

CATATHELASMA

a journal on biodiversity, taxonomy and conservation of fungi

No. 10

December 2008



Geastrum berkeleyi

(Záhorská nížina, Lakšárska Nová Ves; see p. 21–40)



Tulostoma fimbriatum

(Záhorská nížina, Lakšárska Nová Ves; see p. 5–19)



Tulostoma armillatum

(Podunajská nížina, Bratislava;
see p. 5–19)



Tulostoma kotlabae

(Záhorská nížina, Rohožník;
see p. 5–19)

TABLE OF CONTENTS

BIODIVERSITY OF FUNGI

The genus <i>Tulostoma</i> in Slovakia	Mikael Jeppson	5
Notes on some recent records of Gasteromycetes in Slovakia	Mikael Jeppson	21
Additions to the contributions by M. Jeppson on <i>Tulostoma</i> and selected Gasteromycetes	Vladimír Zíta, Ladislav Hagara and Ivona Kautmanová	41
Book notices	Pavel Lizoň	20, 45

PHOTOGRAPHS

<i>Geastrum berkeleyi</i>	M. Jeppson	[1]
<i>Tulostoma fimbriatum</i>	M. Jeppson	[2]
<i>Tulostoma armillatum</i>	M. Jeppson	[2]
<i>Tulostoma kotlabae</i>	M. Jeppson	[2]
<i>Tulostoma melanocyclum</i>	M. Jeppson	[47]
<i>Tulostoma squamosum</i>	M. Jeppson	[47]
<i>Lycoperdon marginatum</i>	T. Knutsson	[47]
<i>Lycoperdon dermoxanthum</i>	M. Jeppson	[48]
<i>Geastrum floriforme</i>	M. Jeppson	[48]

journal is posted at www.cybertruffle.org.uk/cyberliber

Editor's Acknowledgements

The Editor express his appreciation to Slavomír Adamčík and Pavel Lizoň (both Institute of Botany, Bratislava, Slovakia) who have, prior to the acceptance for publication, reviewed, read and/or commented contributions appearing in this issue.

Instructions to Authors

Catathelasma publishes contributions to the better knowledge of fungi preferably in Slovakia and central Europe. Papers should be on bio-diversity (mycofloristics), distribution of selected taxa, taxonomy and nomenclature, conservation of fungi, and book reviews and notices. We accept also announcements on literature for sale and/or exchange (classified) and on events attractive for mycologists. Manuscripts have to be submitted in English with a Slovak or Czech summary.

Elements of an article submitted to Catathelasma

- title: informative and concise
- author's name: full first and last name
- author's mailing and e-mail addresses: footnote
- key words: max. 5 words, not repeating words in the title
- text: brief introduction, presented data (design and structure depend on the topic)
- illustrations: line drawings (scanned and "doc" or "tif" formatted)
- list of references
- abstract/summary in Slovak or Czech: max. 10 lines (starting with author's name and the title of the article)

Please follow these standards: for journal abbreviations *Botanico-Periodico-Huntianum* (Lawrence & al., 1968) and *Botanico-Periodico-Huntianum/Supplementum* (Bridson, 1991), for book abbreviations *Stafleu and Cowan's Taxonomic Literature* (2nd ed., vol. 1-7, 1976-1988, & supplements), for abbreviation of author(s) of taxa *Authors of fungal names* (Kirk & Amsell, 1992), *Authors of plant names* (Brummitt & Powell, 1992), all available at the web site of the International Plant Names Index at www.ipni.org/index.html, for current names CABI Funindex (www.indexfungorum.org), and for collection acronyms Index Herbariorum (Holmgren & al, 1990; www.nybg.org/bsci/ih/ih.html).

Editorial office

Slovak Mycological Society, Dúbravská 14, SK-841 04 Bratislava;
e-mail botumyko@savba.sk.

THE GENUS *TULOSTOMA* IN SLOVAKIA

MIKAEL JEPPSON¹

Key words: Tulostomataceae, Gasteromycetes, key, ecology, taxonomy, Austria, Czech Republic

INTRODUCTION

The genus *Tulostoma* in Slovakia and adjacent regions has been studied mainly by Pouzar (1958) for the Flora ČSR project. *T. brumale* and *T. fimbriatum* were found to be fairly widely distributed whereas Pouzar described *T. kotlabae* as new to science from near Kúty in the Záhorská nížina² in SW Slovakia. *T. pulchellum* was reported by Pouzar (1958; as *T. hollosii*) from Slovakia but was last recorded in 1961 (Kreisel 1963, Moreno & al., 2000). During recent years findings of *Tulostoma* species have been reported by Škubla (1993, 1995, 1996), Kabát and Orthová (1997) and Kabát (1997). For adjacent areas in Burgenland and Niederösterreich (E Austria) Mrazek & al. (1995) added important contributions. In Slovakia and neighbouring regions of the Czech Republic and Austria nine species of *Tulostoma* are on record. A few more species can be added if the sandy plains of central Hungary be included. The Hungarian taxa are however currently under study and will not be dealt with here. *Tulostoma* is a cosmopolitan genus having its centre of species diversity in steppic and semi-desertic regions. The genus comprises 79 species worldwide (Kirk & al. 2001) and about 20 species have been recorded in Europe.

Tulostoma species are considered threatened in a number of European countries and some of the species are even classified as regionally extinct. On a European scale only *T. brumale* and *T. fimbriatum* appear to be regularly met with, others are very rarely reported. There might be a general population decrease for xerophytic macromycetes due to changing land use causing overgrowth because of ceased grazing as well as irrigation and cultivation of steppe habitats, nitrification etc. It is however also a fact that *Tulostoma* species are easily overlooked, growing in habitats rarely visited by mycologists combined with a certain

¹ Lilla Håjumsgatan 4, SE-461 35 Trollhättan; jeppson@svampar.se

² Záhorská nížina is the name of a region (also called Záhorie) in SW Slovakia. The southern lowland part is known as Borská nížina, the northern upland part is called Chvojnická pahorkatina. For details of the geomorphological division of Slovakia see E. Mazúr & M. Lukniš. 1986. Geomorfologické členenie SSR a ČSSR. Bratislava.

taxonomical confusion caused by the relatively few morphological characters that can be used for identification.

In the Slovak Red List (Lizoň 2001), one species of *Tulostoma* is considered to be threatened: *T. kotlabae* (EN – endangered according to the IUCN criteria). In the Czech Republic (Holec & Beran, 2006) *T. pulchellum* and *T. moravecii* are potentially extinct, whereas *T. melanocyclus* is considered endangered (EN). In Austria six species of *Tulostoma* are on the national red list (Krisai-Greilhuber, 1999). According to Austrian criteria *T. armillatum*, *T. kotlabae*, *T. melanocyclus* and *T. moravecii* are strongly endangered (2) whereas *T. fimbriatum* and *T. squamosum* are treated as endangered (3).

The present survey concentrates on the species so far known from Slovak territory but a couple of species known from the Czech Republic and Austria are added since they are likely to appear also in Slovakia. The information on the presented species is based on my own field work in the area during the period 2000-2008 as well as on records available in literature and on the Internet. Additional herbarium samples were kindly provided by the Slovenské národné múzeum in Bratislava (BRA). The aim of this paper is to highlight a group of fungi which are rarely collected but nonetheless important in the conservational work, nationally as well as internationally. Material of *Tulostoma* collected during my field work in Slovakia is deposited in herbarium BRA with duplicates in herbarium GB (University of Göteborg, Sweden) and in the author's personal herbarium (MJ).

ECOLOGY

Most species of *Tulostoma* occur in dry and sun-exposed situations, usually among mosses and low herbs in places with scarce and sometimes patchy vegetation, either on sandy soil (sand steppes, sand dunes), in dry grasslands or rupicolous steppe habitats. A few species occur among grasses on mull rich soil in wooded or at least partially shaded habitats. *Tulostoma* species are considered to be saprotrophs although several species appear to be associated with mosses.

MORPHOLOGY

MACROSCOPICAL FEATURES

The fruitbody of a mature *Tulostoma* consists of a spore sac and a stem usually with a mycelial tuft at its base. Initially the fruitbody is globose – subglobose and develops hypogaeously just beneath the soil surface. It is then totally covered by the exoperidium. At maturity the stem expands

and raises the spore sac which contains the mature spore mass. The spore sac consists of the endoperidium which covers the gleba. A small apical stoma (mouth) opens to enable the spores to puff out when the wall of the spore sac is being mechanically compressed (by wind, rain drops, trampling) in the mode of a bellow's mechanism (Sunhede, 1976). When in a raised position, the thin exoperidium covers the endoperidium. Usually it encrusts sand and soil particles. It is either hyphal (thus appearing as a thin hyphal mat on the endoperidium, gradually wearing away) or membranous (i. e. well differentiated from the endoperidium from which it usually peels off in flakes or membranous patches). The structure of the exoperidium is an important key-character and a base for the infrageneric taxonomy. The colour of the exoperidium is usually whitish – greyish but this is often difficult to observe because of adhering sand and soil and by the fact that it soon disappears after maturity. It generally remains at the base of the spore sac as an annular, sand encrusted socket.

The type of mouth is another taxonomically important feature used in current classification. The mouth is either regular, i. e. a round pit with a regular, entire, even margin which is either flat or more or less protruding like a tube, or less defined, irregularly rounded with a silky or fimbriate, uneven margin. The mouth can be surrounded or not by a darker ring zone or have a delimited peristome, depending on species. The endoperidium is initially reddish brown – orange brown – ochre or more or less white. When dark the colours usually wear away with age to become more or less white or pale ochre – greyish. The stem has a tough and woody texture, is rather thin, 2-4 mm in diameter and usually expanding to 15 – 50 mm in length. The surface of the stem is whitish – ochre – brown – almost black depending on species. It may be almost smooth, longitudinally furrowed or fissured or more or less squamulose. The mature gleba is normally orange brown – ferruginous with little difference between the species.

MICROSCOPICAL FEATURES

The mature gleba consists of long segments of capillitial hyphae, more or less branched and more or less regularly septate, with walls appearing rather thick, sometimes leaving only a narrow lumen. Average diameter of the capillitial threads is about 4 – 7 μm . The morphology of the septum is an important character at species level. It may be either distinctly and bilaterally widened, unilaterally widened or only slightly or not at all widened. In some species (*T. brumale* and sometimes *T. moravecii*) minute, irregularly shaped crystal plaques adhere to the capillitial walls.

The spores are globose – subglobose – ellipsoid, usually ranging from 4 – 6 μm , sometimes provided with a short apiculus. The spore wall ornamentation varies in European taxa from perfectly smooth (A), asperulate (B), verrucose (C) to echinulate (D). In some species there are connective crests between the verrucae, in some species the verrucae are arranged in longitudinal lines but these details are difficult or even impossible to see in a light microscope. SEM photos of the spores offer a great deal more information and has been used as an important tool in the taxonomical studies of the genus conducted by some workers (see Moreno et al., 1995).

TAXONOMY

Wright (1987) published a world monograph of the genus *Tulostoma* comprising 137 taxa. Some of these have later been reduced to synonymy by eg Moreno & al. (1992a, 1992b) and Altés & al. (1999). Pouzar (1958) proposed an infrageneric subdivision which was expanded by Wright (1987). It was a morphologically based classification relying on the structure of the exoperidium (hyphal or membraneous) combined with characters of the mouth zone (even or fimbriate margin). Future molecular studies may help to clarify the phylogenetic relationships within the genus.

TECHNIQUE

Mature specimens are essential for examination. The important characters of the exoperidium may be studied under a dissecting microscope. Spores and capillitium are taken out of the fruitbody by cutting a scar in the endoperidium with a razorblade. A pair of thin, acute tweezers can be used to pick a small portion of the gleba which is mounted in a drop of lactophenol+Cotton Blue and heated to boiling for a second. Highest possible magnification using an immersion lense is recommended to enable examination of the spore wall ornamentation.

Important works on *Tulostoma* with keys and descriptions are those of Calonge (1998), Kreisel (1984), Moreno & al. (1995), Pouzar (1958) and Wright (1987).

TENTATIVE KEY TO TAXA KNOWN FROM SLOVAKIA AND ADJACENT REGIONS
(species known from Slovakia are marked with *)

1. Mouth with even margin, more or less tubularly protruding 2
1. Mouth with uneven, fimbriate margin, flat or mammose 7
2. Peristome with brown ring zone 3
2. Peristome without brown ring zone 4
3. Stem ochraceous – wood coloured: spores verrucose (C); capillitial septa distinctly widened; crystal plaques abundant; common species on sand and in steppic vegetation ***T. brumale****
3. Stem deep orange brown – dark brown- almost black; spores echinulate (D); capillitial septa not widened; no crystal plaques; rare species in Slovakia on sand and in steppic dry meadows
T. melanocyclum*
4. Exoperidium hyphal 5
4. Exoperidium membranous 6
5. Slender species with asperulate – verrucose spores (B-C); capillitium with frequent, not or slightly unilaterally widened septa; rare species in Slovakia met with in sandy habitats ***T. kotlabae****
5. Robust species with asperulate (B) spore ornamentation with verrucae ± arranged in longitudinal ridges; capillitium ± moniliform and with scarce non-widened septa; not recorded from Slovakia but in adjacent areas known from anthropogenic habitats (urban pavements); to be expected in Slovakia ***T. giovanellae***
6. Endoperidium dark ochraceous – brownish, smooth; stem dark brown – reddish brown; exoperidial remains form a faint, dark brown areolation; spores echinulate (D); no capillitial crystal plaques; rare species in Slovakia met with in semi-exposed situations ***T. squamosum****
6. Endoperidium white; stem ochre – wood colour; exoperidial remains whitish, not forming an areolate pattern; spores asperulate - verrucose (B-C); sometimes with abundant crystal plaques on capillitium; in dry steppic grassland and rupicolous steppe vegetation. On record from the Czech Republic and Austria but not from Slovakia from where it could be expected ***T. moravecii***
7. Spores densely verrucose (C); undelimited, mammose peristome; endoperidium smooth, greyish; fairly frequent species in dry and open situations ***T. fimbriatum****
7. Spores smooth (A) or asperulate (B) 8
8. Spores smooth, tear-shaped; endoperidium more or less brown with paler peristome; stem brown; in mull-rich soil in wooded situations; one Slovak record ***T. fulvellum****

8. Spores faintly but densely asperulate (B); endoperidium white with chamois-structure with a mammose, delimited peristome concolorous with the rest of the endoperidium; stem ochre – wood colour; in open sandy sites; not recently seen in Slovakia nor the Czech Republic but occurs in Hungary; should be searched for in Slovakia *T. pulchellum**

Tulostoma armillatum Bres. in Petri (1904) p. [2]
syn.: *T. fulvellum* Bres. in Petri (1904)

Spore sac globose – subglobose, 9 – 13 mm in diametre. Exoperidium hyphal and soon disappearing. Endoperidium yellowish brown – brown, smooth with a flat, silky or fimbriate mouth with an indefinite, but conspicuously paler peristome. Stem 20 – 60 mm, fibrillose – adpressed squamulose, brown, with a conspicuous basal mycelial bulb. Spores tear-shaped to pyriform, 2.5 – 3 x 3.5-4.5 µm, apiculate with a collar-like structure, smooth (A). Capillitium not swollen at septa. No crystal plaques.

T. armillatum is an extremely rare species which has not been recorded outside Europe. It was recently met with in Slovakia at Pečniansky les near Bratislava (Kabát, 1997; BRA). In adjacent regions there is one record from Lobau near Vienna dating back to 1986 (Mrazek & al., 1995). There are further European records from Italy (type localities for *T. armillatum* and *T. fulvellum* respectively in the beginning of the 20:th century), France (Besançon, 1910), Switzerland (Geneva, 1965), Germany (Baden-Württemberg, 1957 and 1966) and Spain (Vitoria, 1972). It seems to be a species of shaded situations in forests on calcareous soils. In one case (Baden-Württemberg) the fruit bodies occurred among mosses on a stone wall (Winterhoff 2000). The fragmented distribution combined with very few recent records make this species an urgent candidate on a future European Redlist.

T. brumale Pers. (1801)

Spore sac globose – subglobose, 4 – 12 mm in diametre. Exoperidium whitish, membraneous (sometimes submembraneous or almost hyphal). Endoperidium orange brown, ochre - whitening with age, with a prominent brown or orange brown ring around the projecting, tube-like mouth with a round, regular and even outline. Stem 10 - 40 x 2-4 mm, smooth – slightly furrowed, ochre – pale brown (wood colour). Spores subglobose – ellipsoidal, 4 – 6 µm, verrucose (C). Capillitium with distinct bilaterally widened septa. Abundant irregular crystal plaques stick to the capillitial walls.

T. brumale seems to be one of the more widespread species of the genus, having an extensive distribution in Europe, ranging from the Mediterranean region north to Fennoscandia. From Slovakia Pouzar (1958) reported it from Malacky, Kostolište and Borský Mikuláš. Being a fairly frequent species in sandy heathland and calcareous dry meadows it has subsequently been on record from several parts of Slovakia (Škubla 1993, Wright 1987) and it seems to be a relatively common species. Excellent illustrations of it are provided on the Internet by Bednár (2006, 2008) and Roučka (2006).

***T. fimbriatum* Fr. (1821)** p. [2]

Spore sac globose – subglobose, 10 – 15 mm in diameter. Exoperidium greyish, hyphal and soon disappearing. Endoperidium greyish – pale ochraceous, tough, with a flat or a slightly mammose, silky or fimbriate mouth with a more or less irregular outline. Peristome indefinite, concolorous with the rest of the endoperidium. Stem 20 – 50 x 2 – 5 mm, smooth or longitudinally furrowed – slightly squamulose, greyish-brown – reddish brown. Spores globose – subglobose, 4 – 6 µm, densely and conspicuously warted (C). Capillitium slightly widened at the scarce septa. No crystal plaques.

T. fimbriatum has a worldwide distribution and is also widely spread in Europe. It grows in sandy exposed sites, often on road verges or at forest edges. Pouzar (1958) recorded it from several sites in the former Czechoslovakia and it seems to be a fairly widely distributed species with abundant recent records in Slovakia (Záhorská nížina, Podunajská nížina, Malé Karpaty, Devínska Kobyla, Východoslovenská nížina (Pouzar, 1958, Škubla, 1993, 1995, 1996, Wright, 1987).

***Tulostoma giovanellae* Bres. (1881)**

Spore sac subglobose, 10-20 mm in diameter. Exoperidium hyphal, soon disappearing. Endoperidium whitish-greyish, smooth with a circular, rather wide, flat or shortly tubular mouth with even margin. Stem 15 – 60 x 2-5 mm, yellowish – wood colour, somewhat scaly - more or less squamulose. Spores subglobose, 4 – 6 µm, finely asperulate (B) with warts partly arranged in longitudinal lines (sometimes possible to see in LM, using an immersion lense). Capillitium often “moniliform” with rare, non-widened septa. No crystal plaques.

This mainly Mediterranean species has not been on record from Slovakia but is known from Germany (Potsdam), Austria (Wiener Neustadt) and Hungary (Budapest). In Potsdam and Budapest it was found in

anthropogenic sites along urban pavements and brick walls (Nagy & Babos, 1969, Kreisel, 1987).

T. kotlabae Pouzar (1958) p. [2]

Spore sac globose – subglobose, 4 – 13 mm in diameter. Exoperidium whitish-greyish, hyphal and soon disappearing. Endoperidium white – greyish with a slightly projecting, more or less tubular mouth with a round, regular and even outline. Stem 15-40 x 2-4 mm, smooth – slightly furrowed, pale ochre – greyish white. Spores subglobose – ellipsoidal, finely verrucose (B-C). Capillitium usually only slightly and unilaterally widened at the septa. No crystal plaques.

T. kotlabae has a wide European distribution. In Slovakia it seems to be rare. Pouzar (1958) reported it from the Záhorská nížina: Kúty (type locality), Borský Mikuláš and between Kostolište and Gajary. In connection with the 14th and 16th Meetings of Czech and Slovak mycologists in the summers of 2006 and 2008 it was met with in several localities in the Záhorská nížina. Škubla (1993) gave records from Podunajská nížina and Zita (2004) added a good illustration on the Internet of *T. kotlabae* from Chotínské Piesky NR.

T. melanocyclum Bres. in Petri (1904) p. [47]

Spore sac globose – subglobose, 5 – 13 mm in diameter. Exoperidium whitish-greyish and hyphal, soon disappearing. Endoperidium initially white, greyish with age, with a projecting, tubular mouth with a round, regular and even outline, encircled by a prominent dark brown ring zone. Stem 10 – 40 x 2 – 4 mm, young dark brown, at apex more or less orange brown, somewhat banded, later brown – dark brown to almost blackish, smooth or furrowed - slightly squamulose. Spores globose - subglobose, 4-6 µm, distinctly warted - echinulate (D). Capillitium not or only slightly widened at the septa. No crystal plaques.

T. melanocyclum has an extensive distribution in Central Europe occurring in sandy habitats as well as in calcareous dry meadows and rupicolous steppes. Pouzar (1958) reported a few findings in Czechia, Moravia and Slovakia respectively. In Záhorie he recorded it from Plavecký Štvrtok and Malacky (along the road to Gajary). Although devoted a dedicated search in the sandy areas around Malacky it has not been re-found. It was however recently recorded in Plavecké Podhradie in connection with the 14th meeting of the Czech and Slovak mycologists. Pouzar (1958) and Škubla (1993b) also reported it from Podunajská

nížina. Wright (1987) added findings in Východoslovenská nížina, Trábeč and Ipeľsko-rimavská brázda.

Tulostoma moravecii Pouzar (1958)

Spore sac subglobose, 5-10 mm in diameter. Exoperidium whitish, membranous. Endoperidium white, smooth often with small patchy remnants of the exoperidium. Mouth tubularly protruding with an even margin. Stem 10-30 x 2-3 mm, ochraceous, smooth or minutely scaly. Spores subglobose – ellipsoid, 5 – 6 μm , finely verrucose (B-C). Capillitium much branched and abundantly septate. Septa not or slightly widened. Sometimes with crystal plaques adhering to the capillitial wall.

This is a rare species which was described by Pouzar (1958) from a steppic habitat near Prague (type locality at Ločovské údolí). Mrazek & al. (1995) added records from two sites in southeast Austria. In one of these sites, Tenau in Burgenland, it was seen by the author in 2006, growing in a sloping, steppic grassland with calcareous outcrops. In the herbarium of the University of Vienna, there are also fairly recent records from Niederösterreich according to the database at herbarium WU (herbarium.univie.ac.at/database). It seems however not to have been met with on Slovak territory but could be expected. In Europe there seem to be additional records only from Germany (Brandenburg, herb. WU) and Spain (Calonge, 1998).

T. pulchellum Saccardo (1889)

syn.: *T. hollosii* Moravec (1956)

Spore sac globose – subglobose, 5 – 12 mm in diameter. Exoperidium whitish distinctly membranous, flaking off, sometimes with flaring edges. Endoperidium pure white – greyish white, chamois-like when young, later smooth. Mouth distinctly mammose, silky or fimbriate, with a more or less prominently delimited peristome concolorous with the rest of the endoperidium. Stem 15 – 40 x 2-4 mm, ochre - wood colour - greyish brown, smooth - longitudinally furrowed but not squamulose. Spores globose – subglobose, 4 – 6 μm , minutely, densely and evenly asperulate (B). Capillitium with rare, not widened septa. No crystal plaques.

T. pulchellum is a species of open and dry, preferably sandy habitats. It was described from Prokopské údolí near Prague as *T. hollosii* by Z. Moravec and was later (1953-54) collected by Staněk at Gajary and Malacky in the Záhorská nížina in Slovakia. In 1961 Kreisel collected it on the sand dunes between Kostolište and Gajary in Záhorská nížina (Kreisel, 1963, Moreno & al., 2001), but there seem to be no current

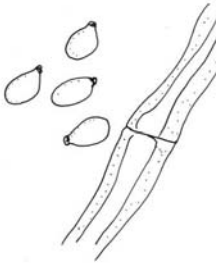
Czech or Slovak records of it. Moravec's description of *T. hollosii* was based on the Hungarian mycologist Hollós's concept of *T. fimbriatum* Fr., a taxon which was reported to occur in the sandy regions of central Hungary around 1900. According to Hollós (1904) this taxon was readily distinguished from the more frequent species he called *T. granulosum* Lév., a synonym to *T. fimbriatum* in modern taxonomy. Moreno & al. (1992) established the identity between *T. hollosii* and *T. pulchellum*, a species described from Australia which had been recorded in America as *T. poculatum* White and *T. minutum* White. Moreno & al. (1992b) also found the Slovak samples from Záhorská nížina to be identical with the American species *T. subfuscum* White which they however reduced to variety under *T. pulchellum* (var. *subfuscum* (White) Wright, Moreno & Altés).

T. pulchellum was not re-found in Hungary until recently when it was recorded in 2004 and 2006 at about 10 localities south of Kecskemét, the home town of László Hollós (Jeppson unpublished). Elsewhere in Europe it seems to be on record only from Spain (Calonge, 1998), France and Germany (Kreisel, 2006). Its scarce population in Europe and the few current records puts it on the high-priority list in connection with the elaboration of a future European Red list. It should be subject to a dedicated search in southern and western Slovakia.

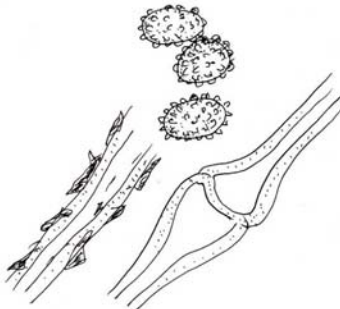
T. squamosum J.F. Gmelin:Pers. (1801) p. [47]

Spore sac globose – subglobose, 8 – 20 mm in diameter. Exoperidium brown, membraneous, long remaining as dark brown small patches forming a faint to prominent areolation on the dark ochre – orange brown endoperidium. Mouth shortly – distinctly tubularly protruding, with a round and even outline. Peristome concolorous with the rest of the endoperidium or slightly paler or sometimes greyish. Stem 20-50 x 2-4 mm, reddish brown - cinnamon, concolorous all over, not banded but with longitudinal furrows or fissures or distinctly squamulose. Spores globose – subglobose 4 – 6 µm, distinctly warted – echinulate (D). Capillitium not or only slightly widened at the septa. No crystal plaques.

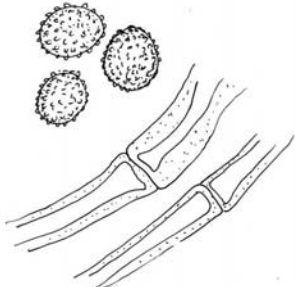
According to Pouzar (1958) this is a species of humus rich sites on rocks and steppe localities rather than of sandy habitats. It has a wide distribution in south and central Europe but seems to be rare in Slovakia. Pouzar (1958) reported it from Branisko and the Slovensky kras and Orthová & Kabát (1997) mentioned it from Podunajská nížina (Imel') and Devínska Kobyla near Bratislava.



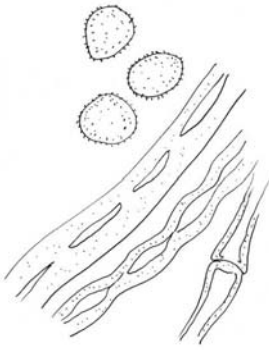
T. armillatum



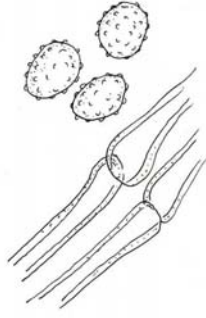
T. brumale



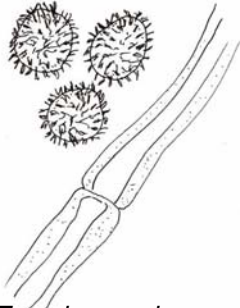
T. fimbriatum



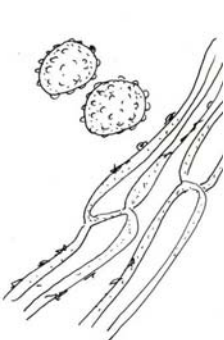
T. giovanellae



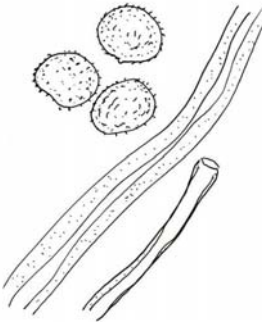
T. kotlabae



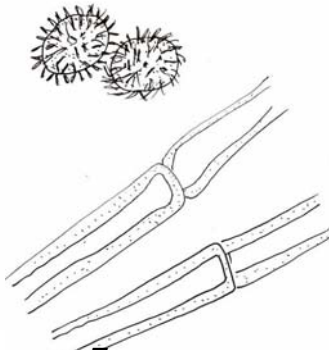
T. melanocyclum



T. moravecii



T. pulchellum



T. squamosum

Specimens studied

- Tulostoma armillatum*: Slovakia, Podunajská nížina, Bratislava, Pečniansky les, 28. 4. 1997, V. Kabát (BRA).
- T. brumale*: Austria, Burgenland, Oslip, 2. 11. 2000, J. & M. Jeppson (MJ 5369). Siegendorf, St. Margarethenberg, 27. 6. 2000, J. & M. Jeppson (MJ); Czech Republic, Moravia, Mikulovská vrchovina, Děvín, 31. 10. 2000, J. & M. Jeppson (MJ 5336); Slovakia, Bratislava, Devínska Kobyla, 2. 10. 2005, T. Knutsson (MJ); Malé Karpaty, Plavecké Podhradie, 24. 6. 2006, M. Jeppson (MJ 7945); Podunajská nížina, Marcelová, Marcelovské piesky, 16. 10. 2004, M. Jeppson (MJ 7333); Záhorská nížina, Mikulášov, 3. 10. 2005, leg. M. Jeppson (MJ). Rohožník, 22. 6. 2006, M. Jeppson (MJ 7921). Studienka, 26. 5. 2006, M. Jeppson (MJ 7951).
- T. fimbriatum*: Slovakia, Bratislava, Devínska Kobyla, 1. 11. 2000, J. & M. Jeppson (MJ 5346). Podunajská nížina, Hurbanovo, Svätý Peter, 30. 10. 2000, J. & M. Jeppson (MJ 5328). Marcelová, Marcelovské piesky, 16. 10. 2004, M. Jeppson (MJ 7331). Révayovská pustatina, 16. 10. 2004, M. Jeppson (MJ 7336); Záhorská nížina, Lakšárska Nová Ves, 28. 6. 2008, M. Jeppson (MJ, BRA, GB). Mikulášov, road towards Plavecký Mikuláš, 22. 6. 2006, M. Jeppson (MJ7932). Rohožník, 24. 6. 2006, M. Jeppson (MJ 7941). Sekule, 19. 10. 2004, leg. M. Jeppson (MJ 7351). Veľke Leváre, by the church, 2. 10. 2005, J. & M. Jeppson (MJ 7472);
- T. giovanellae*: Hungary, Budapest, Újpest, Erzsébet utca, 7. 9. 1970, Nagy (BP); Spain, Almería, Tabernas, 22. 4. 2008, M. Jeppson (MJ).
- T. kotlabae*: Slovakia, Záhorská nížina, Borský Mikuláš, NW of village, dry sandy road verge in light pine forest, 24. 6. 2006, I. Kautmanová & al. (MJ). Lakšárska Nová Ves, "Pri čiernom piesku", road verge in sandy pine forest, 28. 6. 2008, M. Jeppson (MJ). Plavecký Mikuláš, military area along road to Mikulášov, dry sandy road verge in pine forest, 22. 6. 2006, M. Jeppson (MJ 7923, 7931). Rohožník, military area N of village, sandy soil at pine forest edge, 24. 6. 2006, I. Kautmanová & al. (MJ 7943); N of village, along road to Malacky, sandy verge in dry pine forest, 22. 6. 2006, M. Jeppson (MJ 7922). Studienka, along road to Lakšárska Nová Ves, sandy slope on road verge, 25. 6. 2006, M. Jeppson (MJ 7953); in village, road to Kúdelka, sandy road verge, 25. 6. 2006, M. Jeppson (MJ 7952).
- T. melanocyclum*: Austria, Burgenland, Breitenbrunn, Thenau, 4. 3. 1989, E. Mrazek (MJ); Czech Republic, Moravia, Mikulovská vrchovina, Děvín, 31. 10. 2000, J. & M. Jeppson (MJ 5335); Slovakia, Malé Karpaty, Plavecké Podhradie, 24. 6. 2006, leg. Lizoň & al. (MJ 7946, BRA)
- T. moravecii*: Austria, Niederösterreich, Schönfeld, 12. 12. 1982, E. Mrazek (MJ); Burgenland, Breitenbrunn, 9. 10. 2005, M. Jeppson (MJ). Spain, Zaragoza, Caspe, 27. 4. 1999, S., J. & M. Jeppson (MJ 5006).

T. pulchellum: Hungary, Bács-Kiskun, 10. 4. 2006, T. Knutsson & al. (MJ 7733).

T. squamosum: Austria, Niederösterreich, Marchegg, Schönfeldt, 18. 9. 1985, E. Mrazek (MJ); Slovakia, Bratislava, Devínska Kobyla, 7. 1. 2007, V. Kautman (BRA, MJ).

Illustrations

[2] *Tulostoma fimbriatum*, Slovakia, Záhorská nížina, Lakšárska Nová Ves, 28. 6. 2008, M. Jeppson (MJ).

[2] *Tulostoma armillatum*. Slovakia, Podunajská nížina, Bratislava, Pečniansky les, 28. 4. 1997, V. Kabát (BRA).

[2] *Tulostoma kotlabae*. Slovakia, Záhorská nížina, Rohožník, 22. 6. 2006, M. Jeppson (BRA).

[47] *Tulostoma melanocyclum*. Slovakia, Malé Karpaty, Plavecké Podhradie, 24. 6. 2006, P. Lizoň & al. (MJ 7946; BRA).

[47] *Tulostoma squamosum*. Slovakia, Bratislava, Devínska Kobyla, 7. 1. 2007, V. Kautman (BRA, herb. MJ).

(15, line drawings by M. Jeppson) Spores and details of capillitia. A. *Tulostoma armillatum*. Slovakia, Bratislava, Pečniansky les, 28. 4. 1997, V. Kabát (BRA). B. *Tulostoma brumale*. Slovakia, Bratislava, Devínska Kobyla, 2. 10. 2006, I. Kautmanová & T. Knutsson (BRA, GB). C. *Tulostoma fimbriatum*. Slovakia, Záhorská nížina, Lakšárska Nová Ves, 28. 6. 2008, M. Jeppson (MJ, BRA, GB). D. *Tulostoma giovanellae*. Spain, Almería, 22. 4. 2008, M. Jeppson (MJ). E. *Tulostoma kotlabae*. Slovakia, Záhorská nížina, Rohožník, 22. 6. 2006, M. Jeppson (MJ 7923, BRA). F. *Tulostoma melanocyclum*. Slovakia, Malé Karpaty, Plavecké Podhradie, 24. 6. 2006, P. Lizoň & al. (MJ 7946, BRA). G. *Tulostoma moravecii*. Austria, Burgenland, 9. 10. 2005, M. Jeppson (MJ). H. *Tulostoma pulchellum*. Hungary, Bács-Kiskun, 10. 4. 2006, T. Knutsson & al. (MJ). I. *Tulostoma squamosum*. Slovakia, Bratislava, Devínska Kobyla, 7. 1. 2007, V. Kautman (BRA, MJ).

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to Pavel Lizoň, Ivona and Václav Kautmanovi, Slavomir Adamčík, Viktor Kučera and Soňa Ripková for guiding me in my field work in Slovakia and for providing herbarium material and necessary literature references for previous findings of *Tulostoma* species in Slovakia. I am also grateful to Pavel Lizoň and Slavomir Adamčík (both Institute of Botany, Bratislava) for critical reading of the manuscript and for providing valuable additions. I would also like to thank Vincent Kabát for interesting discussions on *Tulostoma armillatum*. Thanks are also due to my father, Jörgen Jeppson, for participating in forays in Slovakia. Financial support from Kapten Carl Stenholms Donationsfond is gratefully acknowledged.

REFERENCES

- Altés, A., Moreno, G. & Wright, J.E. 1999. Notes on *Tulostoma volvulatum* and *T. giovanellae*. *Mycol. Res.* 103:91-98.
- Bednár, R. 2006. *Tulostoma brumale*. [www.nahuby.sk/obrazok_detail.php?obrazok_id=53352].
- Bednár, R. 2008. *Tulostoma brumale*. [www.nahuby.sk/obrazok_detail.php?obrazok_id=96644].
- Calonge, F. D. 1998. *Gasteromycetes 1. Flora Mycológica Ibérica vol. 3. Real Jardín Botánico Madrid.*
- Hollós, L. 1904. Die Gasteromyceten Ungarns. O. Weigel, Leipzig.
- Kabát, V. 1997. Nález vzácneho stopkatca hladkovýtrusného *Tulostoma fulvellum* Bres. in Petri. *Sprav. slov. mykol.* (16):10-11.
- Kirk, P.M., Cannon, P.F., David, J.C & Stalpers, J. 2001. *Ainsworth & Bisby's Dictionary of the Fungi.* CABI Bioscience, Wallingford.
- Kreisel, H. 1963. Ergänzungen und kritische Bemerkungen zur "Flora ČSR – Gasteromycetes". *Čes. Mykol.* 17:203-206.
- Kreisel, H. 1984. Die Stielboviste (Gattung *Tulostoma*) der Deutschen Demokratischen republik und Westberlins. *Hercynia*, N.F. 21:376-416.
- Kreisel, H. 1987. *Pilzflora der Deutschen Demokratischen Republik.* VEB Gustav Fischer Verlag, Jena.
- Kreisel, H. 2004. *Tulostoma pulchellum* in Brandenburg – neu für Detschland. *Z. Mykol.* 70:107-110.
- Krisai-Greilhuber, I. 1999. Rote Liste gefährdeter Großpilze Österreichs. 2. Fassung. In: Niklfeld, H. (Ed.): *Rote Listen gefährdeter Pflanzen Österreichs, 2. Auflage. Grüne Reihe des Bundesministeriums für Umwelt, Jugend und Familie* 10: 229-266.
- Lizoň, P. 2001. Červený zoznam húb Slovenska. 3. verzia (december 2001). In: Baláž, D., Marhold, K. & Urban, P. (eds.). 2001. Červený zoznam rastlín a živočíchov Slovenska. *Ochr. Prír.* 20., suppl., p. 6-13.
- Moreno, G., Altés, A. & Wright, J.E. 1992a. *Tulostoma squamosum*, *T. verrucosum* and *T. mussooriense* are the same species. *Mycotaxon* 43:61-68.
- Moreno, G., Altés, A. & Wright, J.E. 1992b. *Tulostoma pseudopulchellum* sp. nov. (Tulostomatales, Gasteromycetes) and allied species. *Mycotaxon* 43:479-486.
- Moreno, G., Altés, A., Ochoa, C. & Wright, J. 1995. Contribution to the study of Tulostomataceae in Baja California, Mexico . I. *Mycologia* 87:96-120.
- Moreno, G., Kreisel, H. & Altés, A. 2000. Notes on the genus *Tulostoma* in H. Kreisel's Herbarium. *Cryptogamie, Mycol.* 22:57-66.
- Mrazek, E., Krisai-Greilhuber, I. & Hausknecht, A. 1995. Bemerkenswerte epigäische Gasteromyceten-Funde aus Österreich. *Öster. Z. Pilzk.* 4:11-33.
- Nagy, L. & Babos, M. 1969. Egy ritka nyelöpöfeteg faj előfordulása Magyarországon, a *Tulostoma giovanellae* Bres.. *Mikol. Közlem.* 1969:115-122.
- Orthová, V. & Kabát, V. 1997. Stopkatec šupinatý *Tulostoma squamosum* Gmel.: Pers. na Devínskej Kobyle. *Sprav. slov. mykol.* (16): 9.
- Pouzar, Z. 1958. *Tulostoma*. In: Pilát, A. (ed.). *Gasteromycetes – Houby bříchatky.* Flora ČSR B-1. Nakladatelství Československé akademie věd, Praha.

Roučka, O. 2006. *Tulostoma brumale*.

[www.nahuby.sk/obrazok_detail.php?obrazok_id=51527].

Škubla, P. 1993. Nové náleziská vzácných húb z rodu stopkovec (*Tulostoma*).

Sprav. slov. mykol. (2): 9.

Škubla, P. 1995. Vzácnější nálezy z roku 1994. *Sprav. slov. mykol.* (7): 25-27.

Škubla, P. 1996. Vzácnější nálezy roku 1995. *Sprav. slov. mykol.* (13): 25-26.

Sunhede, S. 1976. Spore liberation in *Tulostoma* (Gasteromycetes). *Windahlia* 5-6: 68-70.

Winterhoff, W. 2000. Epigäische Gasteromycetanae. In: Krieglsteiner, G. J.: Die Grosspilze Baden-Württembergs Bd. 2. Stuttgart.

Zita, V. 2004. *Tulostoma kotlabae*.

[www.nahuby.sk/obrazok_detail.php?obrazok_id=3384].

Mikael Jeppson: Rod stopkovec (*Tulostoma*) na Slovensku.

Catathelasma (9): 5-19, 2008.

Deväť druhov rodu *Tulostoma* (*T. brumale*, *T. fimbriatum*, *T. fulvellum*, *T. giovanellae*, *T. kotlabae*, *T. melanocyclum*, *T. moravecii*, *T. pulchellum* and *T. squamosum*), ktoré sa vyskytujú na Slovensku a v priľahlých oblastiach Rakúska a Českej republiky je opísaných a vyobrazených.

BOOK NOTICES

Ivan Jarolímek and Jozef Šibík. 2008. **Vegetation of Slovakia. Diagnostic, constant and dominant species of higher vegetation units of Slovakia.** [1]-329, Veda, Bratislava. ISBN 978-80-224-1024-3. Price not indicated (buy from the publisher www.veda.sav.sk, for exchange contact the librarian of the Institute of Botany at eva.zaletova@savba.sk).

The book represents a statistical revision of plantsociological data that have been collected in the Slovak National Vegetation Database (SNVD). Affinities of vascular plants, bryophytes and lichens to major syntaxa were calculated by the statistically defined coefficient of fidelity.

Similar summarizing study was published for the Czech republic by Chytrý and Tichý (2003).

For characteristics of biotopes and plant communities in Slovakia see the catalogue (Stanová & Valachovič, 2002) and the outline of important biotopes (Viceníková & Polák, 2003), both published in Slovak by the NGO Daphne.

Previous volumes in the series *Vegetácia Slovenska / Vegetation of Slovakia*:

pioneer vegetation: M. Valachovič (ed.). 1995. *Rastlinné spoločenstvá Slovenska. Vol.1. Pionierska vegetácia.* Veda, Bratislava.

synanthropic vegetation: I. Jarolímek & al. 1997. *Rastlinné spoločenstvá Slovenska. Vol. 2. Synantropná vegetácia.* Veda, Bratislava.

vegetation of wetlands: M. Valachovič (ed.). 2001. *Rastlinné spoločenstvá Slovenska. Vol. 3. Vegetácia mokradí.* Veda, Bratislava.

high-mountain vegetation: J. Kliment & M. Valachovič (eds.). 2007.

Rastlinné spoločenstvá Slovenska. Vol. 4. Vysokohorská vegetácia. Veda, Bratislava.

References:

Chytrý, M. & L. Tichý. 2003. Diagnostic, constant and dominant species of vegetation classes and alliances of the Czech Republic: a statistical revision. *Folia Fac. Sci. Nat. Univ. Masaryk. Brun., Biol.*, 108: 1–231.

Viceníková, A. & P. Polák (eds.). 2003. *Európsky významné biotopy na Slovensku.* Daphne, Banská Bystrica.

Stanová, V. & M. Valachovič (eds.). 2002. *Katalóg biotopov Slovenska.* Daphne, Bratislava.

NOTES ON SOME RECENT RECORDS OF GASTEROMYCETES IN SLOVAKIA

MIKAEL JEPPSON³

Key words: Geastraceae, Lycoperdaceae, Sclerodermataceae, Tulostomataceae, endangered taxa, new records

The Flora ČSR volume on Gasteromycetes edited by Pilát (1958) constitutes a base for the knowledge of those fungi in Slovakia. However, since its appearance 50 years ago, only scattered records of Slovak Gasteromycetes have been published and the current status of several species is unknown. Some recent publications on Gasteromycetes in Slovakia are those of Adamčík & Ripková (2006), Jeppson (2006), Jeppson & Piątek (2005), Kabát (1996, 1997), Lizoň (2006), Orthová & Kabát (1997), Škubla (1993, 1995, 1996, 1998) and Záhrovská & Lišková (1996).

However on a European scale several Gasteromycetes seem to have declining populations, mainly due to habitat loss, and some species are hence nationally redlisted in the countries where they occur, or they may be candidates for a pan-European redlist now on in progress. In Slovakia 14 species of Gasteromycetes in a wide sense are redlisted (Lizoň 2001).

The present paper is a summing up of some new or interesting records of epigaeal gasteromycetes made during field studies by the author in southern and western Slovakia in 2000, 2004, 2005, 2006 and 2008. 26 species of Gasteromycetes belonging to Geastraceae (Phallales), Lycoperdaceae (Agaricales), Sclerodermataceae (Boletales) and Tulostomataceae (Agaricales) are listed, four of which are currently redlisted in Slovakia. Five species (*Bovista furfuracea*, *Geastrum kotlabae*, *G. lageniforme*, *Lycoperdon norvegicum* and *Scleroderma areolatum*) does not seem to have previous records from Slovakia.

MATERIAL AND METHODS

Macromorphological features were studied under a dissecting microscope. Microscopic studies were conducted in a light microscope Leitz. Spores and capillitia were mounted in Lactophenol + Cotton blue and heated to boiling for about a second. Collections are deposited in BRA or GB or in the author's private herbarium of Mikael Jeppson (MJ).

³ Lilla Håjumsgatan 4, SE-461 35 Trollhättan; jeppson@svampar.se

ANNOTATED SPECIES LIST

***Bovista aestivalis* (Bon.) Demoulin**

= *B. polymorpha* (Vitt.) Kreisel, *Lycoperdon ericetorum* Pers. var. *ericetorum*

Bovista aestivalis is a frequent puffball in dry and warm situations all over Europe. It is easily recognized by its compact and cottony, often yellowish subgleba (in section) and its orange or copper peridium colours at the base of the mature fruiting body. The spores are smooth to faintly punctuate. In Slovakia Šmarda (1958) recorded it as *Lycoperdon ericetorum* var. *ericetorum* from several sites. Lizoň (2006) reported it from Strážovské vrchy Mts. Hagara (1992) and Hagara & al (2005) published photos of it (as *B. polymorpha*) from Marcelová (Podunajská nížina). It appears to be a fairly frequent species of open situations and pine forest margins as well as along sandy road tracks in pine forests.

Záhorská nížina: Borský Svätý Jur, "pri Krúžku", sandy road verge in pine forest, 30. 10. 2000, leg. J. & M. Jeppson (MJ 5311). Gajary, 1.5 km N of village, sandy grassland, 29. 10. 2000, leg. J. & M. Jeppson (MJ 5303).

Jakubov, by the lake, sandy road verge, 23. 6. 2006, leg. M. Jeppson (MJ 7938). Kostolište, sandy road verge at pine forest edge, 23. 6. 2006, leg. M. Jeppson (MJ 7939). Lakšárska Nová Ves, sandy road verge in pine forest, 30. 10. 2000, leg. J. & M. Jeppson (MJ 5318); 17. 10. 2004, leg. M. Jeppson (MJ 7344, 7352). Malacky, military training field SE of Malacky, "Pastvisko", Široká, dry sandy grassland, 4. 10. 2005, leg. T. Knutsson, J. & N. Jeppson (MJ 7516). Moravský Svätý Ján, Borová, sand dune, 19. 10. 2004, leg. I. Kautmanová & M. Jeppson (MJ 7357, 7364, 7366); Coryneporetum, 2. 10. 2005, leg. I. Kautmanová, T. Knutsson, J. & M. Jeppson (MJ 7484); Coryneporetum, 25. 6. 2006, leg. M. Jeppson & Meeting of Czech and Slovak Mycologists (MJ). Moravský Svätý Ján, Dúbrava, dry, sandy pine forest, 30. 10. 2000, leg. J. & M. Jeppson (MJ 5306). Plavecký Mikuláš, military area along road to Mikulášov, sandy road verge in pine forest, 22. 6. 2006, leg. M. Jeppson (7930). Rohožník, N of village, along road in sandy thermophilous pine forest, 22. 6. 2006, leg. M. Jeppson (MJ 7920); sandy soil at pine forest edge, 24. 6. 2006, leg. I. Kautmanová, S. Ripková, V. Kučera, S. Adamčík, P. Lizoň & M. Jeppson (MJ 7940). Šaštín, "pri Dube", Coryneporetum, 30. 10. 2000, leg. J. & M. Jeppson (MJ 5315). Studienka, along road to Lakšárska Nová Ves, Coryneporetum at pine forest edge, 25. 6. 2006, leg. M. Jeppson (MJ 7955). Závod, S of railway station, along path in sandy pine forest, 3. 10. 2005, leg. T. Knutsson, J. & M. Jeppson (MJ 7488).

Podunajská nížina: Marcelová, Marcelovské piesky, 30. 10. 2004, leg. K. Bergelin, K. & A. Bohlin, S.-Å. Hanson, T. Knutsson & M. Jeppson (MJ 7328, 7329, 7330).

***Bovista furfuracea* (J. F. Gmelin) Pers.**

= *B. pusilla* (Batsch) Pers. p. p sensu auct.

B. furfuracea is a small (0.5-1.5 cm in diameter) subglobose puffball, lacking a subgleba. Its capillitium is of *Lycoperdon*-type throughout and its spores are globose, and faintly warted. Šmarda (1958) treated this species as *Lycoperdon ericetorum* var. *pusillum* and reported it from a few sites in Czechia and Moravia. It is a widely distributed species on the European continent and it reaches its northernmost outposts in Fennoscandia. It is a species characteristic of open and dry sandy sites as well as dry meadow vegetation. The nomenclatorial situation is somewhat confusing as it has traditionally been treated as *Bovista pusilla*. However *B. pusilla* was recently divided in two separate taxa, *B. furfuracea* and *B. dermoxantha* and the name *B. pusilla* was abandoned (Moyersoen & Demoulin, 1996). As a result of a recent molecular study of Lycoperdaceae (Larsson & Jeppson, 2008) *B. dermoxantha* was placed in *Lycoperdon* as *Lycoperdon dermoxanthum* (cfr below).

Záhorská nížina: Gajary, Vel'ký Piesok, 2000. Corynephorretum, 29. 10. 2000, leg. J. & M. Jeppson (MJ 5289). Jakubov, lake shore S of village, dry, sandy grassland, 28. 10. 2000, leg. J. & M. Jeppson (MJ 5289). Malacky, military training field SE of Malacky, "Pastvisko", Široká, dry sandy grassland, 4. 10. 2005, leg. T. Knutsson, J. & M. Jeppson (MJ 7509, 7517). Plavecký Mikuláš, military area along road to Mikulášov, dry sandy grassland, 3. 10. 2005, leg. T. Knutsson, J. & M. Jeppson (MJ 7499, 7509).

***Bovista tomentosa* (Vitt.) De Toni**

A small and dark brown, subglobose puffball without subgleba. Like the common and widely distributed *B. plumbea* it has a dichotomously branched capillitium and spores with pedicel. It differs from *B. plumbea* by the colour of the inner peridium and by the fact the the fruiting bodies are not wind blown at maturity. Šmarda (1958) gave Slovak records from few places. Lizoň (2006) reported it from Strážovské vrchy Mts. It is a characteristic species in xerothermic situations on calcareous sand and in rupicolous steppe vegetation. It has a wide European distribution being recorded from the Mediterranean vegetation all the way north to Fennoscandia and Iceland (Kreisel, 1967).

Malé Karpaty: Plavecké Podhradie, dry calcareous grassland on mountain slope, 24. 10. 2006, leg. I. Kautmanová, S. Ripková, V. Kučera, S. Adamčík, P. Lizoň & M. Jeppson (MJ 7948).

***Calvatia candida* (Rostk.) Hollós**

VU

Calvatia candida is characterized by subglobose fruiting bodies rarely exceeding 4 cm in diameter provided with a prominent rhizomorph and an endoperidium breaking up irregularly at maturity, exposing an olivaceous brown gleba. Its spores are strongly warted and its capillitium is fragile and provided with numerous septa. Its European distribution is confined to xerothermic habitats in continental and Mediterranean regions. It is considered a declining species all through its European distribution range due to habitat loss by decreasing or ceased grazing. It is redlisted in Slovakia (VU: Lizoň, 2001), the Czech Republic (EN: Holec & Beran, 2006), Poland (endangered: Wojewoda & Ławrynowicz, 2004) and Germany (Benkert & al., 1992). Šmarda (1958) reported it from several places in Slovakia but there seem to be no recent records.

Záhorská nížina: Malacky, military training field SE of Malacky, "Pastvisko", Široká, dry sandy grassland, 4. 10. 2005, leg. T. Knutsson, J. & N. Jeppson (MJ 7513).

***Calvatia fragilis* (Vitt.) Morg.**

LR: nt

= *C. lilacina* (Berk. & Mont.) P. Henn.

Although larger in size, this is a species of similar habitats as *C. candida*. It has the morphological habitus of the common *Lycoperdon utriforme* (*Handkea utriformis*) but is readily distinguished by a violet gleba and strongly warted spores when mature. There are scattered Central European records and it seems to be rare and potentially declining due to habitat loss by decreasing or ceased grazing. It is however still fairly frequent in the Mediterranean area. It is redlisted in Slovakia as potentially threatened (LR: nt: Lizoň, 2001). In the Czech Republic it is thought to be extinct (Holec & Beran, 2006). Šmarda (1958) recorded it as *Calvatia lilacina* from few sites in SW Slovakia. The sample from Moravský Svätý Ján was later revised and re-determined as *C. candida* (Kreisel, 1963). Our only recent Slovak record of *Calvatia fragilis* however refers to a single, beautifully violet specimen from a dry sandy grassland in Moravský Svätý Ján in October 2005.

Záhorská nížina: Moravský Svätý Ján, Borová, dry sandy grassland, 2. 10. 2005, leg. I. Kautmanová, T. Knutsson, J. & M. Jeppson (MJ 7475).

***Disciseda bovista* (Klotzsch) P. Henn.**

The genus *Disciseda* is represented in East and Central Europe by three species: *D. bovista*, *D. candida* (syn. *D. calva*) and *D. verrucosa* (= *D. arida*). *D. bovista* is the largest of the three, presenting subglobose fruiting bodies up to 4 cm in diameter, often with greyish-brownish peridial colours when mature. Its spores are strongly warted and 5-7 µm in diameter. Its close relative *D. verrucosa* is to date only from the Czech Republic (Stránčice in 1934 and Čelákovice in 1953), Slovakia (Slovenské Nové Mest in 1950) according to Moravec (1958, as *D. arida*) and central Spain (Moreno & al., 2003). It strongly resembles *D. bovista* in macroscopical features but differs in larger spore size. It should be subject to a dedicated search at Tarbucka and the surrounding area. Moravec (1958) noted that *D. bovista* was widely distributed in the former Czechoslovakia. From Slovakia he recorded it from several sites in the South. *D. bovista* is widely distributed in Europe but is redlisted or suggested for redlisting in a number of European countries due to habitat loss.

Záhorská nížina: Gajary, Veľký Piesok, Corynephoretum, 20. 10. 2000, leg. J. & M. Jeppson (MJ 5298). Jakubov, by the lake, sandy ruderal grassland, 26. 6. 2006, leg. M. Jeppson (MJ 7936). Lakšárska Nová Ves, ruderal grassland with garden refuse in sandy pine forest, 3. 10. 2005, leg. M. Jeppson (MJ 7497). Moravský Svätý Ján, Borová, Corynephoretum, 19. 10. 2004, leg. I. Kautmanová & M. Jeppson (MJ 7356, 7361, 7377); Corynephoretum, 3. 10. 2005, leg. I. Kautmanová, T. Knutsson, J. & M. Jeppson (MJ 7480); Corynephoretum at pine forest edge, 25. 6. 2006, leg. 14th Meeting of Czech & Slovak mycologists & M. Jeppson (MJ).

Podunajská nížina: Marcelová, Marcelovské piesky, sandy grassland, 16. 10. 2004, leg. K. Bergelin, K. & A. Bohlin, S.-Å. Hanson, T. Knutsson & M. Jeppson (MJ 7324, 7325).

***Disciseda candida* (Schwein.) Lloyd**

This is the more common of the European *Disciseda* species. It is characterized by small (1-1.5 cm in diameter) greyish fruiting bodies which may easily be misidentified as either *D. bovista* or even *Bovista plumbea*. *D. candida* has a wide European distribution but is nevertheless redlisted or suggested for redlisting in several European countries. Moravec (1958) noted Slovak records from only few places.

Záhorská nížina: Borský Svätý Jur, "pri Krúžku", sandy road verge in pine forest, 22. 6. 2006, leg. J. & M. Jeppson (MJ 7933). Gajary, Veľký

Piesok, Corynephorum, 29. 10. 2000, leg. J. & M. Jeppson (MJ 5299, 5300); Gajary, 1.5 km N of village, dry sandy grassland, 29. 10. 2000, leg. J. & M. Jeppson (MJ 5304); Radlica, 2006.06.21, dry, sandy road verge at pine forest edge, leg. M. Jeppson (MJ 7915). Moravský Svätý Ján, Borová, Corynephorum, 3. 10. 2005, leg. I. Kautmanová, T. Knutsson, J. & M. Jeppson (MJ 7483); Corynephorum at pine forest edge, 25. 6. 2006, leg. 14th Meeting of Czech & Slovak mycologists & M. Jeppson (MJ). Plavecký Mikuláš, military area along road to Mikulášov, 22.6.2006, sandy road verge in pine forest, leg. M. Jeppson (MJ 7929). Rohožník, military area N of village, sandy soil at pine forest edge, 24. 6. 2006, leg. I, Kautmanová, S. Ripková, V. Kučera, S. Adamčík, P. Lizoň & M. Jeppson (MJ 7944). Šaštín, "pri Dube", Corynephorum, 30. 10. 2000, leg. J. & M. Jeppson (MJ 5316, 5317). Sekule, by the lake, sandy grassland, 19. 10. 2004, leg. M. Jeppson (MJ 7371, 7375). Závod, by the lake SW of railway station, along road track in sandy grassland, 27. 6. 2008, leg. M. Jeppson (MJ).

Podunajská nížina: Marcelová, Marcelovské Piesky, sandy grassland, 16. 10. 2004, leg. K. Bergelin, K. & A. Bohlin, S.-Å. Hanson, T. Knutsson & M. Jeppson (MJ 7326).

***Geastrum berkeleyi* Massee – VU**

p. [1]

This is a rare non-hygroscopic earth star characterized by slightly reddish brown fruiting bodies with a rough, sand paper-like endoperidium and a delimited, sulcate peristome. It has a wide European distribution but is nevertheless considered redlisted in several European countries. According to Sunhede (1989) it is recorded in forests as well as on open grazed ground, preferably on calcareous soil. In Slovakia it is classified as vulnerable (VU: Lizoň, 2001) whereas in the Czech Republic it is considered critically endangered (CR: Holec & Beran, 2006). Staněk (1958) treated the species in two varieties, viz. var. *berkeleyi* and var. *continentale*. The former was reported only from Roztoky near Prague (Czechy) in 1913 and the latter from Brno (Morava) in 1949 and 1955 and from Južné Biele Karpaty Mts. in Slovakia in 1877 (cfr. Hollós 1899, 1904). Sunhede (1989) considered var. *continentale* a synonym of *G. berkeleyi* s. str. Kotlaba (1995) reported *G. berkeleyi* from Bajč and Konkol' in Podunajská nížina Lowland and Brezová pod Bradlom in the Myjavská pahorkatina hills. Dermek (1977) also reported it (as var. *continentale*) from Podunajská nížina. It is apparently an extremely rare species in Slovakia with few recent records. In our experience we know it from one single Slovak locality in the Záhorská nížina, where fresh fruiting bodies have abounded in 2004, 2005 and 2006. The habitat is a

ruderal site (less than 20 m²) with wood chips and garden refuse at the edge of a sandy pine forest at the outskirts of a village. Several species of *Geastrum* as well as *Disciseda candida* and *Tulostoma fimbriatum* occur on the same spot (cfr below).

Záhorská nížina: Lakšárska Nová Ves, ruderal grassland with garden refuse and wood chips in sandy pine forest, 17. 10. 2004, leg. K. Bergelin, K. & A. Bohlin, S.-Å. Hanson, T. Knutsson & M. Jeppson (MJ 7347); 3. 10. 2005, leg. T. Knutsson, J. & M. Jeppson (MJ 7494); 24. 6. 2006, leg. I. Kautmanová, S. Ripková, V. Kučera, S. Adamčík, P. Lizoň & M. Jeppson (MJ).

***Geastrum campestre* Morgan**

Similar to *G. berkeleyi* this earth star has a rough endoperidium and a delimited, sulcate-furrowed peristome. The exoperidial rays however are hygroscopic but rarely cover the whole endoperidium. It is a species of continental, dry, open areas, often along sandy roads and paths in pastures or at forest edges. It is widely distributed in south and central Europe but appears on the redlists of several European countries due to a potential habitat loss when grazing is abandoned. In the Czech Republic it is considered endangered (EN: Holec & Beran, 2006). Staněk (1958) recorded it from Ipeľsko-rimavská brázda and from Záhorská nížina (Malacky, Veľke Leváre add Kostolište, cfr. Kotlaba, 1955, Staněk, 1952). According to literature there seem to be no recent reports of its occurrence in Slovakia. Zíta (2004a) however published a photo of it from the Podunajská nížina (Svätý Peter, 17. 9. 2001). During our field work we have observed it in the Záhorská nížina on two sites, both on south facing sandy road verges at pine forest margins.

Záhorská nížina: Borský Svätý Jur, "pri Krúžku", sandy road verge in pine forest, 3. 10. 2000, leg. J. & M. Jeppson (MJ 5313). Láb, sandy road track in pine forest, 21. 6. 2006, leg. M. Jeppson (MJ 7911).

***Geastrum floriforme* Vitt.**

p. [4á]

Geastrum floriforme is a small earth star characterized by strongly hygroscopic exoperidial rays and a smooth to fimbriate, non-delimited peristome. It has a wide European distribution ranging from the Mediterranean area north to the boreal vegetation zone (Carlsson & al., 2008, Sunhede, 1989). Staněk (1958) reported it from several localities in Bohemia and Moravia. From Slovakia he noted it from localities around Malacky in Záhorská nížina (cfr. Kotlaba 1955) and from Ipeľsko-

rimavská brázda. Zíta (2004b) reported it on the Internet with a photo from Marcelová (Podunajská nížina) in 2001.

Záhorská nížina: Jakubov, by the lake, sandy grassland under *Populus*, 23. 6. 2006, leg. M. Jeppson (MJ 7937). Lakšárska Nová Ves, "Pri čiernom piesku", sandy road verges in pine forest, 28. 6. 2008, leg. M. Jeppson (MJ).

***Geastrum kotlabae* Pouzar**

Geastrum kotlabae is yet another hygrosopic earth star, morphologically reminding of *G. floriforme* from which it is easily distinguished by having a strongly sulcate-furrowed peristome. It differs from *G. campestre* in its smaller size and in having a sessile and less asperulate endoperidium. It was described by Staněk (1958) based on a Hungarian collection but up to now there seems to be no published records from Slovakia. In Europe it is known only from sandy habitats in Central Hungary (Hollós, 1904 and herb. MJ), from a not verified finding in the vicinity of Halle in Germany (Kreisel, 1987) and from Spain (Calonge, 1998 and herb. MJ). In connection with our field work in the Záhorská nížina it was met with once in a ruderal habitat with wood chips and garden refuse at the outskirts of a village (cfr *G. berkeleyi*). On a European scale it is a species with a very small and fragmented population and it should be considered for national redlists in the countries where it occurs. It should also be highlighted in the efforts to accomplish a pan-European redlist.

Záhorská nížina: Lakšárska Nová Ves, ruderal grassland with garden refuse and wood chips in sandy pine forest, 17. 10. 2004, leg. K. Bergelin, K. & A. Bohlin, S.-Å. Hanson, T. Knutsson & M. Jeppson (MJ 7346).

***Geastrum lageniforme* Vitt.**

This earthstar is characterized by a delimited and fimbriate peristome and long and narrow rays of the exoperidium. It is closely related to *G. saccatum* from which it can be distinguished by the longer and more acute exoperidial rays, the shape of the basidia and the lack of clamp connections in the outer part of the mycelial layer of the exoperidium (Sunhede, 1989). The outside of the exoperidium is smooth and usually longitudinally striate. It has a wide distribution in south and central Europe but as the morphological differences towards *G. saccatum* are rather unclear, it might frequently have been misidentified. A number of records of *G. lageniforme* may thus refer to the much more frequent *G. saccatum*. A future analysis of DNA sequences combined with a thorough

morphological study will prove necessary to clarify the matter. Staněk (1958) gave no Slovak records of *G. lageniforme* but reported it from adjacent regions of E Moravia (Czech Republic). It is redlisted as critically endangered (CR) in the Czech Republic (Holec & Beran, 2006).

Podunajská nížina: Hurbanovo, Révayovská pustatina, in Robinietum, 16. 10. 2004, leg. K. Bergelin, K. & A. Bohlin, S.-Å. Hanson, T. Knutsson & M. Jeppson (MJ 7337).

***Geastrum minimum* Schw.**

Geastrum minimum is a small, non-hygroscopic earth star with pale colours of the exoperidium and a greyish endoperidium with a crystalline cover. The peristome is distinctly delimited, smooth or fibrillose, never sulcate. It has a wide distribution in Europe ranging from the Mediterranean area all the way up in the actic-alpine vegetation (Sunhede, 1989). Staněk (1958) reported it from several sites. Lizoň (2006) reported it from Strážovské vrchy Mts. In our experience it has scattered occurrences in dry sandy habitats as well as in calcareous dry grasslands.

Záhorská nížina: Lakšárska Nová Ves, ruderal grassland with garden refuse and wood chips in sandy pine forest, 17. 10. 2004, leg. K. Bergelin, K. & A. Bohlin, S.-Å. Hanson, T. Knutsson & M. Jeppson (MJ 7350); 24. 5. 2006, leg. I. Kautmanová, S. Ripková, V. Kučera, S. Adamčík, P. Lizoň & M. Jeppson (MJ). Plavecký Mikuláš, military area along road to Mikulášov, sandy road verge in pine forest, 22. 6. 2006, leg. M. Jeppson (7928); 3. 10. 2005, in sandy Pinus- Quercus forest and in Corynephorum, leg. T. Knutsson, J & M. Jeppson (MJ); 6. 10. 2005, dry sandy road verge, leg. T. Knutsson, J. & M. Jeppson (MJ 7533).

Malé Karpaty: Plavecké Podhradie, dry calcareous grassland on southfacing mountain slope, 24. 6. 2006, leg. I. Kautmanová, S. Ripková, V. Kučera, S. Adamčík, P. Lizoň & M. Jeppson (MJ 7947).

***Geastrum pseudolimbatum* Hollós**

A rare species closely related to the more frequent *G. coronatum* from which it differs in having more or less hygroscopic exoperidial rays, a warted endoperidium with a more or less delimited peristome. On a European scale it is a rare species confined to areas with a dry and warm climate. It has a fragmented distribution ranging from the Mediterranean area north to the nemoral vegetation zone in southern Fennoscandia. Staněk (1958) recorded it from a single locality in Czechia and for Slovakia from a number of sites in Záhorská nížina (Malacky, Veľke

Leváre and Borský Svätý Mikuláš, cfr Kotlaba, 1955, Staněk, 1952). In the Czech Republic it is regarded as potentially extinct (Holec & Beran, 2006) but in Slovakia there are is a recent unverified record from Devínska Kobyla near Bratislava (Záhorovská & Lišková, 1996). We can add two recent records from the Záhorská nížina.

Záhorská nížina: Lakšárska Nová Ves, ruderal grassland with garden refuse and wood chips in sandy pine forest, 17. 10. 2004, leg. K.

Bergelin, K. & A. Bohlin, S.-Å. Hanson, T. Knutsson & M. Jeppson (MJ 7348); 3. 10. 2005, leg. T. Knutsson, J. & M. Jeppson (MJ 7495), 24. 6. 2006, leg. I. Kautmanová, S. Ripková, V. Kučera, S. Adamčík, P. Lizoň & M. Jeppson (MJ 7950); "Pri čiernom piesky", sandy road verge in pine forest, 28. 6. 2008, leg. M. Jeppson (MJ).

***Geastrum schmidelii* Vitt.**

= *Geastrum nanum* Pers.

A small non-hygroscopic earth star with a smooth endoperidium and a distinctly sulcate-furrowed peristome. Staněk (1958) divided the species (as *G. nanum*) in two varieties, var. *nanum* and var. *coniferarum*. Sunhede (1989) could however not find any reliable discriminating characters between the two varieties. It is a widespread species of dry calcareous grasslands, sand dunes and sand fields all over Europe. It generally grows amongst low herbs, grasses, mosses and lichens. It is favoured by trampling and grazing by animals and is hence potentially threatened by changing agricultural methods, including ceased grazing. According to Staněk (1958, as *G. nanum* var. *nanum* and var. *coniferarum*) it is widespread in the former Czechoslovakia. From Slovakia he recorded it from Záhorská nížina (cfr. Kotlaba, 1955), Podunajská nížina (cfr. Šmarda, 1950) and Ipel'sko-rimavská brázda. According to literature there seems to be no recent Slovak records of it, although it has been recently reported with photos on the Internet from Chtelnica (Komár, 2007) and Štiavnické vrchy Mts. (Walterová, 2006).

Záhorská nížina: Lakšárska Nová Ves, ruderal grassland with garden refuse and wood chips in sandy pine forest, 17. 10. 2004, leg. K.

Bergelin, K. & A. Bohlin, S.-Å. Hanson, T. Knutsson & M. Jeppson (MJ 7349); 24. 6. 2006, leg. I. Kautmanová, S. Ripková, V. Kučera, S. Adamčík, P. Lizoň & M. Jeppson (MJ). Moravský Svätý Ján, Borová, dry sandy grassland, 3. 10. 2005, leg. I. Kautmanová, T. Knutsson, J. & M. Jeppson (MJ 7476). Plavecký Mikuláš, military area along road to Mikulášov, dry sandy road verge in pine forest, 22. 6. 2006, leg. M. Jeppson (MJ 7925).

Podunajská nížina: Chotín, Chotínské piesky, dry sandy grassland, 30. 10. 2000, leg. J. & M. Jeppson (MJ 5325). Hurbanovo, Révayovská pustatina, sandy road verge, 16. 10. 2004, leg. K. Bergelin, K. & A. Bohlin, S.-Å. Hanson, T. Knutsson & M. Jeppson (MJ 7335). Marcelová, Marcelovské piesky, sandy grassland, 16. 10. 2004, leg. K. Bergelin, K. & A. Bohlin, S.-Å. Hanson, T. Knutsson & M. Jeppson (MJ 7334).
Malé Karpaty: Bratislava, Devínska Kobyla, sandy grassland, 1. 11. 2000, leg. J. & M. Jeppson (MJ 5343).

***Lycoperdon dermoxanthum* Vitt.**

p. [48]

= *Lycoperdon hungaricum* Hollós, *Bovista dermoxantha* (Vitt.) De Toni
A small subglobose and often somewhat flattened puffball characterized by its radially wrinkled or furrowed base and the presence of a minute, whitish subgleba (in section) when fully mature. The spores are distinctly warted. Šmarda (1958) recorded it as *Lycoperdon hungaricum* and gave a Slovak record from the Záhorská nížina (Malacky). We have found it to be one of the more characteristic and frequent species of acidic, open sand and sandy grassland in some parts of the Záhorská nížina and we have notes of it from early summer all through to October.

The nomenclatoric situation of *L. dermoxanthum* is somewhat confusing. It was segregated (as *Bovista dermoxantha*) by Moyersoen & Demoulin (1996) from what had traditionally been known as *Bovista pusilla*. The Belgian authors found the name *B. pusilla* ambiguous and abandoned it in favour of *B. furfuracea* for a well defined species which is still retained in the genus *Bovista* (cfr Larsson & Jeppson, 2008), characterized by small globose fruiting bodies lacking a subgleba (cfr above).

Záhorská nížina: Borský Svätý Jur, "pri Krúžku", sandy road verge in pine forest, 22. 6. 2006, leg. J. & M. Jeppson (MJ 7934). Gajary, Radlica, sandy road track at edge of pine forest, 21. 6. 2006, leg. M. Jeppson (MJ 7914). Kostolište, W of village, open acidic sand on inland sand dune, 20. 10. 2000, leg. J. & M. Jeppson (MJ 5293, 5294, 5295); 17. 10. 2004, leg. T. Knutsson, J. & M. Jeppson (MJ 7354). Láb, road verge in sandy pine forest with Robinia, 28. 10. 2000, leg. J. & M. Jeppson (MJ 5287). Malacky, military training field SE of Malacky, "Pastvisko", Široká, 4. 10. 2005, dry sandy grassland, leg. T. Knutsson, J. & N. Jeppson (MJ 7513). Moravský Stätý Jan, Borová, Coryneporetum, 10. 19. 2004, leg. I. Kautmanová, K. Bergelin, K. & A. Bohlin, S.-Å. Hanson, T. Knutsson & M. Jeppson (MJ 7358); 2. 10. 2005, Coryneporetum, leg. I. Kautmanová, T. Knutsson, J. & M. Jeppson (MJ 7479); 25. 6. 2006, Coryneporetum at pine forest edge, leg. 14th Meeting of Czech & Slovak mycologists & M.

Jeppson (MJ). Plavecký Mikuláš, military area along road to Mikulášov, sandy road verge in pine forest, 10. 7. 2004, leg. K. Bergelin, K. & A. Bohlin, S.-Å. Hanson, T. Knutsson & M. Jeppson (MJ 7342). Studienka, along road to Lakšárska Nová Ves, Corynephorretum at pine forest edge, 25. 6. 2006, leg. M. Jeppson (7956).

Podunajská nížina: Marcelová, Marcelovské Piesky, 16. 10. 2004, leg. K. Bergelin, K. & A. Bohlin, S.-Å. Hanson, T. Knutsson & M. Jeppson (MJ 7376).

***Lycoperdon ericaeum* Bon.**

A turbinate or cylindrical puffball with a greyish-brownish (more or less “café au lait”) colour and minute and slender, convergent and persistent exoperidial spines at maturity. Its spores are distinctly warted and its capillitium is usually frequently septated and has numerous small pores in its walls. It is characteristic of acidic sandy heathland habitats as well as of dry, unfertilized grasslands in North and Central Europe. Demoulin (1971) recorded it from seven localities in the former Czechoslovakia but included var. *subareolatum*, a taxon different from our concept of *L. ericaeum* (= var. *ericaeum* in the sense of Demoulin, 1971). *Lycoperdon ericaeum* var. *subareolatum* is typical of moist meadows and wet forests and is often found among *Sphagnum*. Šmarda (1958) treated this taxon as *L. muscorum* and reported it from mountainous regions of Slovakia. *L. ericaeum* s. str., the species of dry, sandy heathland, was however recorded by Kreisel (1963) from the Záhorská nížina. We can add one recent record from the same region.

Záhorská nížina: Plavecký Mikuláš, military area along road to Mikulášov, Pinus-Quercus forest on acidic sand, 3. 10. 2005, leg. T. Knutsson, J. & M. Jeppson (MJ 7705, 7506, 7507, 7508).

***Lycoperdon marginatum* Vitt.**

p. [47]

= *Lycoperdon candidum* Pers. s. auct.

A conspicuous puffball which is easy to recognize. In young stages it is provided with groups of snow-white spines with their tips more or less convergent; later these spines fall off in groups or flakes to expose a velvety, brownish endoperidium. It is a species of dry acidic heathland and sandy pine forest habitats in continental Europe and the Mediterranean area. It is considered critically endangered in Germany (Benkert & al., 1992) and endangered in Poland (Wojewoda & Ławrynowicz, 2004) and the Czech Republic (Holec & Beran, 2006). From Slovakia, Šmarda (1958) recorded it as *L. candidum* from only two

sites: Plavecký Štvrtok and Sekule in the Záhorská nížina. We have met with it in two recent sites in the same region.

Záhorská nížina: Plavecký Mikuláš, military area along road to Mikulášov, Pinus-Quercus forest on acidic sand, 17. 10. 2004, leg. K. Bergelin, K. & A. Bohlin, S.-Å. Hanson, T. Knutsson & M. Jeppson (MJ 7341); 3. 10. 2005, leg. T. Knutsson, J. & M. Jeppson (MJ 7503). Závod, S of railway station, along path in pine forest on sand, 3. 10. 2005, leg. T. Knutsson, J. & M. Jeppson (MJ 7492).

***Lycoperdon norvegicum* Demoulin**

Lycoperdon norvegicum is a rare puffball with ochre – straw-coloured subglobose - pyriform fruiting bodies at maturity. The exoperidium is constructed of groups of pale, slender connivent spines. At maturity it sheds most of its slender spines and a faint, pale ochre areolation is revealed. The mature spores are more or less smooth. *L. norvegicum* has a wide distribution in somewhat continentally influenced regions of Europe and North America. It is a species found in dry pastures and at forest edges as well as in clearings in dry, sandy pine forests. We have noted it on two sites growing along roads and paths in open pine forests in the Záhorská nížina. Demoulin (1971) gave a single record of it from Moravia, but there seems to be no previous findings in Slovakia.

Záhorská nížina:

Plavecký Mikuláš, military area along road to Mikulášov, sandy pine forest, 3. 10. 2005, leg. T. Knutsson, J. & M. Jeppson (MJ 7511, 7515). Závod, S of railway station, dry sandy pine forest, 30. 10. 2000, leg. J. & M. Jeppson (MJ 5305); 3. 10. 2005, leg. T. Knutsson, J. & M., Jeppson (MJ 7511).

***Lycoperdon rimulatum* Peck**

Lycoperdon rimulatum is a rare and characteristic puffball distinguished by its almost smooth exoperidium and its large (5–6 µm), strongly warted spores provided with long pedicels. It was recently met with in the Záhorská nížina, in an area of dry, acidic sand where it occurred in a glade in a light forest of pine and oak on a military training field. This species has its main distribution in North America and the finding in Slovakia appears to be the fourth European record. A previous record by Šmarda (1958) from Srbsko near Beroun in the Czech Republic (as *L. decipiens* var. *rimulatum*) has proved to be erroneous and belongs to typical *L. decipiens* according to Kreisel (1963). *L. rimulatum* might however have been overlooked in dry heathland habitats in Europe. It

should be highlighted in the conservational work with redlists and site management plans and should be subject to a dedicated search on dry pannonic sanddunes and sandy heathland habitats in Slovakia and elsewhere in East and Central Europe.

***Lycoperdon umbrinum* Pers.**

Lycoperdon umbrinum is a frequent species of coniferous forests all over Europe. It is recognized by its exoperidium built up of groups of slender, dark brown connivent spines. At maturity the spines in the upper part of the fruiting body are shed to expose a shiny, yellowish endoperidial surface. There is a risk of confusion with some forms of the polymorphous *L. molle* but under the microscope *L. umbrinum* shows weakly ornamented spores whereas they are coarsely warted in *L. molle*. Šmarda (1958) recorded it from Czechia and Moravia but neither he nor Demoulin (1972; cfr map) gave any Slovak records. It should however be a frequent species in coniferous forests in the mountain ranges of Slovakia. It was eg. recorded from numerous sites in the Strazovské vrchy during the 9th meeting of the Slovak Mycological Society (Lizoň, 2006), but we also have a record of it from a sandy pine forest in the Záhorská nížina.

Záhorská nížina: Plavecký Mikuláš, military area along road to Mikulášov, pine forest on sand, 3. 10. 2005, leg. T. Knutsson, J. & M. Jeppson (MJ 7514).

***Mycenastrum corium* (Guers.) Desv.**

Mycenastrum corium is a cosmopolitan species of dry pastures and sandy grasslands as well as nitrogen rich sites at forest edges, in parks and gardens. In Europe it is widely distributed but it is nevertheless on the redlists as a threatened species in several countries. In the Czech Republic it is considered Near Threatened (NT: Holec & Beran, 2006). In Slovakia it was reported from the Záhorská nížina by Kotlaba (1955) and Staněk (1958). The latter author also gave records from Podunajská nížina and Ipeľsko-rimavská brázda. Recent records with photos on the Internet includes findings in Malacky 2004 (Zelenay, 2004), Čhtelnica 2008 (Komár, 2008) and Hodonisko 2007 (Polčák, 2007).

Záhorská nížina: Gajary, Veľký Piesok, Corynephorum, 29. 10. 2000, leg. J. & M. Jeppson (MJ 5301).

***Scleroderma areolatum* Ehrenb.**

= *S. lycoperdoides* Schw.

A small, short-stiped puffball with a pale yellowish peridium covered with small, dark brown to almost black, regularly shaped squamules. It forms mykorrhiza with *Quercus*, perhaps also with other trees. It has often been confused with the *S. verrucosum*, a species which however forms larger fruiting bodies provided with a distinct stipe, having more irregular peridial ornamentation and smaller spores. *S. areolatum* is fairly frequent in north European nemoral and boreo-nemoral deciduous forests but seems to be rare in south and central Europe, being more or less replaced by its look-alike, *S. verrucosum* (cfr Demoulin, 1966, Hagara & al., 2005, Jeppson, 1979, 2008). Šebek (1958) mentioned this species in his determination key for Flora ČSR (as *Scleroderma lycoperdoides*) and was of the opinion that it might occur in the former Czechoslovakia. There are some records published by Lizoň (1977), Dermek (1978), Kult (1989), Glejdura & al. (1998), Kuthan & al. (1999) and Škubla (2003) that need critical revision (if voucher specimens are available). We have met with it in a deciduous forest habitat in the Záhorská nížina. It might be overlooked in other parts of Slovakia.

Záhorská nížina: Malacky, Vasková, 700 m N of railway crossing, deciduous forest with *Quercus*, *Tilia*, *Alnus* and *Prunus*, 3. 10. 2005, leg. T. Knutsson, J. & M. Jeppson (MJ 7487).

***Scleroderma septentrionale* Jeppson**

Scleroderma septentrionale is a recently described species which is regularly found in litoral sand dunes and sand fields of North Europe (Jeppson, 1998) and North America (Guzmán & Ovrebø, 2000). Recently it was also reported from inland sand dunes in Central Europe (Poland and Slovakia) by Jeppson & Piątek (2005). It is characterized by a rooted stipe, small and dark peridial squamules and spiny, reticulate spores. It seems to be closely related to *S. bovista* from which it differs mainly in the features of the stipe and the peridium.

Záhorská nížina: Moravský Svätý Ján, Borová, 2004.10.19, sandy pine forest on sand dune, leg. I. Kautmanová & M. Jeppson (MJ 7360; BRA).

***Tulostoma kotlabae* Pouzar – EN**

Tulostoma kotlabae is a species closely resembling *T. brumale*. It can be separated macroscopically by its pale, whitish-greyish colours and by lacking the brown ring around the shortly tube-like ostiole. Microscopically it has less ornamented spores than *T. brumale* and the capillitial septa

(which are distinctly bilaterally widened in *T. brumale*) are only slightly and unilaterally widened. It has a wide European distribution in areas with open calcareous sand inland and it is also found along the Baltic and west Scandinavian coastlines. It is however rare and regarded as threatened in several countries. In Slovakia it is redlisted as Endangered (EN: Lizoň, 2006). Pouzar (1958) described this species as new to science from Kúty in the Záhorská nížina and reported it also from nearby Borský Svätý Mikuláš. Škubla (1993) and Kotlaba (1995) added findings in the Podunajská nížina. Zíta (2004c) published a photo of it originating from Chotínské piesky in 2001. In connection with the 14th and 16th meetings of Czech and Slovak mycologists *T. kotlabae* was devoted a dedicated search in the Záhorská nížina and its occurrence could be verified in several localities. All findings were made on sandy road verges or in exposed sand with low mosses and annual herbs at pine forest edges.

Záhorská nížina: Borský Mikuláš, NW of village, dry sandy road verge in light pine forest, leg. 24. 6. 2006, I. Kautmanová, S. Ripková, V. Kučera, S. Adamčík, P. Lizoň & M. Jeppson (MJ). Lakšárska Nová Ves, "Pri čiernom piesky", road verge in sandy pine forest, 28. 6. 2008, leg. M. Jeppson (MJ). Plavecký Mikuláš, military area along road to Mikulášov, dry sandy road verge in pine forest, 22. 6. 2006, leg. M. Jeppson (MJ 7923, 7931). Rohožník, military area N of village, sandy soil at pine forest edge, 24. 6. 2006, leg. I. Kautmanová, S. Ripková, V. Kučera, S. Adamčík, P. Lizoň & M. Jeppson (MJ 7943); N of village, along road to Malacky, sandy verge in dry pine forest, 22. 6. 2006, leg. M. Jeppson (MJ 7922). Studienka, along road to Lakšárska Nová Ves, sandy slope on road verge, 25. 6. 2006, leg. M. Jeppson (MJ 7953); in village, road to Kúdelka, sandy road verge, 25. 6. 2006, leg. M. Jeppson (MJ 7952).

***Tulostoma melanocyclus* Bres.**

T. melanocyclus is a *T. brumale* look-alike with which it shares the dark brown ring around the tube-like, protruding ostiole. It can be macroscopically distinguished by the presence of a dark brown to almost blackish brown stipe. Under the microscope it reveals strongly warted spores and lacks the widened capillitial septa typical of *T. brumale*. It has a wide European distribution in warm and dry calcareous areas and on sand dunes along the European coastlines but is rare and considered to be threatened in several countries. From Slovakia Pouzar (1958) recorded it from a few sites in the Záhorská nížina and from the Podunajská nížina. From the latter region it was also reported by Škubla

(1993) and Wright (1987). There are also findings in the Východoslovenská nížina and Trábeč (Wright, 1987).

Malé Karpaty: Plavecké Podhradie, dry calcareous grassland on southfacing mountain slope, leg. 24. 6. 2006, I. Kautmanová, S. Ripková, V. Kučera, S. Adamčík, P. Lizoň & M. Jeppson (MJ 7946).

Illustrations

- [1] *Geastrum berkeleyi*. Záhorská nížina, Lakšárska Nová Ves, 3. 10. 2005, T. Knutsson, J. & M. Jeppson (MJ).
- [45] *Lycoperdon marginatum*. Záhorská nížina, Závod, S of the railway station, 3. 10. 2005, T. Knutsson, J. & M. Jeppson (MJ).
- [46] *Lycoperdon dermoxanthum*. Záhorská nížina, Borský Svätý Jur, 22. 6. 2006, M. Jeppson (MJ).
- [46] *Geastrum floriforme*. Záhorská nížina, Jakubov, by the lake, 23. 6. 2006, M. Jeppson (MJ).

ACKNOWLEDGEMENTS

I am grateful to Ivona Kautmanová, Viktor Kučera, Soňa Ripková, Tommy Knutsson, Kerstin Bergelin, Karin & Anders Bohlin, Sven-Åke Hanson, Jörgen Jeppson for providing the specimens. Slavomír Adamčík and Pavel Lizoň kindly read and commented the text. Financial support from Kapten Carl Stenholms Donationsfond is gratefully acknowledged.

REFERENCES

- Adamčík, S. & Ripková, S. 2006. *Gymnopilus fulgens* and *Bovista paludosa*, rare peat fungi collected in the Laborecká Vrchovina Mts. *Catathelasma* 8: 29-32.
- Benkert, D., Dörfelt, H., Hardtke, H.-J., Hirsch, G., Kreisel, H., Krieglsteiner, G. J., Lüderitz, M., Runge, A., Schmid, H., Schmitt, J. A., Winterhoff, W., Wöldecke, K. & Zehfuss, H.-D. 1992. Rote Liste der gefährdeten Großpilze in Deutschland. Naturschutz Spezial. Eching.
- Calonge, F. D. 1998. *Gasteromycetes* 1. Flora Mycológica Ibérica vol. 3. Real Jardín Botánico Madrid CSIC. J. Cramer. Madrid, Berlin, Stuttgart.
- Carlsson, R.-G., Johansson, N. & Johansson, K.-A. 2008. Blomjordstjärna (*Geastrum floriforme*) funnen i Västergötland. *Svensk Mykol. Tidskr.* 29(2): 74-79.
- Demoulin, V. 1966. Un groupe de champignons méconnus en Belgique: les Sclérodermes. *Naturalistes Belges* 47(8): 398-403.
- Demoulin, V. 1971. *Lycoperdon norvegicum* Demoulin n. sp. A new *Gasteromycete* with boreo-continental distribution in Europe and North America. *Norw. J. Bot.* 18(3-4):161-167.

- Demoulin, V. 1972. Le genre *Lycoperdon* en Europe et en Amérique du Nord. Thesis. Université de Liège.
- Durmek A. 1977. Atlas našich húb. Obzor, Bratislava.
- Guzmán, G. & Ovrebo, C. L. 2000. New observations on sclerodermataceous fungi. *Mycologia* 92: 174-179.
- Hagara L. 1992. Huby - dvojníky. Obzor, Bratislava.
- Hagara, L., Antonín, V. & Baier, J. 2005 Velký atlas hub. Ottovo nakladatelství, Praha.
- Holec, J. & Beran, M. 2006. Červený seznam hub (makromycetů) České republiky. *Příroda* 24. Praha.
- Hollós L. 1899. Új adatok Magyarorság gombáinak ismeretéhez. *All. Főiskola Ertesítő* 1898 - 1899: 1-30.
- Hollós, L. 1904. Die Gasteromyceten Ungarns. O. Weigel, Leipzig.
- Jeppson, M. 1979. Notes on the occurrence of *Scleroderma areolatum* and *Scleroderma verrucosum* in Sweden. Göteborg Svampkl. Årsskr. 1979: 39-44.
- Jeppson 1998 *Scleroderma septentrionale*, a new gasteromycete from North-European sand dunes. *Karstenia* 38: 37-43.
- Jeppson 2008. Rottryfflar och deras släktingar i Nordeuropa. *Svensk Mykol. Tidskr.* 29(2): 46-73.
- Jeppson M. & Piątek, M. 2005. *Scleroderma septentrionale* (Fungi, Basidiomycetes), first records from Central Europe. *Polish Bot. J.* 50: 15-17.
- Kabát V. 1996. Mykoflóra Devínskej Kobyly - niektoré zaujímavé nálezy. *Sprav. Slov. Mykol.* (12): 17-18.
- Kabát, V. 1997. Nález vzácneho stopkatca hladkovýtrosného *Tulostoma fulvellum* Bres. in Petri. *Sprav. Slov. Mykol.* (16):10-11.
- Komár, J. 2007. *Geastrum schmidelii*.
[\[www.nahuby.sk/obrazok_detail.php?obrazok_id=94616\]](http://www.nahuby.sk/obrazok_detail.php?obrazok_id=94616).
- Komár, J. 2008. *Mycenastrum corium*.
[\[www.nahuby.sk/obrazok_detail.php?obrazok_id=103131\]](http://www.nahuby.sk/obrazok_detail.php?obrazok_id=103131).
- Kotlaba F. 1955. Lokalita vzácných teplomilných bříchatek (*Gasteromycetes*) "Pasienok" u Velkých Levár. *Česká Mykol.* 9: 189-192.
- Kotlaba F. (ed.) 1995. Červená kniha ohrozených a vzácných druhov rastlín a živočíchov SR a ČR, vol. 4. Příroda, Bratislava.
- Kreisel, H. 1963. Ergänzungen und kritische Bemerkungen zur "Flora ČSR – Gasteromycetes". *Česká Mykol.* 17: 203-206.
- Kreisel, H. 1967. Taxonomisch-Pflanzengeographische Monographie der Gattung *Bovista*. *Beih. Nova Hedwigia* 25. J. Cramer, Lehre.
- Kreisel, H. 1987. Pilzflora der Deutschen Demokratischen Republik. VEB Gustav Fischer Verlag, Jena.
- Larsson, E. & Jeppson, M. 2008. Phylogenetic relationships among species and genera of *Lycoperdaceae* based on ITS and LSU sequence data from north European taxa. *Mycol. Res.* 112: 4-22.

- Lizoň, P. 2001. Červený zoznam húb Slovenska. 3. verzia (december 2001). In: Baláž, D., Marhold, K. & Urban, P. (eds.). 2001. Červený zoznam rastlín a živočíchov Slovenska. *Ochr. Prír.* 20., suppl., p. 6-13.
- Lizoň, P. 2006. Macrofungi collected during the 9th Mycological Foray in Slovakia. *Catathelasma* (7): 17-33.
- Moravec, Z. 1958. Disciseda Czern – žaludice. In A. Pilát (ed.), *Gasteromycetes*, p. 377-386. Nakladatelství ČSAV, Praha.
- Moreno, G., Altés, A. & Ochoa, C. 2003. Notes on some type materials of Disciseda (Lycoperdaceae). *Persoonia* 18: 215 – 223.
- Moyersoen, B. & Demoulin, V. 1996. Les gastéromycètes de Corse: Taxonomie, Écologie, Chorologie. *Lejeunia*, ser. n. 152: 1-128.
- Orthová, V. & Kabát, V. 1997. Stopkatec šupinatý *Tulostoma squamosum* Gmel.:Pers. na Devínskej Kobyle. *Sprav. Slov. Mykol.* (16): 9.
- Pilát, A. (1958). *Gasteromycetes. Houby - břichatky*. In: F. A. Novák (ed.), *Flora ČSR, Řada mykologicko-lichenologická, Svazek 1*, Nakladatelství ČSAV, Praha.
- Polčák, J. 2007. *Mycenastrum corium*.
[\[www.nahuby.sk/obrazok_detail.php?obrazok_id=68078\]](http://www.nahuby.sk/obrazok_detail.php?obrazok_id=68078).
- Pouzar, Z. 1958. *Tulostoma Pers. ex Pers. – palečka*. In A. Pilát (ed.), *Gasteromycetes*, p. 589-613. Nakladatelství ČSAV, Praha.
- Šebek, S. 1958. *Sclerodermataceae – pešťecovitě*. In A. Pilát (ed.), *Gasteromycetes*, p. 558-573. Nakladatelství ČSAV, Praha.
- Škubla, P. 1993. *Nové máleziská vzacných húb z rodu stopkovec (Tulostoma)*. *Sprav. Slov. Mykol.* (2): 9.
- Škubla P. 1995. *Vzácnější nálezy z roku 1994*. *Sprav. Slov. Mykol.* (7): 25-27.
- Škubla P. 1996. *Vzácnější nálezy roku 1995*. *Sprav. Slov. Mykol.* (13): 25-26.
- Škubla P. 1998. *Vzácnější nálezy roku 1997*. *Sprav. Slov. Mykol.* (19): 25–29.
- Šmarda, F. 1950. *Břichatkovité houby jihoslovanských píscin*. *Česká Mykol.* 4: 53-56.
- Šmarda, F. 1958. *Lycoperdaceae – pýchavkovité*. In A. Pilát (ed.), *Gasteromycetes*, p. 257-377. Nakladatelství ČSAV, Praha.
- Staněk, V. J. 1952. *Nálezy vzácných břichatkovitých hub na stepi jihozápadního Slovenska*. *Česká Mykol.* 6: 162-165.
- Sunhede, S. 1989. *Geastraceae (Basidiomycotina)*. Morphology, ecology and systematics with special emphasis on the North European species. [Synopsis Fungorum 1]. Fungiflora, Oslo.
- Walterová, A. 2006. *Geastrum schmidelii*.
[\[www.nahuby.sk/obrazok_detail.php?obrazok_id=40475\]](http://www.nahuby.sk/obrazok_detail.php?obrazok_id=40475).
- Wojewoda, W. & Ławrynowicz, M. 2004. *Czerwona lista grzybów wielkoowocnikowych zagrożonych w Polsce (wyd. 3)*. In: K. Zarzycki & Z. Mirek (eds): *List of slime moulds, algae, macrofungi, mosses, liverworts and plants threatened in Poland*. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków.

- Wright, J. E. 1987. The genus *Tulostoma* (Gasteromycetes) – A world monograph. [Bibliotheca Mycologica 113]. J. Cramer, Berlin & Stuttgart.
- Záhorovská E. & Lišková D. (1996): Mykolóra Devínskej Kobyly medzi obcami Devín a Devínska N. Ves. *Sprav. Slov. Mykol.* (11): 20-22.
- Zelenay, M. 2004. *Mycenastrum corium*. [www.nahuby.sk/obrazok_detail.php?obrazok_id=3227].
- Zíta, V. 2004a. *Geastrum campestre*. [www.nahuby.sk/obrazok_detail.php?obrazok_id=3436].
- Zíta, V. 2004b. *Geastrum floriforme*. [www.nahuby.sk/obrazok_detail.php?obrazok_id=3428].
- Zíta, V. 2004c. *Tulostoma kotlabae*. [www.nahuby.sk/obrazok_detail.php?obrazok_id=3384].

Mikael Jeppson: Poznámky o niektorých súčasných nálezoch bruchatiek na Slovensku. *Catathelasma* (10): 21-40, 2008.

Počas exkurzií na západné a južné Slovensko v posledných rokoch sa našlo o. i. aj 26 bruchatiek (Gasteromycetes), o ktorých referujeme v tomto príspevku. *Bovista furfuracea*, *Geastrum kotlabae*, *G. lageniforme*, *Lycoperdon norvegicum* a *Scleroderma areolatum* neboli predtým známe z nášho územia a *Calvatia candida*, *C. fragilis*, *Geastrum berkeleyi*, *G. campestre*, *G. floriforme*, *G. pseudolimbatum*, *G. schmidelii*, *Lycoperdon ericaeum*, *Mycenastrum corium*, *Tulostoma kotlabae* a *T. melanocyclus* neboli udávané v posledných rokoch.

**ADDITIONS TO THE CONTRIBUTIONS
BY M. JEPPSON**

ON TULOSTOMA AND SELECTED GASTEROMYCETES

contributed by VLADIMÍR ZÍTA⁴, LADISLAV HAGARA⁵ and Ivona Kautmanová⁶

Key words: puffballs, Slovakia, collections

Mikael Jeppson is presenting in this issue of *Catathelasma* results of his numerous collecting trips to Slovakia. Here are some additional records of puffballs, kept in private herbaria of Vladimír Zíta (VZ) and Ladislav Hagara (LH), and in the herbarium of Slovak National Museum, Bratislava (BRA), that he has not studied.

Bovista furfuracea

Podunajská rovina: Chotín, Nat. preserve Chotínske piesky, 9. 9. 1994, L. Hagara (LH).

Calvatia candida

Podunajská rovina: Bajč – Vlkanová, 29. 6. 1985, J. Kuthanová, J. Kuthan & L. Hagara (BRA).

Disciseda bovista

Podunajská rovina: Hurbanovo, Nat. preserve Révayovská pustatina, under Robinia pseudoacacia, 16. 9. 1998, E. Skála, P. Špinar & V. Zíta (VZ 1048). Marcelová, Nat. preserve Marcelovské piesky, sandy grassland, 11. 9. 2006, E. Skála, P. Špinar & V. Zíta (VZ 1224). Hurbanovo – Bohatá, sandy grassland 13. 9. 2001, E. Skála, P. Špinar & V. Zíta (VZ 1088).

Disciseda candida

Borská nížina: Moravský Svätý Ján, sand dune Borová, sandy grassland, 8. 9. 2001, L. Hagara, I. Kautmanová, E. Skála, P. Špinar & V. Zíta (VZ 1077, 1079; LH).

Podunajská rovina: Bajč, SW margin of the forest Diviačie, sandy grassland, 13. 9. 2001, L. Hagara, E. Skála, P. Špinar & V. Zíta (VZ 1086). Imeľ, cemetery, sandy grassland, 12. 9. 2006, E. Skála, P. Špinar & V. Zíta (VZ 1228).

4 Opavská 2626, CZ 415 01 Teplice, Czech rep.; v.zita@volny.cz

5 Mišíkova 20/A, SK-811 06 Bratislava, Slovakia; irpex@stonline.sk

6 Slovak National Museum, Vajanského nábr. 2, 814 86 Bratislava, Slovakia; botanika@snm.sk

Geastrum berkeleyi

Podunajská rovina: Hurbanovo, Nat. preserve Révayovská pustatina, under Robinia pseudoacacia, 16. 9. 1998, E. Skála, P. Špinar & V. Zíta (VZ 0170). Svätý Peter, woodland SW to the village Chotín, under Robinia pseudoacacia, 17. 9. 1998, E. Skála, P. Špinar & V. Zíta (VZ 0182). Bajč, forest Diviačie S to the village, under Robinia pseudoacacia, 13. 9. 2001, E. Skála, P. Špinar & V. Zíta (VZ 0277; LH).

Geastrum campestre

Podunajská rovina: Svätý Peter, woodland SW to the village Chotín, under Robinia pseudoacacia, 17. 9. 1998, E. Skála, P. Špinar & V. Zíta (VZ 0180).

Geastrum floriforme

Podunajská rovina: Marcelová, Nat. preserve Marcelovské piesky, sandy grassland, 12. 9. 2006, L. Hagara, E. Skála, P. Špinar & V. Zíta (VZ 0472; LH).

Geastrum lageniforme

Malé Karpaty: Bratislava – Záhorská Bystrica, hill Cimbal, oak forest, 11. 10. 1991, L. Hagara (LH).

Podunajská rovina: Imeľ, cemetery, under Robinia and Syringa, 16. 9. 1998, E. Skála, P. Špinar & V. Zíta (VZ 0159). Svätý Peter, woodland SW to the village Chotín, under Robinia pseudoacacia, 17. 9. 1998, E. Skála, P. Špinar & V. Zíta (VZ 0178). Marcelová, woodland SE to the village, under Robinia pseudoacacia and Sambucus nigra, 11. 9. 1996, E. Skála, P. Špinar & V. Zíta (VZ 0112). Hurbanovo – Pavlov Dvor, under Robinia pseudoacacia, 12. 9. 1996, E. Skála, P. Špinar & V. Zíta (VZ 0120). Chotín, Nat. preserve Chotínské piesky, under Robinia, 9. 9. 2001, E. Skála, P. Špinar & V. Zíta (VZ 0249). Hurbanovo, Nat. preserve Révayovská pustatina, under Robinia, 12. 9. 2006, E. Skála, P. Špinar & V. Zíta (VZ 0473).

Východoslovenská rovina: Boňany, Natl. nar. preserve Botiansky luh, horn-beam forest, 13. 9. 1996, L. Hagara (LH).

Geastrum minimum

Podunajská rovina: Marcelová, Nar. preserve Marcelovské piesky, sandy grassland, 12. 9. 2001, E. Skála, P. Špinar & V. Zíta (VZ 0273). Chotín, Nat. preserve Chotínské piesky, sandy grassland, 12. 9. 2001, E. Skála, P. Špinar & V. Zíta (VZ 0269; LH).

Gastrum schmidelii

Malé Karpaty: Bratislava – Devínska Nová Ves, hill Piesočník (Sandberg), stepp stand, D. Krajný & L. Hagara (LH).

Borská nížina: Moravský Svätý Ján, sand dune Borová, sandy grassland, 8. 9. 2001, E. Skála, P. Špinar & V. Zíta (VZ 0244).

Podunajská rovina: Chotín, Nat. preserve Chotínské piesky, sandy grassland, 12. 9. 2001, E. Skála, P. Špinar & V. Zíta (VZ 0270; LH). Hurbanovo, Nat. preserve Révayovská pustatina, under Robinia, 16. 9. 1998, E. Skála, P. Špinar & V. Zíta (VZ 0175). Svätý Peter, woodland SW to the village Chotín, under Robinia pseudoacacia, 17. 9. 2001, E. Skála, P. Špinar & V. Zíta (VZ 0181). Marcelová, Nat. preserve Marcelovské piesky, sandy grassland, 12. 9. 2001, E. Skála, P. Špinar & V. Zíta (VZ 0272).

Mycenastrum corium

Borská nížina: Bilkove Humence, meadow, 4. 9. 1976, A.Kálman (BRA). Between Malacky and Rohožník, Pinus forest, 28. 5. 2004, M. Zelenay (BRA). Moravský Ján, Borová, 120 m, sand dunes, 5. 6. 1997, I.Kautmanová (BRA). Sekule, Sekulské lúky, 250 m, Robinia growth, 27. 7. 1981, V.Weinzettel (BRA). Veľké Leváre, 250 m, pasture, 9. 6. 1974, P.Lizoň (BRA).

Podunajská rovina: Bajč, 15. 7. 1969, E.Futó (BRA), 19. 9. 1970, E.Futó (BRA). Bajč - Vlkanovo, 125 m, steppe, 29. 6. 1985, J.Kuthan (BRA), at the margin of a marsh., 10. 4. 1988, P.Škubla (BRA). Bratislava, Bílikova St., 250 m, in lawn, 18. 7. 2005, M. Pokorná (BRA), Drobného St., in grass., 8. 10. 1981, G.Fél (BRA). Dolný Peter, 1. 7. 1972, E.Futó (BRA), 23. 10. 1971, I. Fábry (BRA), pasture, 1. 5. 1974, E.Futó (BRA). Chotín, 11. 7. 1969, E.Futó (BRA). Imeľ, 110 m, Robinia growth, 10. 4. 1988, P.Škubla (BRA). Between Moča and Búč, Robinia growth, 7. 3. 1972, E.Futó (BRA). **Strážovské vrchy:** Bojnice, 350 m, in grass, 5. 6. 1974, P.Polievka (BRA).

Tulostoma brumale

Podunajská rovina: Bratislava – Rusovce, stepp stand, 24. 1. 1993, L. Hagara (LH). Between Imeľ and Hurbanovo, S to the highway, sandy grassland, 12. 9. 2006, E. Skála, P. Špinar & V. Zíta (VZ 1227). Marcelová, Nat. preserve Marcelovské piesky, sandy grassland, 10. 9. 2001, E. Skála, P. Špinar & V. Zíta (VZ 1083). Mostová (distr. of Galanta), Nat. preserve Mostovské presypy, sandy grassland, 9. 9. 2006, E. Skála, P. Špinar & V. Zíta (VZ 1219). Chotín, Nat. preserve Chotínské piesky, sandy grassland, 11. 9. 2006, E. Skála, P. Špinar & V. Zíta (VZ 1221). Čenkov, Natl. nat. preserve Čenkovská lesostep, sandy grassland, 13. 9. 2006, E. Skála, P. Špinar & V. Zíta (VZ 1232).

Tulostoma fimbriatum

Malé Karpaty: Bratislava – Devínska Nová Ves, hill Piesočník (Sandberg), stepp stand, 3. 4. 1988, L. Hagara (BRA).

Podunajská rovina: Balvany (distr. of Komárno), sandy grassland, 14. 9. 2006, E. Skála, P. Špinar & V. Zíta (VZ 1235). Chotín, Nat. preserve Chotínské piesky, sandy grassland, 11. 9. 2006, E. Skála, P. Špinar & V. Zíta (VZ 1223). Čenkov, Natl. nat. preserve Čenkovská lesostep, sandy grassland, 13. 9. 2006, E. Skála, P. Špinar & V. Zíta (VZ 1230).

Tulostoma kotlabae

Podunajská rovina: Chotín, Nat. preserve Chotínské piesky, sandy grassland, 9. 9. 2001, E. Skála, P. Špinar & V. Zíta (VZ 1080). Mostová (distr. of Galanta), Nat. preserve Mostovské presypy, sandy grassland, 9. 9. 2006, E. Skála, P. Špinar & V. Zíta (VZ 1237). Between Imeľ and Hurbanovo, S to the highway, sandy grassland, 12. 9. 2006, E. Skála, P. Špinar & V. Zíta (VZ 1234). Čenkov, Natl. nat. preserve Čenkovská lesostep, sandy grassland, 13. 9. 2006, E. Skála, P. Špinar & V. Zíta (VZ 1233).

Tulostoma melanocyclum

Podunajská rovina: Chotín, Nat. preserve Chotínské piesky, sandy grassland, 11. 9. 2006, E. Skála, P. Špinar & V. Zíta (VZ 1222). Between Imeľ and Hurbanovo, S to the highway, sandy grassland, 12. 9. 2006, E. Skála, P. Špinar & V. Zíta (VZ 1226). Marcelová, Nat. preserve Marcelovské piesky, sandy grassland, 11. 9. 2006, E. Skála, P. Špinar & V. Zíta (VZ 1225). Mostová (distr. of Galanta), Nat. preserve Mostovské presypy, sandy grassland, 9. 9. 2006, E. Skála, P. Špinar & V. Zíta (VZ 1218). Čenkov, Natl. nat. preserve Čenkovská lesostep, sandy grassland, 13. 9. 2006, E. Skála, P. Špinar & V. Zíta (VZ 1229). Balvany (distr. of Komárno), sandy grassland, 14. 9. 2006, E. Skála, P. Špinar & V. Zíta (VZ 1236).

Vladimír Zíta, Ladislav Hagara a Ivona Kautmanová: Doplnky k príspevkom M. Jeppsona o rode *Tulostoma* a o vybraných bruchatkách na Slovensku. *Catathelasma* (10): 41-44, 2008.

Ďalšie nálezy bruchatiek z rodov *Tulostoma*, *Bovista*, *Calvatia*, *Disciseda*, *Gestrum* a *Mycenastrum* dokresľujúce ich výskyt a rozšírenie na Slovensku.

BOOK NOTICES

Hennig Knudsen and Jan Vesterholt. 2008. **Funga Nordica. Agaricoid, boletoid and cypheloid genera.** [1]-965, Nordsvamp, Copenhagen. ISBN 978-87-983961-3-0. Price: 95 Euro (depends on bookseller).

In 1992 was published as the first second volume of the treatment on Nordic macromycetes (including Polyporales s. l. and Agaricales s. l.). Five years later was issued another volume (Hansen & Knudsen, 1997) covering the rest of the macroscopic basidiomycetes. It was planned to include also the ascomycetes which were published in a separate volume later (Hansen & Knudsen, 2000).

Funga Nordica (impressive both by contents and size) is presented in its preface as the new edition of the second volume of the Nordic macromycetes (Hansen & Knudsen, 1992). It covers more than 2600 taxa known not only from the Nordic countries but also from the neighboring countries, such as United Kingdom, the Netherlands, Germany, Poland, Lithuania, Latvia, Estonia, and Russia. Gross system is arranged according to new phylogenies and data achieved by the project 'Deep Hypha' (ocid.nacse.org/research/deephyphae) published in a special issue of Mycologia (vol. 98, no. 6, July 2007).

Each taxon has description of macro- and microcharacters, data on ecology, basic synonymy, references to descriptions and illustrations. The descriptions are supplemented by line drawings of microcharacters of selected species. Keys are well constructed and understandable (at least those I have already used).

DVD attached to the book (as a free bonus) contains version 3.1 of the MycoKey by Thomas Læssøe and Jens H. Petersen. It has not only pictorial keys as in previous editions but also all synoptic keys from the book and 4000 colour photographs of described species. Free access to the synoptic keys is on the web page of the MycoKey (www.mycoket.com).

It will be interesting to hear from mycologists how they feel using and comparing the Funga Nordica with the 6th edition of the Meinhard Moser's key (Horak, 2005).

References:

- Hansen, L. & H. Knudsen (eds.). 2000. Nordic Macromycetes, vol. 1. Ascomycetes. Nordsvamp, Copenhagen.
- Hansen, L. & H. Knudsen (eds.). 1992. Nordic Macromycetes, vol. 2. Polyporales, Boletales, Agaricales, Russulales. Nordsvamp, Copenhagen.
- Hansen, L. & H. Knudsen (eds.). 1997. Nordic Macromycetes, vol. 3. Heterobasidioid, aphylophoroid and gastromycetoid basidiomycetes. Nordsvamp, Copenhagen.
- Horak, E. 2005. Röhrlinge und Blätterpilze in Europa. Elsevier, München.



Tulostoma melanocyclum
(Malé Karpaty, Plavecké
Podhradie; see p. 5–19)



Tulostoma squamosum
(Devínska Kobyla, Bratislava;
see p. 5–19)



Lycoperdon marginatum
(Záhorská nížina, Závod; see p. 21–44)



Lycoperdon dermoxanthum
(Záhorská nížina, Borský Svätý Jur; see p. 21–40)



Geastrum floriforme
(Záhorská nížina, Jakubov; see p. 21–44)