in pileus size – in the description only medium-sized fruitbodies („pileus 6–8 cm wide") are recorded. On small twigs fruitbodies with pilei 7–15 mm broad are often collected and on bigger trunks pilei are up to 15 cm (or more) broad.

The original descriptions, which are quoted under most species, are in two cases not relating to the fungi described in the reviewed book: in *Trametes suaveolens* the original description (p. 536) relates in reality to *Haploporus odorus* and the one quoted (on p. 301) for *Ischnoderma resinosum* relates to *Fomitopsis pinicola*.

There are a number of very important new contributions in this book. These are particularly the results of intensive research in Sardinia, especially of xerothermic shrubby vegetation. The most interesting are treatments of such species as *Antrodia sandaliae*, *Echinodontium ryvardenii*, and *Perenniporia rosmarini*. Also very interesting are descriptions and pictures of rare species like *Polyporus corylinus*, *Perenniporia meridionalis*, *Neolentiporus squamosellus* and *Lenzitopsis oxycedri*.

Some new ideas should not escape the reader's attention. An interesting novelty is the distinguishing of *Daedaleopsis confragosa* from the closely related *D. tricolor* by the character of bases of dendrohyphidia: hyaline in *D. confragosa* and coloured in *D. tricolor*. This character should be checked on further material.

The reviewed book is undoubtedly one of the best monographs on polypores published in Europe and will be a significant source of information for every mycologist studying this complicated but very important group of fungi.

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Nomenclature. Latin names should conform to the International code of botanical nomenclature. New taxa must be substantiated by a Latin diagnosis including a reference to the public herbarium where the type specimen is deposited. The authors are asked to use only the acronyms listed in the Index Herbariorum.

References. References are to be listed in alphabetical order according to the surnames of the first authors. The bibliography should be written as follows:

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