CZECH MYCOLOGY

VOLUME 52
DECEMBER 1999

1

CZECH SCIENTIFIC SOCIETY FOR MYCOLOGY PRAHA

ISSN 0009-0476

Vol. 52, No. 1, December 1999

CZECH MYCOLOGY
formerly Česká mykologie
published quarterly by the Czech Scientific Society for Mycology

Czech Mycology is an international scientific journal publishing papers in all aspects of mycology. Publication in the journal is open to members of the Czech Scientific Society for Mycology and non-members.

Contributions to: Czech Mycology, National Museum, Department of Mycology, Václavské nám. 68, 115 79 Praha 1, Czech Republic. Phone: 02/24497259 or 96151284

SUBSCRIPTION. Annual subscription is Kč 350,– (including postage). The annual subscription for abroad is US $ 86,– or DM 136,– (including postage). The annual membership fee of the Czech Scientific Society for Mycology (Kč 270,– or US $ 60,– for foreigners) includes the journal without any other additional payment. For subscriptions, address changes, payment and further information please contact **The Czech Scientific Society for Mycology, P.O.Box 106, 111 21 Praha 1, Czech Republic.**

This journal is indexed or abstracted in:
Biological Abstracts, Abstracts of Mycology, Chemical Abstracts, Excerpta Medica, Bibliography of Systematic Mycology, Index of Fungi, Review of Plant Pathology, Veterinary Bulletin, CAB Abstracts, Rewiew of Medical and Veterinary Mycology.

No. 4 of the vol. 51 of Czech Mycology appeared in July 20, 1999

CZECH MYCOLOGY
Publication of the Czech Scientific Society for Mycology

Volume 52 December 1999 Number 1

Mycocoenological studies in Mediterranean forest ecosystems: calcicolous deciduous oak woods of central-southern Tuscany (Italy)

LAGANÀ A., SALERNI E., BARLUZZI C., PERINI C. and DE DOMINICIS V.

Dipartimento Biologia Ambientale, Università degli Studi, Via P. A. Mattioli 4, I-53100 Siena (ITALY)

Laganà A., Salerni E., Barluzzi C., Perini C. and De Dominicis V. (1999): Mycocoenological studies in Mediterranean forest ecosystems: calcicolous deciduous oak woods of central-southern Tuscany (Italy) – Czech Mycol. 52: 1–16

The results of mycocoenological studies carried out in calcicolous deciduous oak woods of central-southern Tuscany are reported. Comparison with the results of studies in other forest ecosystems of the same area revealed exclusive differential species of deciduous oak woods and clarified the knowledge on mycocoenoses of central-southern Tuscany. The obtained information on individual species is also useful for understanding the relatively unexplored field of the ecology of macrofungi.

Key words: mycocoenology, calcicolous deciduous oak woods, Mediterranean.

Laganà A., Salerni E., Barluzzi C., Petrini C. a De Dominicis (1999): Mykocenologická studie středomořského lesního ekosystému: vápnomilné doubravy na jihu středního Toskánska (Itálie). – Czech Mycol. 52: 1–16

Jsou podány výsledky mykocenologických studií vápnomilných společenstev listnatých lesů s převažujícími duby (*Quercus cerris, Q. pubescens, Q. ilex*, ass. *Roso sempervirentis-Quercetum pubescentis*) na jihu středního Toskánska. Srovnání s výsledky studia jiných lesních ekosystémů v téže oblasti odhalily význačné diferenciální druhy těchto doubrav a objasnilo znalosti mykocenóz jižní části centrálního Toskánska. Informace získané o jednotlivých druzích jsou rovněž užitečné pro porozumění relativně neprobádané ekologii makromycetů.

INTRODUCTION

Knowledge of biodiversity is a prerequisite for distribution mapping and conservation of the organisms populating ecosystems. These topics, which are the daily work of zoologists and botanists, have also been of interest to mycologists for some years. In central and northern Europe, there have been a good number of studies on fungal communities and their distribution and changes in time. Relatively little is known about the ecology and distribution of fungi in the Mediterranean area.

This prompted the mycologists of the Department of Environmental Biology of Siena University to begin mycocoenological studies (the best method to obtain information on the ecology and spatial-temporal distribution of fungi) in various forest ecosystems of central-southern Tuscany, at the end of the 1970s. The studies are still in progress. The present study belongs to this framework and is concerned with calcicolous deciduous oak woods.

The aim of the present study was not only to fill gaps in the current knowledge of the mycocoenoses developing in the different forest ecosystems of central-southern Tuscany, but also to obtain more information on the ecology and distribution of certain fungal species, especially those closely related to the Mediterranean environment.

STUDY AREA

The Montagnola Senese is part of the southern segment of the mid-Tuscan ridge. The geology includes Mesozoic and Palaeozoic carbonate-argillaceous-silicious formations (Lazzarotto 1993). The four oak coppices in which the study was carried out are in this area; on Mt. Maggio (658 m). The geological substrate of the four plots is dark grey breccia-like limestone with a typically spongy surface, formed by weathering of the surface stratum of the Tuscan nappe, and is known as "calcare cavernoso". Soil pH in the four plots is neutral-basic: 7.4 in plot 1, 6.8 in plot 2, 6.8 in plot 3 and 6.8 in plot 4 (Laganà et al. 1996).

According to Thornthwaite (1948) the climate of the study area is subhumid, mesothermic, with moderate summer drought. The mean annual temperature is 13–14 °C. The mean annual rainfall is 900–1100 mm (Barazzuoli et al. 1993). An important parameter in the climate classification proposed by Thornthwaite (1948) is the global humidity index, I_m, which is the difference between the humidity and the aridity indexes. Humid climates have $I_m > 0$ and arid climates have $I_m < 0$. The study area has a B1 type climate, which is humid with $20 < I_m < 40$. In the study area phytosociological relevés were made. The most frequent tree species was *Quercus cerris* L., together with a good number of *Quercus pubescens* Willd. *Quercus ilex* L., a thermophilous species indicating a mild climate. *Fraxinus ornus* L. and *Sorbus domestica* L. were also present in all plots, but not abundant. The undergrowth was rich, with species such as *Cornus mas* L., *Juniperus communis* L., *Ligustrum vulgare* L. and *Pyracantha coccinea* M. J. Roemer. Lianose plants included *Hedera helix* L. and *Rosa sempervirens* L. In the herb layer, rich in plot 1, species such as *Ajuga reptans* L., *Carex flacca* Schreber, *Cruciata glabra* (L.) Ehrend., *Cyclamen hederifolium* Aiton, *C. repandum* S. et S., *Fragaria vesca* L., *Helleborus bocconei* Ten., *Melittis melissophyllum* L., *Stachys officinalis* (L.) Trevisan and *Viola alba* Besser were found. These results indicate that the

vegetation in the study area represents an evolved stage of the association *Cytiso-Quercetum pubescentis*, described by Blasi et al. in 1982. According to Arrigoni (1998) these woods could be ranged under the association *Roso sempervirentis-Quercetum pubescentis* Biondi 1986.

Materials and methods

The results reported here cover research in the period 1992–1993. Research continued until December 1996, but the data are still being processed. Each of the plots has an area of 1000 m^2, as suggested by Arnolds (1981) and Jansen (1981). Relevés were made monthly, but discontinuous in summer when drought and high temperatures did not favour fungal fruiting. At each visit, all carpophores of epigeous macrofungi were recorded and counted. For our purposes, macrofungi were fungi with fruit-bodies visible to the naked eye, larger than one millimetre (Arnolds 1981). The reference exsiccata are deposited in the Herbarium Universitatis Senensis (SIENA). For details on the methods of mycocoenological research, see Arnolds (1981), Jansen (1981) and Perini and Barluzzi (1987).

The list of species found in calcicolous deciduous oak woods in the first two years of observations, including abundance and frequency values, is given in Laganà et al. (1996). Here they are reported with abundance values only (Table 1) together with species of the other forest communities investigated by our Department (De Dominicis and Barluzzi 1983; Barluzzi et al. 1992; Perini et al. 1989; 1995); exclusive differential species of calcicolous deciduous oak woods are reported in Tab. 2.

Where possible, Arnolds et al. (1995) was used for the nomenclature of fungal species. For other species (indicated with *) we used current texts and monographs (e.g. Kühner and Romagnesi 1953; Romagnesi 1967; Bon 1980; Moser 1983; Alessio 1985; Riva 1988; Jülich 1989; Brandrud et al. 1990–94; Antonín and Noordeloos 1993; Courtecuisse and Duhem 1994; Candusso 1997). Authors' names of the species are abbreviated as indicated by Brummitt and Powell (1992). Abundance is expressed as mDCv (maximum density of carpophores per visit) proposed by Arnolds (1981). Tabs. 1 and 2 do not give sporadic species (those found in only one plot with mDCv < 3) and exclusive differential species of other forest community than those of calcicolous deciduous oak woods.

The vegetation was studied by the method of Braun-Blanquet (1964). Plant species nomenclature is according to Pignatti et al. (1982).

Soil pH was measured using the method proposed by Arnolds (1981). The data are given as means of eight samples (four superficial and four at a depth of 10 cm) from each plot.

Multivariate analysis of the data was performed with the programme PC SYNTAX, using the Jaccard (1901) index as dissimilarity measure and the average link as clustering function.

RESULTS AND DISCUSSION

A total of 184 species of fungi was found in the four plots; 76 were found in only one plot and 31 were shared by all four. For instance, *Cortinarius aprinus* was found constantly in these oak woods; according to Marchand (1975–86) this species prefers forests of broadleaves dominated by oaks. Like *Cortinarius cotoneus, C. olivaceofuscus, Inocybe tenebrosa, I. flocculosa, I. splendens* and *Russula maculata* (Romagnesi 1967; Thoen 1970; 1971; Lisiewska 1974; Marchand 1975–86; Breitenbach and Kränzlin 1981–95; Kuyper 1986; Brandrud et al. 1990–94; Stangl 1991) this species is regarded characteristic of calcicolous forests.

Other taxa closely related to calcareous substrates were *Boletus satanas* and *Inocybe pusio*. According to Alessio (1985), *Boletus satanas* is a species with a broad ecological range, especially in southern and central Europe, but not ubiquitous (in some areas it is rare or absent). Darimont (1973) and Lisiewska (1974) list it as a thermophilous species.

According to Breitenbach and Kränzlin (1981–95) and Maas Geesteranus (1992) *Mycena polyadelpha*, found in two out of four plots, grows on oak litter and less frequently on beech litter. Its presence in the study area can be ascribed to the type of vegetation – unlike the species mentioned above, which have requirements as to the lithological substrate. The same can be said for *Lactarius chrysorrheus*, which is indicated in the literature as a species linked to woods dominated by *Quercus* (Malençon and Bertault 1971, 1972; Bertault 1982). Bohus and Babos (1967) consider it mycorrhizal of oaks.

Our data were compared with those of other forest ecosystems in central-southern Tuscany: chestnut woods (Cs), evergreen oak woods of the coast and of the inland hills (Qs), and fir woods of Mt. Amiata and the Casentino (Ab). Tab. 1 gives a summary of mycocoenological relevés in 30 plots (4 deciduous oak woods (Qb), 10 Qs, 9 Cs, 7 Ab). The species reported in Tab. 1 are 268 in number; only 37 of these are common to all forests. These are mainly species of a broad ecological range, such as *Amanita rubescens, Cantharellus cibarius, Hydnum repandum, Hygrophorus discoxanthus, Laccaria laccata, Mycena galopus, M. pura, Tricholoma saponaceum*, etc. The first group of interest contained 47 species found in deciduous oak woods, chestnut woods and evergreen oak woods; they included *Russula risigallina*, that Bertault (1982) reports to grow only in this type of environment (broadleaves), *Boletus luridus*, which according to Galli (1980) prefers broadleaf woods with *Quercus, Carpinus* and *Castanea*, and *Marasmiellus*

Table 1 Synthesis of mycocoenological survey carried out in different forest ecosystems of central-southern Tuscany. (Qb = calcicolous deciduous oak woods; Qs = evergreen oak woods; Cs = chestnut coppices; Ab = fir woods). The sing * indicate that the name of the corresponding species is not in accordance with Arnolds et al. (1995).

	Qb	Qb	Qb	Qb	Qs	Qs	Qs	Qs	Qs	Qs	Qs	Qs	Qs	Qs	Cs	Cs	Cs	Cs	Cs	Cs	Cs	Cs	Cs	Cs	Ab	Ab	Ab	Ab	Ab	Ab	Ab
Number of exclusive differential species	**2**		**7**		**5**									**4**	**1**									**1**	**6**						**6**
Amanita phalloides (Fr.: Fr.) Link	1		1		2	3	1	2							1						2	1			3	2		1			
Amanita rubescens Pers.: Fr.			1			3		2		1					2	2	1	+	1	1	+	1	1		2			2		1	
Boletus chrysenteron (Bull.) ss. str.		1	2		2	2	1		2			+						+		+						2		2		
Cantharellus cibarius Fr.: Fr.			1		2		1	3	2	1					5	1	3	3	2	3	1	3	1				2			4	
Clavulina coralloides (L.: Fr.) J. Schröt. ss. str.		1	1		2	2	2	1	1						3		2		1		4	2	1		6	2	5	7	3	6	6
Clitocybe phaeophthalma (Pers.) Kuyper			1			2		1									2				+				3						
Collybia butyracea (Bull.: Fr.) P. Kumm.	1	1	1		4	4	4	4	2							+				2					1		2	4		3	2
Collybia dryophila s.l.	3		1				3	2	3				+									2				3	3	2			
Collybia peronata (Bolton: Fr.) P. Kumm.			1				2	2							5				+			1			3					
Cortinarius infractus (Pers.: Fr.) Fr.	1		1		2	1	+	2	1	2	+	+	1	3								1							5	3	3
Cortinarius lividoochraceus (Berk.) Berk.	1		1		2	2	2	2	1	2					1	4	2	1			+				3	1	2	2			
Cortinarius torvus (Bull.: Fr.) Fr.			1		+		2	1							1	4	+	1	3	+		+			5		1		1		
Cortinarius trivialis J. E. Lange	3		3	2	2	+	2	1	1	1	2	2	1		2	4		2		1	1				1		1				
Craterellus cornucopioides (L.: Fr.) Pers.			3		3		5	5		3		1			5	4			2	5		4				4				5	
Cystolepiota seminuda (Lasch) Bon		2	1		1		1		2							1	+								3	3					
Hydnum repandum L.: Fr.	2	2	1					1	2		2	3	1		4	1	4	3	3			4	2				2			1	
Hygrophorus discoxanthus (Fr.) Rea	3	2				1	2	2	2	3	+	2	3		1		1					1			3			1	1		
Laccaria laccata s.l.		1	3		4	2	4	5	2	3	3	1		+	+	2	+		+	2	4	5	+		5		4	3	4	6	4
Lactarius chrysorrheus Fr.	2	4	3	1	4	3	1	2	+		3	2	1	2	3	2	1	+							1						
Lepiota clypeolaria (Bull.: Fr.) P. Kumm.	2	1		1			+						+		+		+			3		+					2			
Lycoperdon perlatum Pers.: Pers.		2	1		1	2	3	2	2			1			1	1			2	3	2		4		4		4	4		2	3
Lyophyllum deliberatum (Britzelm.) Kreisel	1	1				+		2		+		1			2		+	+	1				1		1						
Marasmius androsaceus (L.: Fr.) Fr.	2		1										+			1		2							4	4	3		1	5	5
Marasmius rotula (Scop.: Fr.) Fr.		3	2	4			1								1	3			1	3	2							4			
Mycena epipterygia (Scop.: Fr.) Gray		2	2		+											1	+					3	+		4	4	4	2	3	3	5
Mycena galopus (Pers.: Fr.) P. Kumm.	4	3	4	6	3	3	2	3	3	+		1	+		3	2	3	3	1	5	4	5	+		6	2	2	1		2	
Mycena pelianthina (Fr.: Fr.) Quél.	1		1	2			4					1			+				1	3					3	3	1	3			
Mycena polygramma (Bull.: Fr.) Gray	1	3	1	1			1			1					1	1	1	+	+	1	1	3			4	6	4	4		2	1
Mycena pura (Pers.: Fr.) P. Kumm.	3	4	3	3	4	4	3	3	4		1	2	1		4		1		1	4	4	2			7	7	6	5	3	3	4
Mycena sanguinolenta (Alb. & Schwein.: Fr.) P. Kumm.		2	2	2			2		4						+	1	+	1	1	+		1			1	1		1		2	
Mycena vitilis (Fr.) Quél.	1	3	4	2	1		1	2	1								+	1	+	+		+			2	2	1				
Mycena xantholeuca Kühner				1										+			4	2		3										1	
Russula albonigra (Krombh.) Fr.		2				1	+	+		1					2	1													3		
Russula cyanoxantha Schaeff.: Fr.				1	1		1	2							1	1		1	2	+	+	1	1			3	2		2	2	
Russula delica Fr. ss. str.	1				3	2	3	3	2								1	+	3		2	+			2	2	4	4	3	3	3
Tricholoma saponaceum (Fr.: Fr.) P. Kumm.	1	2	1		1		1	+	3	4		1			3		+			3	1				2	1	2		4	3	

Table 1 cont.

	Q Q Q Q Q Q Q Q Q Q Q Q Q C C C C C C C C C A A A A A A A A
	b b b b s s s s s s s s s s s s s s s s s b b b b b b b b
Number of exclusive differential species	**2 7** **5 4** **1 1** **6 6**
Xylaria hypoxylon (L.: Fr.) Grev.	3 2 4 2 3 2 1 3 2 6 5 4 4 5 6
Amanita citrina (Schaeff. –>) Pers.	1 1 2 2 4 2 + + 1 + 1 +
Amanita vaginata (Bull.: Fr.) Lam. ss. str.	1 2 + 1 2 + 1 + 1 + 1 + 2 1 + +
Aureoboletus gentilis (Quél.) Pouzar	1 1 1 1 +
Boletus luridus Schaeff.: Fr.	1 1 1 1 1 + 1 2 + 2 +
Clavaria fragilis Holmsk.: Fr.	3 1 2 1 5 2 4 + 1
Clitopilus prunulus (Scop.: Fr.) P. Kumm.	1 1 2 + + 1 + 1 + 1
Coprinus picaceus (Bull.: Fr.) Gray	2 2 + 1 1
Cortinarius aprinus Melot*	3 2 2 1 2 1 1 1
Cortinarius calochrous (Pers.: Fr.) Fr.	2 2 2 1 + 1 1 + 2 2 +
Cortinarius cristallinus Fr. ss. str.	1 1 + + 2 +
Cortinarius duracinus Fr.	2 1 3 1 2 2 3 3 3 1 2 1 2 1 1
Cortinarius obtusus (Fr.: Fr.) Fr. ss. str.	1 2 2 1 1 1 1
Cortinarius semisanguineus (Fr.: Fr.) Gillet	2 + + 2
Cortinarius sodagnitus Rob. Henry	2 1 1 2 2 2 + 1 2 + +
Crepidotus variabilis (Pers.: Fr.) P. Kumm. ss. str	4 4 2 3 1 2 2 4 1 1 2
Entoloma rhodopolium (Fr.: Fr.) P. Kumm. f. nidorosum	1 1 1 2 + 2 1 1 1 1 4 2
Entoloma sinuatum (Bull. ex Pers.: Fr.) P. Kumm.	2 + 1 4 1 1 + 1 2
Ganoderma lucidum (M. A. Curtis: Fr.) P. Karst.	1 1 1 1 + + +
Hebeloma crustuliniforme (Bull.) Quél. ss. str.	2 2 2 1 + 1 2 3 + + 2 1 3 1
Hebeloma sinapizans (Fr.) Gillet	1 2 1 1 2 4 3 2 3 3 4 + 1 + 1
Hydnellum concrescens (Pers.) Banker ss. str.	1 4 2 2 4 3 4 2 2 2 4 4 4 5
Hydnum rufescens Fr.: Fr.	2 2 2 1 2 2 2 2 4 1 + 3 + + 2 4 4
Hygrocybe conica (Schaeff.: Fr.) P. Kumm. f. pseudoconica (J. E. Lange) Arnolds	2 2 1 3 3 1 + 1 +
Hygrocybe virginea (Wulfen: Fr.) P.D. Orton et Watling	1 1 2 1 4 5 4 1 + +
Lactarius insulsus (Fr.: Fr.) Fr.	1 1 1 1 1 1 1 + 3 2 +
Lactarius vellereus (Fr.: Fr.) Fr.	4 1 3 1 + 1 1 2 +
Lepista flaccida (J. Sowerby: Fr.) Pat.	1 4 4 1 1 2
Marasmiellus ramealis (Bull.: Fr.) Singer	3 3 1 1 2 2 1 4
Marasmius epiphyllus (Pers.: Fr.) Fr.	1 2 3 2
Mycena galericulata (Scop.: Fr.) Gray	1 1 + 1 2 + + 3 + 2
Mycena maculata P. Karst.	1 1 2 + 2 2 1 4
Mycena rosea (Bull.–>) Gramberg	4 3 1 1 5 5 4 4 + + 2 + + 2 1 2 1 1
Phellinus torulosus (Pers.) Bourd. et Galzin	1 4 4 4 3 2 2 2 2 + + +
Phellodon niger (Fr.: Fr.) P. Karst.	2 3 2 4 2 3 2 2 2 2 2
Russula fragilis (Pers.: Fr.) Fr. ss. str.	1 2 3 2 2 2 1 2 1 + 1 + 2 1 + + + 1 1
Russula olivacea (Schaeff.) Pers.	2 1 + + 1 +
Russula risigallina (Batsch) Sacc.	1 + 2 1 2 1 1 1 1 1 1 1 1 +

Table 1 cont.

	Q Q Q Q	Q Q Q Q Q Q Q Q Q Q Q	C C C C C C C C C	A A A A A A A
	b b b b	s s s s s s s s s s s	s s s s s s s s s	b b b b b b b
Number of exclusive differential species	**2 7**	**5 4**	**1 1**	**6 6**
Russula vesca Fr.	1 1	2 2 2 2 2	2 + 1 2 1 +	
Tricholoma acerbum (Bull.: Fr.) Quél.	2	1 2 1 3 3	+ 2 1 + 3 2	
Tricholoma atrosquamosum (Chev.) Sacc.*	3 1 1 1	1 2 + 3 2	+ + 1 1	
Tricholoma bresadolianum Clemençon*	2	3 1	+ 1	
Tricholoma scalpturatum (Fr.) Quél.*	1 1	2 3	1	
Tricholoma sejunctum (J. Sowerby: Fr.) Quél.	1	+ 1 +	+	
Tricholoma sulphureum (Bull.: Fr.) P. Kumm.	2 3	1 1 1	1 + 1 3 4 1	
Tricholoma ustale (Fr.: Fr.) P. Kumm.	1	2 1	1 1 2 2	
Tricholoma ustaloides Romagn.	1	+ 2 + + 2 2 2 3 1	1 1 3 2 3	
Xerula pudens (Pers.) Singer	1 1 1	1	+ + + + + 1 1 +	
Hemimycena cephalotricha (Joss.) Singer*	4 3 4	3 4 4		1
Micromphale foetidum (J. Sowerby: Fr.) Singer	1	2		4
Mycena metata (Fr.: Fr.) P. Kumm.	2	1 2 1 2 2		5 4 2 4
Mycena stylobates (Pers.: Fr.) P. Kumm.	3 3 2 4	1 1 1		4 2 2
Tricholoma squarrulosum Bres.*	1 1	2 1 1 3 1 1		1
Clitocybe fragrans (With.: Fr.) P. Kumm.	4 3		+	3 2 1
Cortinarius paleaceus Fr. ss. str.	2 2 3 1		1	4
Mycena leptocephala (Pers.: Fr.) Gillet	2 3 1		2 1 3 2 1	4 2 2 3 4 1 4
Psilocybe aeruginosa (M.A. Curtis: Fr.) Noordel. ss. str.	1		+ 2	1 4
Rickenella fibula (Bull.: Fr.) Raithelh.	4		2 1 2 2 + 2	3 2
Xerula radicata (Relhan: Fr.) Dörfelt	1 1 2		+	2 2 3 3
Amanita pantherina (DC.: Fr.) Krombh.		2 2 1 1 + 1 1 +	+ 1 + + 1 1	2
Boletus fechtneri Velen.		+	1 1	1
Cantharellus tubaeformis Fr.: Fr.		3	5 4 2 3 2 3 +	4
Clitocybe nebularis (Batsch:Fr.) P.Kumm.		3 1 2	2 + 2 2	3
Clitocybe odora (Bull.: Fr.) P. Kumm.		1	+ 2 4 2 4 1 3	1
Cortinarius trivialis J. E. Lange var. squamosipes Rob. Henry		+ 1 + +	+	1 1
Cortinarius uraceus Fr. ss. J. E. Lange		1 1 1 2 2	1 1 1	2 1 2
Crepidotus pubescens Bres.		3 2 3	3	1
Helvella crispa (Scop.: Fr.) Fr.		1	+	3
Inocybe cervicolor (Pers.) Quél.		1 1	1	4
Inocybe geophylla (Fr.: Fr.) P. Kumm.		2 3 3 + 2 + +	+ + 2	3 1 3 4 3 1
Inocybe sindonia (Fr.) P. Karst.		1 1	2	2 3
Laccaria amethystina (Huds.–>) Cooke		3	1 2 3 +	4 2 3 4 4 4
Lactarius piperatus (L.: Fr.) Pers.		+ 2 1 1 +	+ 1 1 2 + 1 1	1 1 3
Lactarius subdulcis (Bull.: Fr.) Gray		1 1 1 +	+ 1	3 3 2
Leotia lubrica (Scop.: Fr.) Pers.		2 2 2	2 1 1 1 2 2 1	4
Lycoperdon atropurpureum Vittad.*		2 + 1 2 2	1 + 1	2 4 3

Table 1 cont.

	Q Q Q Q b b b b	Q Q Q Q Q Q Q Q Q Q Q Q s s s s s s s s s s s s	C C C C C C C C C C s s s s s s s s s s	A A A A A A A A b b b b b b b b
Number of exclusive differential species	**2 7**	**5 4**	**1 1**	**6 6**
Lycoperdon pyriforme Schaeff.: Pers.		1 2 3 2 1	3 3 2 2 1 4	1 2
Marasmius torquescens Quél.		1	1 1	3 2
Mycena filopes (Bull.: Fr.) P. Kumm. ss. str.		+	1 1 +	3 1 3
Mycena sepia J. E. Lange		+	1	4 2 1 3
Psilocybe fascicularis (Huds.: Fr.) Noordel.		3	1 3 4 5	3
Ramaria formosa (Pers.: Fr.) Quél.		1	4 1 4	1
Sarcoscypha coccinea s.l.		+ 3 + 1 +	1 +	1
Boletus radicans Pers.: Fr.	1	1		
Boletus rubellus Krombh. ss. str.	1	+ 2		
Boletus satanas Lenz	1	+ 1 1 2		
Cantharellus cinereus (Pers.: Fr.) Fr.	4	2 4		
Cortinarius bulliardii (Pers.: Fr.) Fr.	2 2 1	3 1 +		
Cortinarius cotoneus Fr.*	1 1	1 1		
Cortinarius decipiens (Pers.: Fr.) Fr.*	2	+ 2		
Cortinarius purpurascens (Fr.: Fr.) Fr.	1	+		
Cortinarius safranopes Rob. Henry	2 2 3 3	3 4 1		
Entoloma mougeotii (Fr.) Hesler	1 1	2		
Flammulaster carpophilus (Fr.) Earle	5 1	3 3 1 2 +		
Gyroporus castaneus (Bull.: Fr.) Quél.	1 1	+ + 1 1 +		
Hapalopilus rutilans (Pers.: Fr.) P. Karst.	3 2	2		
Hohenbuehelia petaloides (Bull.: Fr.) S. Schulz.	1	1		
Humaria hemisphaerica (Wiggers: Fr.) Fuckel	1 2 1	1		
Hygrocybe acutoconica (Clemençon) Singer	1	1 + 2		
Hygrocybe pratensis (Pers.: Fr.) Murrill	1	1 2 3 2		
Hygrocybe psittacina (Schaeff.: Fr.) P. Kumm.	1	1		
Hygrocybe real (Maire) J. E. Lange	1	+ + 1 1 +		
Hygrophorus penarius Fr.	1 3	1 +		
Hygrophorus persoonii Arnolds var. fuscovinosus (Bon) Bon*	1 2	+ 1 2 1 1 2 2 +		
Hygrophorus russula (Fr.: Fr.) Quél.	3 2	2 3 3 3 1 4 2 5 3		
Hymenoscyphus fructigenus (Bull.: Fr.) Gray	2 1	2 2 3		
Inocybe asterospora Quél.	1	+ 1		
Inocybe bongardii (Weinm.) Quél.	3 1 1 1	2 3		
Inocybe cincinnata (Fr.: Fr.) Quél. var. major (S. Petersen) Kuyper	1	2		
Lyophyllum paelochroum Clemençon	1 2 1	1 1 + 1 +		
Lyophyllum transforme (Britzelm.) Singer*	2	1 1		
Micromphale brassicolens (Romagn.) P. D. Orton*	1	1 3 +		
Mutinus caninus (Huds.: Pers.) Fr.	1 1 2	1 + +		

Table 1 cont.

	Q Q Q Q b b b b	Q Q Q Q Q Q Q Q Q Q s s s s s s s s s s	C C C C C C C C C C s s s s s s s s s s	A A A A A A A b b b b b b b
Number of exclusive differential species	**2 7**	**5 4**	**1 1**	**6 6**
Pluteus romellii (Britzelm.) Sacc.	1 2 1 1	+ + +		
Pseudoclitocybe expallens (Pers.: Fr.) Singer	1	+		
Russula acrifolia Romagn.	3	1 2 2		
Russula decipiens (Singer) Svrček	1	2		
Russula foetens Pers.: Fr.	1	1 1 2 +		
Russula maculata Quél.	2 2 1 1	2 2 3 4 4		
Russula vinosobrunnea (Bres.) Romagn.	1	+ 1 2 2		
Tubaria furfuracea (Pers.: Fr.) Gillet*	2	1 2		
Boletus ferrugineus Schaeff.	1		1 1 +	
Collybia fusipes (Bull.: Fr.) Quél.	2		1 1	
Cortinarius claroflavus Rob. Henry*	1		+	
Cortinarius venetus (Fr.: Fr.) Fr.	1		1	
Inocybe rimosa (Bull.: Fr.) P. Kumm.	1		1	
Mycena alba (Bres.) Kühner	4		1	
Psilocybe inquilina (Fr.: Fr.) Bres.	1		1 + 2	
Marasmius quercophilus Pouzar	6 4 6 4		2 5 4 4 2	
Agaricus silvicola (Vittad.) Sacc. ss. str.		+	1 + 1	
Amanita caesarea (Scop.: Fr.) Pers.*		2	2	
Amanita crocea (Quél.) Singer		+ 1	+ +	
Armillaria mellea (Vahl.: Fr.) P. Kumm.		4 2 2 2	3	
Armillaria tabescens (Scop.: Fr.) Dennis et al.*		4 4 5	2 3	
Astraeus hygrometricus (Pers.: Pers.) Morgan		1 1 2	+ 2	
Boletus aereus Bull.: Fr.		1 1 1 2	1 1	
Boletus appendiculatus Schaeff.		1	+ 1	
Boletus calopus Pers.: Fr.		+ +	2 +	
Boletus edulis Bull.: Fr. ss. str.		1 +	+ 1 + +	
Bovista plumbea Pers.: Pers.		+ +	+	
Clavulina cinerea (Fr.) J. Schröt.		3 1 1	1 2	
Coprinus plicatilis (M. A. Curtis: Fr.) Fr. ss. str.		+ 1 + 1 1 +	1 1 + 1 1 + 1	
Cortinarius anserinus (Velen.) Rob. Henry		+ 1 + + 1	+ +	
Cortinarius castaneus (Bull.: Fr.) Fr.		+	3	
Cortinarius cinnamomeus L.: Fr. var. cinnamomeofulvus Rob. Henry*		+ + 1	1 + 1 1	
Cortinarius coerulescens (Schaeff.) Fr.		1	+	
Cortinarius croceo-coeruleus (Pers.: Fr.) Fr.		1	+ 2 + 1	
Cortinarius delibutus Fr.		+	+	
Cortinarius dibaphus Fr. var. nemoreus Rob. Henry*		1 2	+	
Cortinarius pseudosulphureus P.D. Orton		1 2	+	
Cortinarius rufoolivaceus (Pers.: Fr.) Fr.*		+ 2 +	+ + 1	

Table 1 cont.

	Q Q Q Q b b b b	Q Q Q Q Q Q Q Q Q Q Q s s s s s s s s s s s	C C C C C C C C C s s s s s s s s s	A A A A A A A b b b b b b b
Number of exclusive differential species	**2 7**	**5 4**	**1 1**	**6 6**
Cortinarius trivialis J. E. Lange var. subolivascens Rob. Henry		1	1 2 1	
Entoloma hirtipes (Schumach.: Fr.) M.M. Moser		+ 1 2 1	1 1	
Entoloma incanum (Fr.: Fr.) Hesler		5	+	
Entoloma rhodopolium (Fr.: Fr.) P. Kumm. ss. str.		1 2 2	+ 3 1 + 1	
Hygrophorus nemoreus (Pers.: Fr.) Fr.		+ 1 2 1 2 1	1 +	
Lactarius atlanticus Bon*		2 1 3	1 1	
Lactarius camphoratus (Bull.: Fr.) Fr.		1	2 1	
Lactarius controversus (Pers.: Fr.) Fr.		1	1 2 +	
Lactarius uvidus (Fr.: Fr.) Fr.		+ 1	2 + 1	
Lepista nuda (Fr.: Fr.) Cooke		2 2 3 2 2 + 3 +	2 2 + 1	
Macrolepiota mastoidea (Fr.: Fr.) Singer		1 1 1 1 2 +	1 + + +	
Mycena pura (Pers.: Fr.) P. Kumm. f. alba (Gillet) Kühner		+	1 2 +	
Omphalotus olearius (DC.: Fr.) Singer*		+ 1 2	3 1	
Otidea cochleata (L.: Fr.) Fuckel		+	3 1	
Panellus stipticus (Bull.: Fr.) P. Karst.		1	2 3 1 2	
Psathyrella piluliformis (Bull.: Fr.) P.D. Orton ss. str.		1	1 1 2 1 3 3 2	
Pseudocraterellus undulatus (Pers.: Fr.) Rauschert		2 3 3	1 +	
Ramaria botrytis (Pers.: Fr.) Ricken		1 +	2	
Ramaria decurrens (Pers.) R. H. Petersen		3 3 2 3 2	2 2 2	
Ramaria flava (Schaeff.: Fr.) Quél.*		2 +	+	
Russula alutacea (Pers.: Fr.) Fr.		1 + 2 +	1 1 +	
Russula amoenicolor Romagn.		2 2 1 2 2	+	
Russula aurata (With.) Fr.*		+ +	+ 1 1 +	
Russula densifolia Gillet		3 3 +	2 +	
Russula emetica (Schaeff.: Fr.) Pers. var. silvestris Singer		+ 1	1	
Russula heterophylla (Fr.: Fr.) Fr.		+ +	1	
Russula minutula Velen.		+	1	
Russula romellii Maire		1	1 3 1 +	
Russula rosea Pers.		2 1 + 1 2	2 1 + 4 1 +	
Russula undulata Velen.		+ 1 2 1	+ 1	
Sarcodon cyrneus Maas Geest.*		1 2 2 3	2	
Scleroderma verrucosum (Bull.: Pers.) Pers. ss. str.		1 2	1 1 1	
Tricholoma album (Schaeff.: Fr.) P. Kumm.		3 2 + 1 1	+ 4	
Bisporella citrina (Batsch: Fr.) Korf et Carpenter	5			6 5 5
Collybia cookei (Bres.) J. D. Arnold	4			1 4
Collybia tuberosa (Bull.: Fr.) P. Kumm.	1			3
Crepidotus cesatii (Rabenh.) Sacc.	3 4			5 3 2
Entoloma juncinum (Kühner & Romagn.) Noordel.	1			3

Table 1 cont.

	Q b	Q b	Q b	Q b	Q s	Q s	Q s	Q s	Q s	Q s	Q s	Q s	Q s	Q s	C s	C s	C s	C s	C s	C s	C s	C s	C s	C s	A b	A b	A b	A b	A b	A b	A b	A b
Number of exclusive differential species	**2**		**7**		**5**									**4**										**1**							**6**	**6**
Hemimycena cucullata (Pers.: Fr.) Singer	2	3	1	1																					4							
Hemimycena lactea (Pers.: Fr.) Singer			1																													2
Inocybe leiocephala D.E. Stuntz	2	2																							3							
Megacollybia platyphylla (Pers.: Fr.) Kotl. et Pouzar			1																						3							
Mycena acicula (Schaeff.: Fr.) P. Kumm.	1	1		1																					3							
Mycena erubescens Höhn.	2	2	1	2																					5	3	3	2	1			3
Mycena flavescens Velen.	1	3	5	2																					6	3	4	1				
Mycena flavoalba (Fr.) Quél.	4	1	3	2																					5	1	6	5	2	2		3
Mycena polyadelpha (Lasch) Kühner	4	1																							4	4		3	3	5		6
Oligoporus subcaesius (A. David) Ryvarden et Gilb.			2																										1	1		1
Agaricus silvaticus Schaeff.: Fr.					2	2			2																		2					
Clavulinopsis corniculata (Schaeff.: Fr.) Corner					1		+	2	2																2							
Clitocybe clavipes (Pers.: Fr.) P. Kumm.										+																			1			
Clitocybe rivulosa (Pers.: Fr.) P. Kumm. ss. str.										1																						1
Collybia erythropus (Pers.: Fr.) P. Kumm.						1	3	2		1																4	2	1				
Coprinus atramentarius (Bull.: Fr.) Fr. ss. str.					+																							2				
Cortinarius anomalus (Fr.: Fr.) Fr. ss. str.							+			1		+													2		1		1			
Cortinarius dionysae Rob. Henry*													+												3			4				
Helvella elastica Bull.: Fr.						1																						3				
Hygrophorus chrysodon (Batsch: Fr.) Fr.*										2																1		1	5			
Hygrophorus discoideus (Pers.: Fr.) Fr.								3																		2						
Lepiota castanea Quél.					2		1	+	1																2							
Macrolepiota procera (Scop.: Fr.) Singer					3	2	1	1	+		2																2				1	
Marasmius alliaceus (Jacq.: Fr.) Fr.*						1																										2
Mycena haematopus (Pers.: Fr.) P. Kumm.							1																		3			4				
Tremella mesenterica Retz.: Fr.					2	2	2	3	2		1	+																1			1	
Tricholoma stans (Fr.) Sacc.										1															3							
Boletus subtomentosus L.:Fr.																		+												2		
Calocybe ionides (Bull.: Fr.) Donk																			1						1							
Cantharellus cibarius Fr.: Fr. var. amethysteus Quél.																				2							4					
Coprinus micaceus (Bull.: Fr.) Fr. ss. str.															+															3	6	
Cyathus striatus (Huds.: Pers.) Willd.															3										3							
Exidia truncata Fr.: Fr.																					+				7							
Galerina marginata (Batsch) Kühner ss. str.																			1	2					3		3	4	4	2	3	
Lycoperdon umbrinum Pers.: Pers.																				2							2					
Marasmius bulliardii Quél.															1				5	4	6	5			3				4	4		
Marasmius cohaerens (Pers.: Fr.) Cooke & Quél.															2	2		+	2	4		1					1					
Marasmius wynnei Berk. & Broome																				2		2			5					2		
Mycena arcangeliana Bres.															1										2							

Table 1 cont.

	Q Q Q Q b b b b	Q Q Q Q Q Q Q Q Q Q s s s s s s s s s s	C C C C C C C C C C s s s s s s s s s s	A A A A A A A A b b b b b b b b
Number of exclusive differential species	**2 7**	**5 4**	**1 1**	**6 6**
Pluteus cervinus (Schaeff.) P. Kumm.			+	1 1 1 2 1 2
Russula laurocerasi Melzer var. fragrans (Romagn.) Kuyper & Vuure			3 + + 1 + 2	2 1
Russula nigricans (Bull.–>) Fr.			3	3 2 4
Tricholoma fulvum (DC.: Fr.) Sacc.			+	1

Table 2 Exclusive differential species of calcicolous deciduous oak woods, in respect to the other studied forest ecosystems. The sing * indicate that the name of the corresponding is not in accordance with Arnolds et al. (1995).

Armillaria ostoyae (Romagn.) Herink			6	
Ciboria batschiana (Zopf) N.F. Buchw.			3	1
Coprinus stercoreus Fr.	4			
Cortinarius hinnuleus Fr. ss. str.	1		1	
Cortinarius olivaceofuscus Kühner	3		2	1
Crepidotus epibryus (Fr.: Fr.) Quél.	3			3
Crepidotus mollis (Schaeff.: Fr.) Kumm.			3	
Entoloma byssisedum (Pers.: Fr.) Donk	1			2
Hemimycena hirsuta (Tode: Fr.) Singer		3		3
Hydropus floccipes (Fr.) Singer*	2	1	2	1
Hydropus scabripes (Murrill) Singer		1	1	
Hygrophorus lindtneri M.M. Moser*		2	1	
Hygrophorus roseodiscoideus Bon & Chevass.*	3		1	
Inocybe flocculosa (Berk–) Sacc.	1	2		1
Inocybe pusio P. Karst.			1	1
Inocybe splendens R. Heim	2	1		1
Inocybe tenebrosa Quél.	3	1		
Macrotyphula juncea (Alb. & Schwein.: Fr.) Berthier	4			7
Mycena abramsii (Murrill) Murrill		2		1
Mycena rorida (Fr.: Fr.) Quél.	1	3	2	3
Otidea alutacea (Pers.) Massee	1		1	1
Phaeomarasmius erinaceus (Fr.: Fr.) Singer		1		1
Phellodon confluens (Pers.) Pouzar		2		1
Pluteus plautus (Weinm.) Gillet	2	1	1	1
Psathyrella ocellata (Romagn.) M.M. Moser	1		1	
Psathyrella spadiceogrisea (Schaeff.) Maire	3			
Russula persicina Krombh.	2	3	2	1

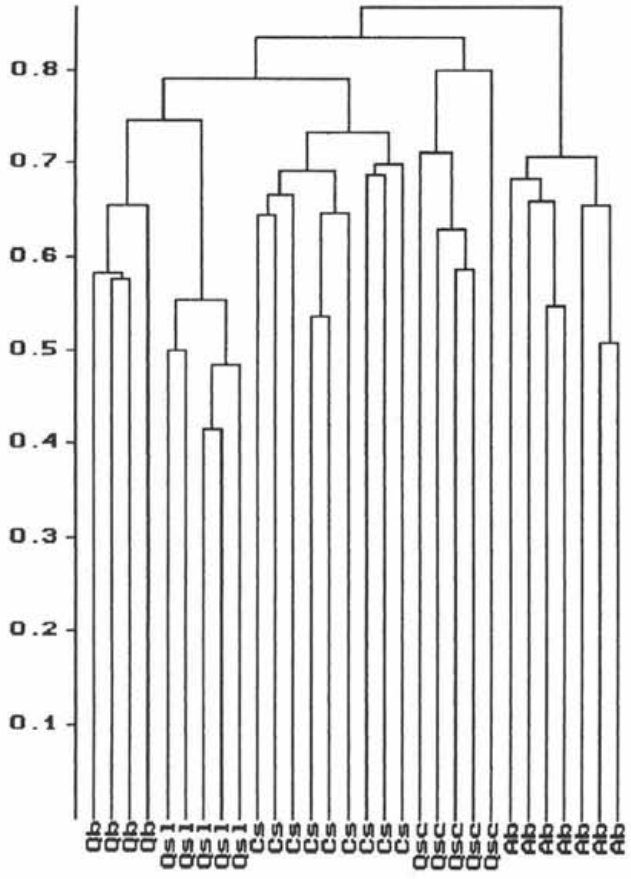


Fig. 1 Dendrogram showing affinity between the studied mycocoenoses. (Qb = calcicolous deciduous oak woods; Qsl = evergreen oak woods of the coast; Cs = chestnut coppices; Qsc = evergreen oak woods of the inland hills; Ab = fir woods).

ramealis, which Jansen (1981) considers to be differential of *Quercion roboripetraeae*. Another interesting group included species common to deciduous and evergreen oak woods. It included *Lyophyllum paelochroum*, which typically grows under *Quercus ilex* (Malençon and Bertault 1971), present in these calcicolous deciduous oak woods and obviously in evergreen oak woods. The literature on *Cortinarius bulliardii* contains contradictions: Bon and Gehu (1964) regard it an acidophilous species of heathlands (pH 4.0–4.5), whereas Thoen (1970; 1971) and Brandrud et al. (1990–94) mention it as a species growing in broadleaf forests (especially Fagus) on calcareous soil. The same can be said for the literature

on *Inocybe bongardii*; Lisiewska (1974), Bon (1983) and Stangl (1991) regard it as associated mainly with beech, and thus with cool moist environments, while Honrubia et al. (1982) indicates it as preferential or exclusive to pine. Only the findings of Kuyper (1986) are in line with ours: "under frondose, exceptionally also under coniferous trees, ...". Many species (35) were common to deciduous and evergreen oak woods of the coast (the first five evergreen oak woods in Tab. 1). Three of these evergreen oak woods had neutral soil (pH around 7); the other two slightly acid (Perini et al. 1989). One of the plots was on "calcare cavernoso", like the present plots. The two areas are also fairly similar as far as vegetation is concerned: in both, species such as *Asparagus acutifolius* L., *Crataegus monogyna* Jacq., *Erica arborea* L., *Fraxinus ornus*, *Phyllirea latifolia* L., *Quercus cerris*, *Q. ilex*, *Q. pubescens* and *Rosa sempervirens* are found, though with different abundance values. These findings could be a reason for the large number of fungal species common to the two phytocoenoses. *Cortinarius cotoneus* and *Russula maculata*, for example, are typically calcicolous (Romagnesi 1967; Lisiewska 1974; Marchand 1975–86; Brandrud et al. 1990–94). In previous studies (Perini et al. 1989, 1993), the species of this group were found to be exclusive differential of evergreen oak woods. Only 15 species were common to deciduous oak woods and fir woods.

Tab. 2 shows the taxa exclusive differential of calcicolous deciduous oak woods. Many of them according to the literature prefer calcareous soil, e.g. *Cortinarius olivaceofuscus*, *Inocybe flocculosa*, *I. splendens* and *I. tenebrosa* (Darimont 1973; Breitenbach and Kränzlin 1981–95; Kuyper 1986; Brandrud et al. 1990–94; Stangl 1991).

The graph of Fig. 1 was plotted to obtain a more exact picture of the position of calcicolous deciduous oak woods with respect to the other forest phytocoenoses investigated. The first aspect that emerges is a division into well defined clusters, corresponding to the different vegetation groups. As expected from the above, the first clusters found to be linked are those of deciduous oak woods and evergreen oak woods of the coast. The next link is with chestnut woods, that have a position between evergreen oak woods of the coastal and hill belts. It seems logical that these four clusters are the first to be linked, since they belong to broadleaf forests. At a much greater distance are the fir woods, which are very different from the others in terms of vegetation and climate.

Although the study of calcicolous oak woods is still underway, the present data enabled us to fill a gap in the mycological knowledge of central-southern Tuscany. We now have data on almost all the phytocoenoses of this region; only beech forests remain to be studied, together with types of vegetation less frequent in Tuscany such as woods of *Ostrya*, *Carpinus* and riparian vegetation. Comparison of the data already available has clarified important aspects of the ecology and distribution of many fungal species. This is significant, in view of recent interest

in this subject, especially in the Mediterranean area, where data such as those reported here, are still largely unavailable.

References

Alessio C. L. (1985): Fungi Europaei. Boletus Dill. ex L. G. – 712 p. Saronno.

Antonín V. and Noordeloos M. E. (1993): Libri Botanici vol. 8. A monograph of Marasmius, Collybia and related genera in Europe. Part 1: Marasmius, Setulipes and Marasmiellus. – 229 p. Eching.

Arnolds E. (1981): Ecology and coenology of macrofungi in grasslands and moist heathlands in Drenthe, the Netherlands. Part 1. Introduction and Synecology. – Bibl. Mycol. 83: 1–410.

Arnolds E., Kuyper Th. W. and Noordeloos E. M. (eds.) (1995): Overzicht van de paddestoelen in Nederland. – 872 p. Wijster.

Arrigoni P. V. (1998): La vegetazione forestale. – 216 p. Firenze.

Barazzuoli P., Guasparri G. and Salleolini M. (1993): Il Clima. – In: Giusti F. (ed.), La storia naturale della Toscana meridionale, p. 141–171, Cinisello Balsamo.

Barluzzi C., Perini C. and De Dominicis V. (1992): Coenological research on macrofungi in chestnut coppices of Tuscany. – Phytocoenologia, 20: 449–465.

Bertault R. (1982): Contribution à la flore mycologique de la Catalogne. – Acta Botanica Barcinonensia 34: 5–35.

Blasi C., Feoli E. and Avena G. C. (1982): Due nuove associazioni dei Quercetalia pubescentis dell'Appennino centrale. – Studia Geobotanica 2: 155–167.

Bohus G. and Babos M. (1967): Mycocoenological investigation of acidophilous deciduous forests in Hungary. – Bot. Jb. 87(3): 304–360.

Bon M. (1980): Clé monographique du genre Lactarius (Pers.: Fr.) S. F. Gray. – Doc. Myc. X(40): 1–85.

Bon M. (1983): Ecologie des macromyctes dans le Sud Amiénois. – Cryptog. Mycol. 4: 207–219.

Bon M. and Gehu J. M. (1964): Unites supérieures de végétation et recoltes mycologiques. – Doc. Myc. 6: 1–40.

Brandrud T. E., Lindström H., Marklund H., Melot J. and Muskos S. (1990–94): Cortinarius. Flora photographica (version française). – Voll. 3 Matfors.

Braun-Blanquet J. (1964): Pflanzensoziologie. Grundzüge der Vegetationskunde. – 864 p. Wien.

Breitenbach J. and Kränzlin F. (1981–95): Champignon de Suisse/Fungi of Switzerland. – Voll. 4. Lucerne.

Brummitt R. K. and Powell C. E. (eds.) (1992): Authors of plant names. – 732 p. Kew.

Candusso M. (1997): Fungi Europaei. Hygrophorus s.l. – 784 p. Alassio.

Courtecuisse R. and Duhem B. (1994): Guide des champignons de France et d'Europe. – 480 p. Lausanne.

Darimont F. (1973): Recherches mycosociologiques dans les forêts de Haute Belgique. – Mém. Inst. Roy. Sc. Nat. Belg. 170: XIV + 220 pp.

De Dominicis V. and Barluzzi C. (1983): Coenological research on macrofungi in evergreen oak woods in the hills near Siena (Italy). – Vegetatio 54: 177–187.

Galli R. (1980): I boleti delle nostre regioni. – 160 p. Milano.

Honrubia M., Alcaraz F., Garcia E. and Llimona X. (1982): El componente fungico de los principales comunidades vegetales del S. E. de España. – Lazaroa 4: 313–325.

Jaccard P. J. (1901): Distribution de la flore alpine dans le Bassin des Dranses et dans quelques régions voisines. – Bull. Soc. vand. Soc. Nat. 37: 241–272.

Jansen A. E. (1981): The vegetation and macrofungi of acid oak woods in the North East Netherlands. – 131 p. Wageningen.

Jülich W. (1989): Guida alla determinazione dei funghi. Vol. 2. Aphyllophorales, Heterobasidiomycetes, Gastromycetes. – 597 p. Trento.

Kühner R. and Romagnesi H. (1953): Flore analytique des champignons supérieurs (Agarics, Bolets, Chantharelles). – 556 p. Paris.

Kuyper T. W. (1986): A revision of genus Inocybe in Europe. I. Subgenus Inosperma and the smooth-spored species of subgenus Inocybe. – 248 p. Leiden.

LAGANÀ A., SALERNI E., PERINI C., BARLUZZI C. and DE DOMINICIS V. (1996): Studi preliminari di comunità fungine in querceti decidui su terreno calcareo (Toscana centro-meridionale). – Mic. Ital. 25: 13–22.

LAZZAROTTO A. (1993): Elementi di geografia e geomorfologia. Elementi di geologia. – In: Giusti F. (ed.), La storia naturale della Toscana meridionale, p. 11–87, Cinisello Balsamo.

LISIEWSKA M. (1974): Macromycetes of beech forests within the eastern part of the Fagus area in Europe. – Acta Mycologica 10(1): 3–72.

MAAS GEESTERANUS R. A. (1992): Mycenas of the Northern Hemisphere. – Vol. 2. Amsterdam/Oxford/New York/Tokyo.

MALENÇON G. and BERTAULT R. (1971): Champignons de la Péninsule Ibérique. – Acta Phytotax. Barcinonensia 8: 5–97.

MALENÇON G. and BERTAULT R. (1972): Champignons de la Péninsule Ibérique. IV – Les Iles Baleares. – Acta Phytotax. Barcinonensia 11: 5–64.

MARCHAND A. (1975–86): Champignons du Nord et du Midi. – Voll. 9 Perpignan.

MOSER M. (1983): Kleine Kryptogamenflora, Band IIb/2: Die Röhrlinge und Blätterpilze. – 533 p. Stuttgart/New York.

PERINI C. and BARLUZZI C. (1987): Considerazioni su aspetti metodologici nello studio delle micocenosi in vari tipi di vegetazione della Toscana centro-meridionale. – In: Pacioni G. (ed.), Studies on fungal communities, p. 73–95, L'Aquila.

PERINI C., BARLUZZI C. and DE DOMINICIS V. (1989): Mycocoenological research in evergreen oak woods in the hills adjacent the Maremma coastline (NW of Grosseto, Italy). – Phytocoenologia 17: 289–306.

PERINI C., BARLUZZI C. and DE DOMINICIS V. (1993): Fungal communities in mediterranean and submediterranean woodlands. – In: Pegler D. N., Boddy L., Ing B. and P. M. Kirk (eds.), Fungi of Europe: Investigation, Recording and Conservation, p. 77–92, Kew.

PERINI C., BARLUZZI C., COMANDINI O. and DE DOMINICIS V. (1995): Mycocoenological research in fir woods in Tuscany (Italy). – Doc. Mycol. 25: 317–336.

PIGNATTI S. (1982): Flora d'Italia. – voll.3. Bologna.

RIVA A. (1988): Fungi Europaei. Tricholoma (Fr.) Staude. – 618 p. Saronno.

ROMAGNESI H. (1967): Les Russules d'Europe et d'Afrique du Nord. – 1002 p. Paris.

STANGL J. (1991): Guida alla determinazione dei funghi: 3.Inocybe. – 438 pp. Trento.

THOEN D. (1970): Etude mycosociologique de quelques associations forestires des districts picardo-brabançon, mosan et ardennais de Belgique. – Bull. Rech. Agr. Gembloux 5: 309–326.

THOEN D. (1971): Etude mycosociologique de quelques associations forestires des districts picardo-brabançon, mosan et ardennais de Belgique. – Bull. Rech. Agr. Gembloux 6: 215–243.

THORNTHWAITE C. W. (1948): An approach toward a rational classification of climate. – Geogr. Review 38: 55–94.

CZECH MYCOL. 52 (1), 1999

A revision of new species of Pholiota and Flammula (Fungi, Agaricales) described by Josef Velenovský

JAN HOLEC

National Museum, Mycological Department,
Václavské nám. 68, 115 79 Praha 1, Czech Republic.

Holec J. (1999): A revision of new species of Pholiota and Flammula (Fungi, Agaricales) described by Josef Velenovský – Czech Mycol. 52: 17–39

New species of *Pholiota* and *Flammula* described by Josef Velenovský, an important Czech mycologist, have been studied using the type specimens, original material and descriptions. All 16 taxa published by Velenovský have been revised: *Pholiota decurrens, P. fallax, P. mammilata, P. maximovici, P. mucosa, P. nigrosetosa, P. pseudohypholoma, P. rigelliae, P. rostrata, P. salicina, P. sulphurea, Flammula granulosa, F. pholiotiformis, F. picea, F. squamulosa* and *F. vacini*. The revision showed that most of them do not belong to the genus *Pholiota* in the modern sense and in fact represent species of the genera *Cortinarius, Flammulaster, Galerina, Kuehneromyces, Pholiotina* and *Tricholomopsis*. Of this group, six species are identical with earlier described taxa (*Cortinarius bolaris, Flammulaster limulatus, Galerina triscopa, G. unicolor, Kuehneromyces mutabilis, Tricholomopsis rutilans*) and the other are considered either insufficiently documented dubious species or should be studied by specialists of the aforementioned genera. All of Velenovský's new species belonging to *Pholiota* in the present sense are identical with earlier described species: *Pholiota albocrenulata, P. alnicola, P. flammans* and *P. gummosa*. Consequently, no species of *Pholiota* s. str. described by Velenovský can be considered a "good" new species.

Key words: fungi, Agaricales, *Pholiota, Flammula*, taxonomy, type study, synonyms, Cortinarius, *Bolbitiaceae, Flammulaster, Galerina, Kuehneromyces, Pholiotina, Tricholomopsis*.

Holec J. (1999): Revize nových druhů rodů Pholiota a Flammula (Fungi, Agaricales) popsaných Josefem Velenovským – Czech Mycol. 52: 17–39

Nové druhy šupinovek, popsané Josefem Velenovským, byly podrobně studovány s využitím typových položek, dalšího originálního materiálu a původní Velenovského dokumentace. Bylo revidováno všech 16 druhů, které Velenovský popsal v rodech *Pholiota* a *Flammula*: *Pholiota decurrens, P. fallax, P. mammilata, P. maximovici, P. mucosa, P. nigrosetosa, P. pseudohypholoma, P. rigelliae, P. rostrata, P. salicina, P. sulphurea, Flammula granulosa, F. pholiotiformis, F. picea, F. squamulosa a F. vacini*. Revize ukázala, že většina z nich nepatří do rodu *Pholiota* v jeho současném vymezení, ale představuje druhy rodů *Cortinarius, Flammulaster, Galerina, Kuehneromyces, Pholiotina a Tricholomopsis*. Šest z nich bylo ztotožněno s dříve popsanými druhy (*Cortinarius bolaris, Flammulaster limulatus, Galerina triscopa, G. unicolor, Kuehneromyces mutabilis, Tricholomopsis rutilans*). Další druhy z této skupiny rodů nemohly být přesně určeny pro neúplnost Velenovského popisů nebo by musely být studovány specialisty na tyto obtížné rody. Všechny Velenovského nové druhy, které patří do rodu *Pholiota* v jeho současném vymezení, jsou identické s dříve popsanými druhy, a to s *Pholiota albocrenulata, P. alnicola, P. flammans* a *P. gummosa*. Revize tedy ukázala, že žádné Velenovského jméno nelze použít jako správné jméno některého druhu rodu *Pholiota*.

INTRODUCTION

Josef Velenovský (1858–1949), outstanding Czech botanist, palaeobotanist and mycologist, described 16 new species of *Pholiota* and *Flammula*, in particular

in the book České houby (Velenovský 1920–1922) and two later published works (Velenovský 1930, 1940). As most of them (14) were described in Czech, a language hardly understandable for foreign mycologists, his species have not been taken into consideration by most leading mycologists and monographers of *Pholiota*. Later Pilát (1948) translated all Czech descriptions of Velenovský's new species into Latin. However, a revision of Velenovský's new species of *Pholiota* and *Flammula* has never been made. As types or original material of most of these taxa are available in PRC and PRM, I decided to take this task upon me. This project is a part of my work on an European monograph of the genus *Pholiota*.

MATERIALS AND METHODS

All types or original specimens of *Pholiota* and *Flammula* described by Velenovský and stored in PRC (Charles University, Prague) and PRM (National Museum, Prague) have been studied. The specimens in PRC are being kept in glass or plastic bottles filled with a formaldehyde-based conservation liquid. The examination of fruitbodies preserved in this way is not easy but the microstructures are mostly well-preserved. In some cases, the original liquid had evaporated and was replaced by another one (based on ethanol). Such specimens mostly are in poor condition because of collapsed cells, invisible pigments and indistinct fine structures of clamps, basidia, cystidia etc. All specimens were examined in a 5 % solution of KOH and staining with Congo Red.

If a species was originally described in Czech, an English translation of this description is included in this paper, because the Latin translations of Velenovský's descriptions have been published a long time ago (Pilát 1948) and are not accessible to all mycologists. Species of which no type material exists are briefly discussed on the basis of the hand-written manuscript of České houby (Velenovský 1920–1922) and later works by Velenovský deposited in the Mycological Department of the National Museum in Prague. In these manuscripts most species are depicted in perfect line-drawings of fruitbodies, spores and cheilocystidia, which are very helpful when interpretating Velenovský's new species. Only a small part of these drawings have been published in České houby. Some of the unpublished line-drawings are reproduced in the present paper. Judging Velenovský's descriptions, it should be kept in mind that the shape of cystidia mostly represents only their upper part projecting from the hymenium.

RESULTS AND DISCUSSION

Pholiota decurrens Velen., České houby, pars 3: 503, 1921

Translation of the original description: "Pileus 3–4.5 cm, obtusely conical, then expanded and broadly obtusely umbonate; thick, firm and fleshy at centre, lobed

at margin, floccose-scaly when young, smooth, glabrous, hygrophanous, without translucently striate margin, honey-yellow, almost red at centre. Stipe twice as long as the pileus diameter, very thick (1 cm), firm, attenuated towards base, roughly fibrillose (fibrils forming a thick crust covering the context), brownish, dark in lower part, in upper part with persistent, broad, membranaceous, white, flaring annulus, below it with brown upright scales. Lamellae crowded, narrow, at z, B. whitish, then ochraceous, deeply and gradually decurrent. Context white in pileus, with sweetish fungoid smell. Spores ovoid-ellipsoid, yellowish translucent, 4–5 μm. Cystidia abundant, filiform, curved.

In dense clusters on rotten wood of a pine on the "Kožený vrch" hill near Mnichovice, September 1918. On rotten roots in soil in the "Krčský les" forest in April 1920. It is a good species, very remarkable by the deeply decurrent lamellae and prominent membranaceous ring. Edible, tasteful."

Reproduction of an unpublished line drawing by Velenovský: Fig. 2/1.

Material studied: 2 syntypes mentioned in České houby: Mnichovice, 1918. PRC (bottle no. 360). – Krčský les, April 1920, PRC (bottle no. 101).

Spores 6.0–8.0(-9.2) × 4.0–4.6(-5.2) μm, ovoid to ovoid-amygdaliform with truncate apex, smooth, wall thick, yellow-ochre, germ pore apparent, 0.8–1.2 μm broad. Basidia 4(2)-spored, 18–23 × 5–6 μm, basidioles 17–18 × 5–6 μm. Cheilocystidia 21–23 × 4.5–6 μm, variable in shape, narrowly cylindrical, clavate, lageniform or fusiform, with cylindrical and often curved upper part, hyaline. Pleurocystidia absent. Lamellar trama regular, made up of parallel 3–12 μm broad hyphae, consisting of cylindrical or slightly fusiform cells. Pileus cuticle a cutis, 2-layered, upper layer made up of cylindrical 3.0–4.5 μm broad hyphae, slightly gelatinizing, lower layer made up of densely arranged cylindrical 4–10 μm broad hyphae, locally with inflated elements up to 20 μm. Stipe cuticle a cutis made up of parallel 3–5 μm broad hyphae, densely covered with flexuose interwoven 3–8 μm broad hyphae forming the scales, cells cylindrical, often curved, terminal elements sometimes slightly clavate, wall relatively thick, with strongly rusty-brown membranal pigment. Clamp connections present in all tissues.

Result of the revision: = ***Kuehneromyces mutabilis*** (Schaeff.: Fr.) Singer et A. H. Smith, see also Fig. 1/1.

Discussion: Microscopically, the specimens examined represent typical *Kuehneromyces mutabilis*. In Velenovský's description of macrocharacters and habitat some data are in disagreement with the typical appearance and ecology of *K. mutabilis*: deeply decurrent lamellae, growth on rotten wood of a conifer (pine) in one case. The deeply decurrent lamellae (see Fig. 2/1) obviously represent an aberrant form of *K. mutabilis* which is known to have broadly adnate to subdecurrent lamellae (I have seen fruitbodies with slightly decurrent lamellae in the field). Concerning the untypical substrate, some finds of *K. mutabilis* on

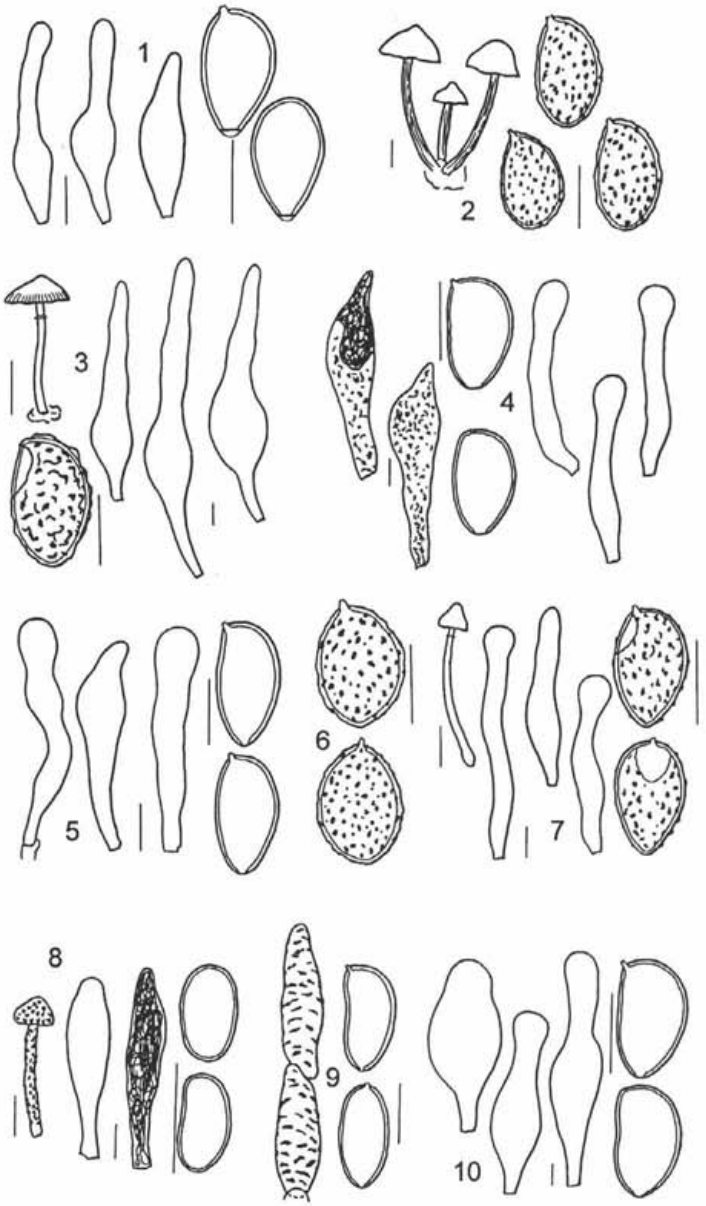


Fig. 1 **1**: *Pholiota decurrens*, cheilocystidia, spores; **2**: *Pholiota fallax*, fruitbodies, spores; **3**: *Pholiota mammilata*, fruitbody, 2 pleurocystidia, 1 cheilocystidium; **4**: *Pholiota mucosa*, chrysocystidia, spores, cheilocystidia; **5**: *Pholiota pseudohypholoma*, cheilocystidia, spores; **6**: *Pholiota rigelliae*, spores; **7**: *Pholiota rostrata*, fruitbody, cheilocystidia, spores; **8**: *Pholiota sulphurea*, fruitbody, cheilocystidia, spores; **9**: *Flammula granulosa*, cells from the pileus cuticle, spores; **10**: *Flammula picea*, 1 pleurocystidium, 2 cheilocystidia, spores. Scale bar: fruitbodies: 1 cm, microcharacters: 5 μm. Drawings by J. Holec.

wood of conifers are mentioned by e.g. Jacobsson (1990) and Breitenbach and Kränzlin (1995).

Conclusion: *Pholiota decurrens* Velen. is a later synonym of *Kuehneromyces mutabilis* (Schaeff.: Fr.) Singer et A. H. Smith

Pholiota fallax Velen., České houby, pars 3: 501, 1921

Translation of the original description: "Rather slender, like *Kuehneromyces mutabilis*, but smaller. Pileus 2–3 cm, campanulate-conical, with obtuse umbo, thin, weakly fleshy, glabrous although not smooth at all but mat, the whole surface conspicuously roughly verrucose-rugulose, hygrophanous, honey-brown with translucent lamellae when moist, alutaceous yellow when dry, paler towards margin. Stipe long, thin (2–3 mm), firm, bulbously thickened towards base, pale honey-coloured, in upper part whitish farinaceous, below the big, flaring, white annulus whitish fibrillose-floccose. Lamellae crowded, thin, broadly ventricose, honey-rusty, edge white, denticulate. Spores ellipsoid, clearly yellow, 6–7 μm. Cystidia long, filiform, obtuse, almost capitate. With slight fungoid smell.

On rotten stump of a deciduous tree in deep moist gorge under Slivenec, May 1918. Separately or in small clusters."

Reproduction of an unpublished line drawing by Velenovský: Fig. 2/2.

Material studied: holotype: Slivenec, May 1918, PRC (bottle no. 201). The holotype consists of a cluster of 5 moderately well-preserved fruitbodies.

Spores (7.0-)7.3–9.0(-9.2) × 5.0–5.5 μm, broadly ellipsoid to ellipsoid, with suprahilar depression, ochre, wall ochre-brown, without plage, roughly verrucose-rugulose. Basidia 4-spored, 23–26 × 7.5–8 μm. Cystidia not found. Lamellar trama regular, made up of parallel 3–15 μm broad hyphae, cells cylindrical to narrowly barrel-shaped, with yellow-ochre membranal pigment. Pileus cuticle a cutis made up of cylindrical parallel to slightly interwoven 3–8(-11) μm broad hyphae, with membranal and incrusting pigments. Stipe cuticle a cutis of parallel cylindrical 3–5 μm broad hyphae covered with nests of interwoven and branched 3–8 μm broad hyphae forming the stipe coverage. Clamp connections present at least in lamellar trama and pileus cuticle.

Result of the revision: = ***Galerina*** sp., see also Fig. 1/2.

I have not been able to identify the fungus at the species level. It is a *Galerina* with an annulus and distinctly verrucose-rugulose spores growing on rotten wood. In spite of a careful microscopic examination no cystidia have been found (they may have collapsed in the conservation liquid, a case often observed in other specimens of Velenovský stored in bottles). The narrowly cylindrical cystidia mentioned and depicted (Fig. 2/2) by Velenovský probably represent the upper cylindrical part of cystidia. The roughly verrucose-rugulose pileus surface is a character unusual in *Galerina*.

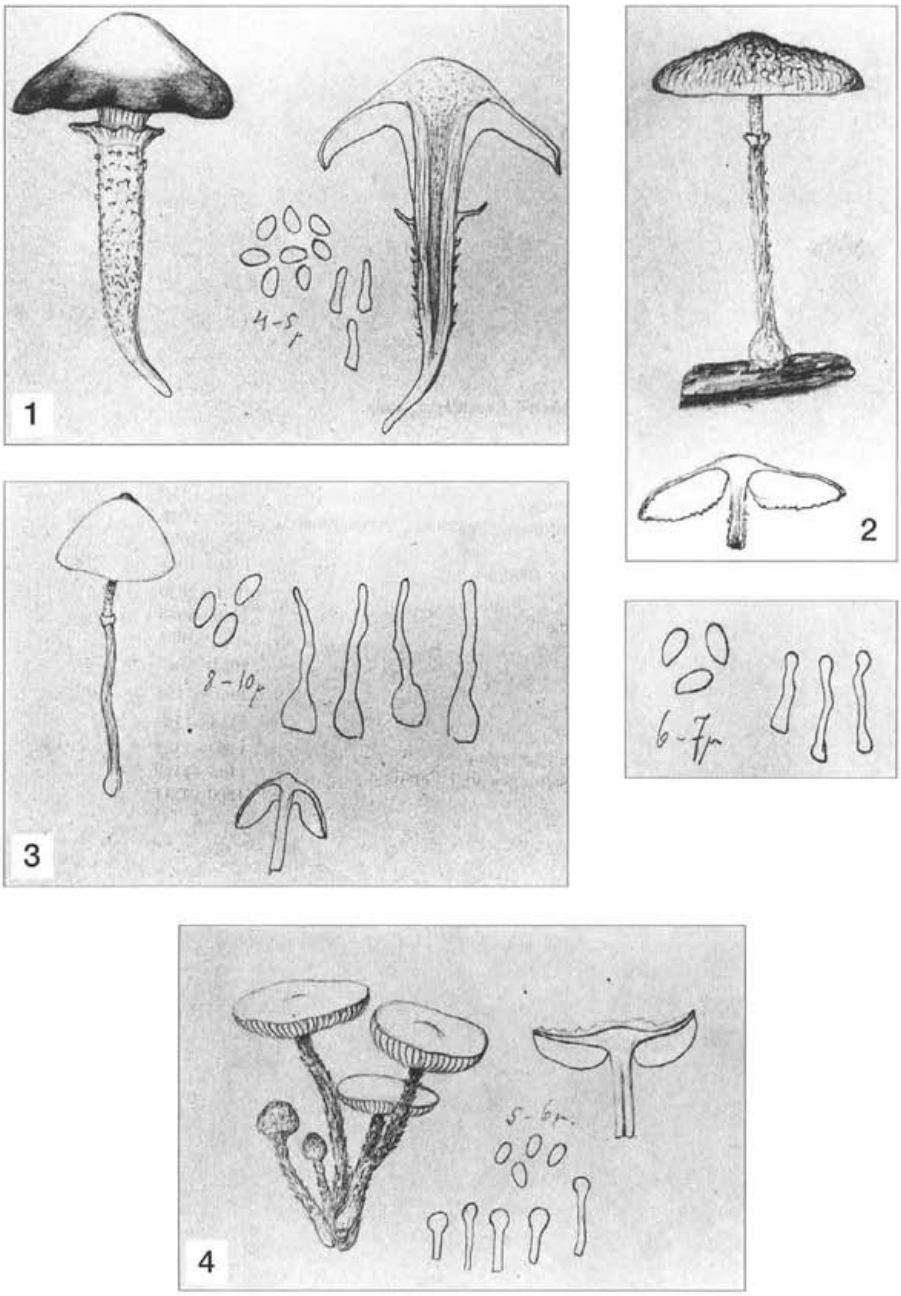


Fig. 2 Reproduction of unpublished pencilled line drawings by J. Velenovský from the manuscript of České houby (Velenovský 1920–1922). Fruitbodies, spores and cheilocystidia – **1**: *Pholiota decurrens*, **2**: *Pholiota fallax*, **3**: *Pholiota mammilata*, **4**: *Pholiota mucosa*. Slightly reduced.

In bottle no. 201, fruitbodies of three other fungal species are kept: *Hydrocybe acuta* Velen., *H. valentini* Velen. and *Dermocybe purpureobadia* Velen. *Pholiota fallax* Velen. was recognized thanks to its fasciculate growth on a small piece of wood in contrast to the other species representing mycorrhizal fungi.

Conclusion: *Pholiota fallax* Velen. is probably a species of *Galerina*, but can not be identified.

Pholiota mammilata Velen., České houby, pars 3: 501, 1921

Translation of the original description: "Tiny fungus, looking like a *Galera*. Pileus 1–1.5 cm, membranaceous, for a long time campanulate-conical with a verrucose umbo at the apex, hygrophanous, honey-coloured with translucent lamellae when moist, whitish to yellowish-ochraceous (originally: "like a bun") when dry, smooth, glabrous. Stipe long, 1–2 mm broad, flexuous, with appressed persistent membranaceous annulus, floccose-farinaceous in upper part, white fibrillose in lower part, glabrous, yellowish-ochraceous (originally: "like a bun"). Lamellae crowded, thin, broadly ventricose, broadly adnate, pale cream. Spores deep yellow, unevenly ellipsoid, 8–10 μm. Cheilocystidia large, with a broadly swollen base and long, gradually attenuated projection, curved, obtuse.

On soil in a *Larix*-forest on western slope near Mnichovice, November 1918. It is related to the previous species [which is *Pholiota blattaria*, see České houby p. 501], see also *Galera togularis*."

Reproduction of an unpublished line drawing by Velenovský: Fig. 2/3.

Material studied: probably holotype (there is no indication of locality and date of the collection on the card describing the content of bottle no. 36), PRC: originally bottle no. 36, fruitbodies of *P. mammilata* have been transferred to a separate small bottle marked 36a. The holotype consists of 2 well-preserved fruitbodies. From the about 30 fruitbodies in bottle 36 (representing *Pholiota mammilata* Velen., *Hebeloma squamulosum* Velen., *Lepiota pomacea* Velen., *Naucoria oligophylla* Velen., *Naucoria straminea* Velen., *Omphalina fusca* Velen., *Omphalina pythia* Velen., *Cantharellus radiatus* Velen., *Galera atripes* Velen., *Psathyra laricina* Velen., *Omphalia fuscipes* Velen.), that of *Pholiota mammilata* was recognized on account of the presence of an annulus, a character absent in all the species mentioned.

Spores 9.2–10.4 × 6.0–6.7 μm, ovoid in face view, ovoid-amygdaliform in side view, with suprahilar depression and distinct plage, roughly verrucose-rugulose, outer layer of the wall slightly separated in some parts, wall rusty brown. Basidia narrowly clavate, 26–31 × 7.5–10 μm, basidioles 20–21 × 7.5–8 μm. Cheilocystidia 56–68 × 11–12 μm, numerous, narrowly fusiform-lageniform. Pleurocystidia 54–77 × 9–14 μm, narrowly fusiform-lageniform. Lamellar trama regular to subregular, made up of 3–17 μm broad hyphae, cells cylindrical to narrowly barrel-shaped.

Pileus cuticle gelatinous, upper layer made up of cylindrical to narrowly fusiform 3.0–7.5 μm broad cells, lower layer formed by similar 6–15 μm broad cells. Stipe cuticle a cutis made up of parallel 2.5–5 μm broad hyphae, thin-walled, finely incrusted. Clamp connections present.

Result of the revision: = ***Galerina unicolor*** (Vahl) Singer, see also Fig. 1/3.

Both macro- and microcharacters of *Pholiota mammilata* Velen. agree very well with the characters of *Galerina unicolor* (Vahl) Singer as recently described by e.g. Smith and Singer (1964) and Gulden (1980). The fruitbodies of *P. mammilata* as well as the line drawing by Velenovský (Fig. 2/3) agree well with the original illustration of *Agaricus unicolor* (Flora Danica vol. 6, fasc. 18, pl. 1071, fig. 1, 1792) or plate 6, fig. B by Smith and Singer (1964).

Conclusion: *Pholiota mammilata* Velen. is a later synonym of *Galerina unicolor* (Vahl) Singer

Pholiota maximovici Velen., České houby, pars 3: 505, 1921

Translation of the original description: "Robust, fleshy, not hygrophanous, pileus 5–8 cm, thickly fleshy, convex, smooth, without scales, viscid, pale ochraceous. Stipe long, hard, firm, hollow, pale yellowish, 1–2 cm broad, with persistent membranaceous annulus, below the annulus with long, rough, fibrillose, brown and erect scales, above it finely densely brown granulose. Lamellae broad, adnate, later teared from the stipe, sparse, attenuated towards margin, olive-brown, edge smooth, white. Context white, smell absent, taste strongly bitter. Spores attenuated at both ends, almost fusiform, smooth, 12–15 μm. Cystidia small, obtusely cylindrical, hardly larger than basidia.

On a linden-tree near Žehušice, September 1920, collected by Mr. R. Maximovič. It belongs to the affinity of the previous species [which are *P. adiposa, P. aurivella* and *P. lucifera*] but does not agree with any one. The spores are very characteristic."

Reproduction of an unpublished line drawing by Velenovský: Fig. 3/5.

No herbarium material exists.

Discussion: The only European *Pholiota* with such long and uniquely shaped spores (see line drawing by Velenovský, Fig. 3/5) is *Pholiota albocrenulata* (Peck) Sacc. Some characters of *P. maximovici* fit this species well: its firm and fleshy fruitbody, appearance (Fig. 3/5), viscid pileus, broad adnate lamellae with white edge, hollow stipe with granulose apex and brown fibrillose scales, white context with bitter taste, obtusely cylindrical upper part of cheilocystidia. On the other hand, a smooth pileus with pale ochraceous colour is not typical of *P. albocrenulata*. As most characters of *P. maximovici* agree with those of *P. albocrenulata*, the absence of scales may be explained by their removal by rain, which is rather frequent in *Pholiota*.

Conclusion: *Pholiota maximovici* Velen. probably represents an aberrant pale form of *Pholiota albocrenulata* (Peck) Sacc. and is considered a later synonym of that species.

Pholiota mucosa Velen., České houby, pars 3: 508, 1921

Translation of the original description: "Growing in great clusters, pileus 1.5–2.5 cm, rather fleshy, at first campanulate-conical, soon convex, finally with a reflexed margin, scaly-tomentose when young, then glabrous, covered with a thick slime layer, with velum remnants at margin, dull olive ochre, slightly hygrophanous. Stipe long, 3–5 cm thick, cylindrical, solid, with a narrow channel only, dull ochre, yellowish in upper part, without a ring, entirely densely covered with white tomentose flaring scales. Lamellae narrow, thin, broadly ventricose, adnexed, pale ochre-yellowish at first, then dull brownish, turning brown after bruising. Context with a pleasant fungoid smell. Spores obtusely ellipsoid, yellow, 5–6 μm. Cystidia numerous, filiform, capitate at apex. Spore print reddish-brown.

Growing from soil in young stand of *Pinus nigra* on warm south slope of the "Michelský les" forest in November 1918. A peculiar fungus, rather distinct from other *Pholiota* species. It cannot be a *Hypholoma* because of the yellow spores and well-developed velum. Stipe covering is still rougher than in *Kuehneromyces mutabilis*."

Reproduction of an unpublished line drawing by Velenovský: Fig. 2/4.

Material studied: holotype: "Michelský les" forest, 1918, PRC (bottle no. 481). The holotype consists of a cluster of 5 moderately well-preserved fruitbodies.

Spores 6.0–7.3(-8.0) × 4.0–4.3 μm, variable in shape and size, ellipsoid to ovoid-ellipsoid in face view, ovoid-ellipsoid to slightly phaseoliform in side view, wall ochre-brown, smooth, germ pore distinct, 0.6–0.8 μm broad. Basidia 21 × 6 μm, cylindrical to narrowly clavate, 4-spored. Cheilocystidia 30–35 × 5–6 μm, forming a sterile band, cylindrical, slightly capitate at apex, thin-walled, hyaline. Chrysocystidia present on lamellae surface, 35–43 × 8–10 μm, clavate with apiculate to mucronate apex, with yellow-rusty refractive inclusion when observed in KOH. Lamellar trama regular, made up of parallel 4–15(-20) μm, near the subhymenium only 3–5 μm broad hyphae, cells cylindrical to barrel-shaped. Pileus cuticle an ixocutis, upper layer gelatinized, made up of loosely arranged 2.5–5 μm broad hyphae, lower layer formed by 5–8 μm broad hyphae, with fine membranal and incrusting pigment. Stipe cuticle a cutis of cylindrical 3–5 μm broad hyphae with finely membranal pigment. Scales on pileus surface formed by cylindrical, curved and apically rounded 5–9 μm broad cells, with membranal and incrusting pigment. Clamp connections present in all tissues.

Result of the revision: = ***Pholiota gummosa*** (Lasch: Fr.) Singer, see also Fig. 1/4.

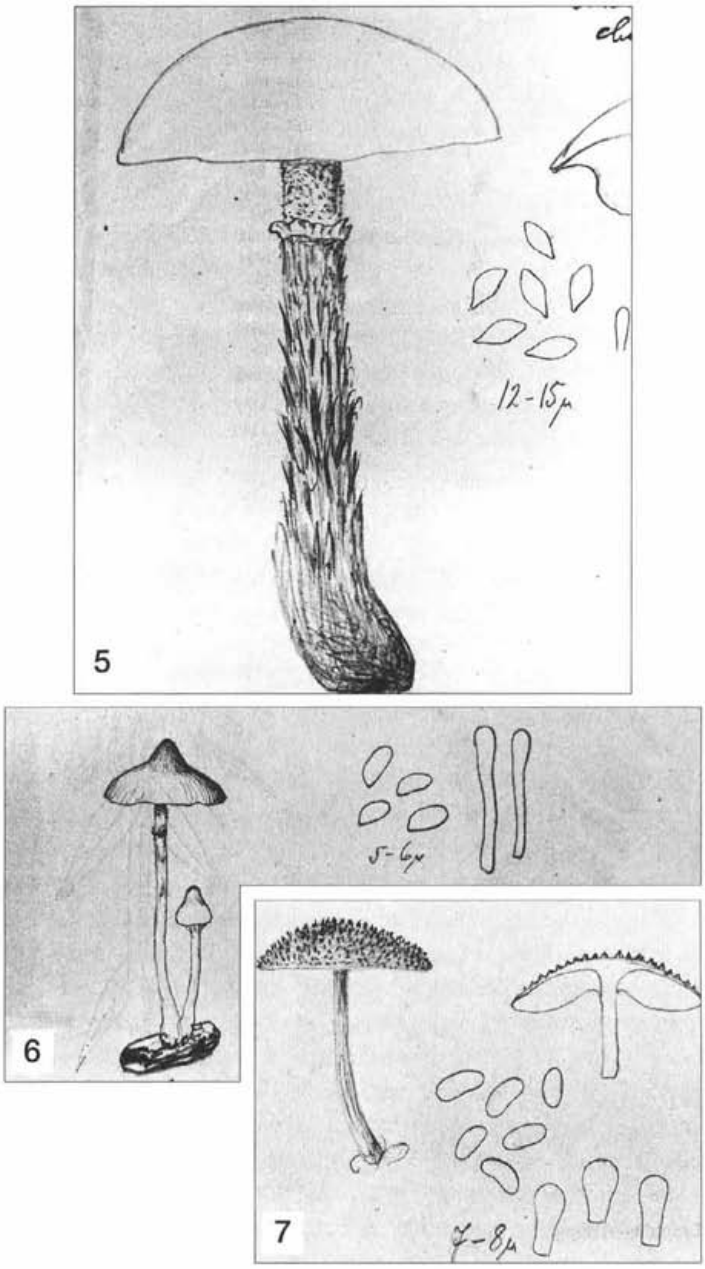


Fig. 3 Reproduction of unpublished pencilled line drawings by J. Velenovský from the manuscript of České houby (Velenovský 1920–1922). Fruitbodies, spores and cheilocystidia – **5**: *Pholiota maximovici*, **6**: *Pholiota rostrata*, **7**: *Flammula granulosa*. Slightly reduced.

Discussion: All microcharacters of the holotype agree well with those of *Pholiota gummosa*. The following macrocharacters of *P. mucosa* are typical of *P. gummosa*: growth in clusters, scaly pileus when young, strongly glutinose pileus surface, olive tinge of the pileus, dull ochre stipe. On the other hand, there are some controversial points in the Velenovský's description – stipe densely covered with white tomentose scales, reddish-brown colour of the spore print. The first character may be explained by the young stage of the fruitbodies and the resulting rich presence of velum, the latter one remains open. However, the fungus is certainly no *Hypholoma* (*Hypholoma* species do not have scaly stipes) or *Stropharia* (there is not such a combination of macro- and microcharacters in any European species). Due to the facts mentioned, the conspecifity of *Pholiota mucosa* and *Pholiota gummosa* seems to be sufficiently proved and acceptable. This conclusion is confirmed by an unpublished line drawing by Velenovský (Fig. 2/4) which perfectly fits young fruitbodies of *P. gummosa*.

Conclusion: *Pholiota mucosa* Velen. is a later synonym of *Pholiota gummosa* (Lasch: Fr.) Singer

Pholiota nigrosetosa Velen., Mykologia 7: 56, 1930.

In his description, Velenovský refers to the previously published description of *Pholiota flammans* in České houby: 504, 1921. In Mykologia, Velenovský writes that *P. nigrosetosa* differs from true *P. flammans* sensu Fries as well as from *Pholiota squarrosa*. According to him, the main distinguishing characters of his new species are firm, setigerous, erect and almost black scales on the pileus surface, large pilei (6–10 cm), growth exclusively on wood of conifers, and small spores (twice as shorter as in *P. squarrosa*). Later Velenovský (1940) summarised his conclusions in a Latin written discussion.

Translation of the original description (České houby, pars 3: 504. 1921; as *Pholiota flammans* Fr.): "In dense clusters, looking like the previous one [which is *P. squarrosa*]. The whole fungus possesses a pale yellow ground covered with erect, spiny, pointed, firm, dark scales. Pileus 6–10 cm, fleshy, hemispherical to obtusely conical when young, then convex, dry, for a long time with veil remnants at margin. Stipe hardly longer than the pileus diameter, 1–2 cm broad, firm, solid, with scaly ring, below it with spiny scales. Lamellae rather firm, at first pale yellowish, then rusty. Context yellowish, soft, with pleasant fungoid smell. Spores cylindrical, small, 3–4 μm.

On stems and stumps of conifers, rare, September-October. On *Picea* near Kunice, on *Abies* near Tehov, Řevnice, Třeboň (Weinzettl)."

No herbarium material exists.

Discussion: If the spore size is omitted, *P. nigrosetosa* seems to be a dark-scaled form of *Pholiota squarrosa* (the same conclusion was published by Pilát

1930: 30). However, the spores are too small for *P. squarrosa*. If the measurements of Velenovský are correct, the spores have exactly the same length as spores of *Pholiota flammans*, a species having the smallest spores in the genus *Pholiota*. However, the pilei of *P. flammans* never reach 10 cm and its scales are yellow. The combination of characters in *P. nigrosetosa* is not known in any European species of *Pholiota*. There are two explanations of this fact: 1) *P. nigrosetosa* really is a new species, or 2) characters of several *Pholiota* species are mixed in the description. Due to the fact that no herbarium material exists and such a fungus has never been collected later, I tend towards the second explanation.

Conclusion: *Pholiota nigrosetosa* Velen. is a dubious species, macroscopically resembling *P. squarrosa*. The name can be considered a nomen dubium.

Pholiota pseudohypholoma Velen., České houby, pars 3: 502, 1921

Translation of the original description: "Size, shape, consistence and colours like *Hypholoma fasciculare*. Pileus 3–5 cm, rather fleshy, campanulate-convex, with apiculate umbo, glutinous, smooth, lustrous, on some places with indistinct scaly velum, rusty fox-coloured at centre, sulphur-yellow in other parts, not hygrophanous, without translucent lamellae. Stipe long, firmly elastic, fibrillose, rusty and floccose-fibrillose in lower part, sulphur-yellow in upper part, with vanishing scaly ring, connected with the pileus by a pale velum when young. Lamellae crowded, even, adnate but soon teared, at first pale but then deep rusty brown, with white edge. Context sweet, whitish yellowish, odour slight pleasantly farinaceous when rubbed. Spores brightly yellow, ellipsoid, 8–10 μm. Cheilocystidia numerous, filiform, obtuse.

In clusters on an apple stump in a communal garden nursery in Mnichovice, September 1918. It is a peculiar fungus, very different from *Ph. mutabilis* by its colour. It is similar to *Hypholoma fasciculare* but has not the acrid taste."

Material studied: no original material mentioned by Velenovský in the original description (České houby p. 502) has been preserved. In PRC, there is one later collected specimen identified by J. Velenovský as *P. pseudohypholoma*: August 1922. Zvánovice, PRC (bottle no. 524). The cells of the fungus are in a bad state (collapsed, shape changed etc.).

Spores 7.3–8.6 × 4.6–5.2 μm ellipsoid in face view, somewhat applanate in side view, wall thick, brown, with distinct germ pore 0.6–0.8 μm broad. Basidia 17–20 × 5–6 μm, narrowly clavate. Chrysocystidia present at the edge, collapsed, shape unidentifiable. Cheilocystidia collapsed, probably cylindrical to narrowly lageniform. Pleurocystidia not identifiable. Lamellar trama regular, made up of parallel 3–8 μm broad hyphae, cells with ochre membranal pigment. Pileus cuticle a cutis, 2-layered, upper layer strongly gelatinous, made up of loosely arranged, 1.5–4 μm broad hyphae with membranal pigment, lower layer formed by parallel

6–19 μm broad hyphae, cells cylindrical, ellipsoid to oval, with membranal pigment. Clamp connections present.

Result of the revision: description in České houby: probably ***Pholiota alnicola*** (Fr.: Fr.) Singer, specimen in bottle 524: ***Hypholoma*** sp.

Discussion: As no original material of *P. pseudohypholoma* has been preserved, the literature data and the later collected specimen in the PRC herbarium must be considered separately. The following combination of macrocharacters given by Velenovský shows that his *P. pseudohypholoma* is no *Hypholoma*: fleshy fruitbodies, sulphur yellow pileus with rusty fox-coloured centre, rusty-brown lamellae, taste mild, sweet (*H. fasciculare*: bitter taste, *H. capnoides*: paler colours, dark grey lamellae, *H. sublateritium*: pileus brick red at centre). There is great similarity with the characters of *Pholiota alnicola*, which is also confirmed by an unpublished line drawing by Velenovský showing a typical appearance of*P. alnicola*, ellipsoid to subamygdaliform spores and cylindrical cheilocystidia.

The fungus kept in PRC (bottle no. 524) is a *Hypholoma* from the group of *H. fasciculare*, *H. sublateritium* and *H. capnoides*. The main character supporting this idea is the presence of inflated cells in the upper layer of the pileus cuticle which is a typical character of the genus *Hypholoma* (character completely absent in *Pholiota*). The cells of the specimen are poorly preserved. Due to this fact and the lack of any information on macrocharacters and habitat, it is impossible to identify the fungus at the species level.

Later published additional text: Velenovský, České houby pars 5: 918. 1922.

Translation of the additional text: "*Pholiota pseudohypholoma* Vel. I found a great number of fruitbodies of this interesting fungus on alder stumps near Jíloviště in November 1921. The pileus is soon convex and umbonate, nice sulphur yellow when young, turning brown at centre when old. Velum abundant in young stage, arachnoid, pure white. Lamellae broad near the stipe, attenuate towards margin. Spores ellipsoid, cystidia narrowly cylindrical or capitate. It has a strong smell, like *P. squarrosa*."

Material studied: Jíloviště, 1921, PRC (bottle no. 198). It is the fungus mentioned in the previous paragraph.

Spores (7.3-)8.6–9.8(-10.4) × (4.3-)5.0–5.5 μm, narrowly subamygdaliform in front view, ellipsoid-ovoid in side view, wall ochre-brown, with minute germ pore. Cheilocystidia cylindrical, narrowly lageniform-fusiform, narrowly clavate, sometimes with a cylindrical outgrowth, hyaline. Chrysocystidia and pleurocystidia absent.

Result of the revision: = ***Pholiota alnicola*** (Fr.: Fr.) Singer, see also Fig. 1/5.

Conclusion: *Pholiota pseudohypholoma* Velen. is a later synonym of *Pholiota alnicola* (Fr.: Fr.) Singer.

Pholiota rigelliae Velen., České houby, pars 3: 506, 1921

Translation of the original description: "Appearance and size like the preceding fungus [which is *Pholiota sulphurea* Velen. = *Pholiota flammans* (Batsch: Fr.) P. Kumm.] but not so sulphur-yellow. Pileus 3–5 cm, broadly convex, thickly fleshy, for a long time involute at margin and connected with the stipe by a yellow velum forming an arachnoid and later disappearing annulus on the stipe, pileus slightly viscid, yellow-brownish, densely covered with minute and rather erect red-brown scales. Stipe about 1 cm thick, long, firm, solid, curved, yellow, below the annulus with red-brown, appressed scales, roughly fibrillose. Context yellow, strongly sweetish aromatic. Spores globose, brown, 5–6 μm. Cystidia not frequent, big, obtusely cylindrical.

In oak forests near Chlumec nad Cidlinou in September 1916, collected by Miss Aloisie Rigellová, my diligent and staunch student."

Illustration: České houby p. 505, Fig. 80/1.

Material studied: holotype: Chlumec nad Cidlinou, 1916, PRC (bottle no. 60). The holotype consists of 5 well-preserved fruitbodies.

Spores (6.4-)7.3–8.6(-9.0) × 5.5–6.4(-6.7) μm, broadly ellipsoid with subacute apex, ochre-brown, wall brown, densely and prominently verrucose. Basidia 32–34 × 7.5–9 μm, narrowly clavate to cylindrical, 4(2)-spored, Basidioles 24–27 × 7.5–9 μm, narrowly clavate. Cheilocystidia and pleurocystidia not found. Lamellar trama regular, of parallel 6–14 μm broad hyphae, cells short, cylindrical. Pileus cuticle formed by 5–11 μm broad hyphae, cells cylindrical or slightly fusiform, with membranal pigment, scales consisting of nests of interwoven curved 9–20 μm broad hyphae, cells cylindrical to narrowly barrel-shaped, with strong membranal pigment. Stipe cuticle formed by parallel cylindrical 5–12 μm broad hyphae, often with ascending and outwards curved terminal elements, membranal pigmented, stipe covering made up of nests of interwoven 9–25 μm broad hyphae, strongly membranal pigmented. Clamp connections present in all tissues.

Result of the revision: = ***Cortinarius bolaris*** (Pers.: Fr.) Zaw., see also Fig. 1/6.

Discussion: Both Velenovský's description and the microcharacters studied by the present author agree well with the characters of *Cortinarius bolaris* as described e.g. by Brandrud et al. (1994). The most typical characters are the red-brown scales on the pileus surface of *Pholiota rigelliae* Velen., yellow context, appearance and size of the fruitbodies (see České houby p. 505, fig. 80/1), scaly stipe, size and shape of the spores and, finally, the occurrence in an oak forest.

Conclusion: *Pholiota rigelliae* Velen. is a later synonym of *Cortinarius bolaris* (Pers.: Fr.) Zaw.

Pholiota rostrata Velen., České houby, pars 3: 500, 1921

Translation of the original description: " Growing fasciculately, pileus 1–1.5 cm, conical-campanulate, with a massive, long, obtuse umbo, hygrophanous, red-brown when moist, with somewhat translucent lamellae, almost brick-coloured when dry, glabrous, smooth. Stipe long, thin (2–3 mm), brown, smooth, cartilaginous, flexuose, connected with the pileus by a white tomentose velum when young, the velum forming a minute, disappearing, scaly annulus on the stipe. Below the annulus the stipe is glabrous or with several small and disappearing scales only. Above the annulus the stipe is finely powdered. Lamellae rather crowded, rusty, adnate, emarginate near the stipe, with white edge. Spores honey-coloured, unevenly ellipsoid, obliquely contracted at base, 5–6 μm. Cystidia numerous, long, filiform, obtuse at apex.

On rotten stumps of *Picea* in "Zvánovické údolí" valley, September 1919."

Reproduction of an unpublished line drawing of Velenovský: Fig. 3/6

Material studied: holotype: Mnichovice, September 1919, PRC (bottle no. 93). The locality given in České houby (Zvánovické údolí valley) does not agree with the one on label of bottle no. 93 (Mnichovice). However, the discrepancy can easily be explained by the fact that "Zvánovické údolí" valley represents a sublocality of Velenovský's favourite locality Mnichovice (a small town he lived in). Bottle no. 93 contains another species: *Telamonia caespitosa* Velen. and *T. olivascens* Velen. *Pholiota rostrata* was recognised on account of its small fruitbody and small spores.

Spores (6.0-)6.7–7.3 × (3.4-)3.7–4.3 μm, ovoid-amygdaliform in face view, amygdaliform in side view, sometimes with slight suprahilar depression, wall rusty, distinctly tuberculose-rugulose, plage present, distinct. Basidia 18–22 × 4–6 μm, cylindrical to narrowly clavate, 4-spored. Basidioles 18–20 × 4–5 μm. Cheilocystidia numerous, 30–40 × 6–7 μm, cylindrical with capitate to subcapitate apex, rarely narrowly lageniform, sometimes flexuous or curved, thin-walled, hyaline. Pleurocystidia absent. Lamellar trama regular, of parallel 3–10 μm broad hyphae, cells cylindrical to slightly barrel-shaped, inflated or narrowly fusiform, with clamp connections. Pileus cuticle formed by 3–6 μm broad hyphae, cells cylindrical, exceptionally also oval to globose, 11–15 μm broad hyphae. Stipe cuticle a cutis of parallel, cylindrical 3–5 μm broad hyphae, rarely with caulocystidia of the same size and shape like the cheilocystidia.

Result of the revision: = ***Galerina triscopa*** (Fr.) Kühner, see also Fig. 1/7, 3/6.

Discussion: All characters of *Pholiota rostrata* and the unpublished line drawing by Velenovský (Fig. 3/6) agree well with the descriptions of *Galerina triscopa* by Smith and Singer (1964) or Watling and Gregory (1993) and with figure 123B by J. E. Lange (1935–1940).

Conclusion: *Pholiota rostrata* Velen. is a later synonym of *Galerina triscopa* (Fr.) Kühner

Pholiota salicina Velen., České houby, pars 3: 506, 1921

Translation of the original description: "Fruitbodies small, pale, flesh thin. Pileus 2–3 cm, obtusely campanulate-convex, dry, pallid with a yellowish tinge, covered with minute scrappy brownish scales. Stipe twice as longer as the diameter of the pileus, 2–3 mm thick, firm, white, scarcely floccose-scaly, thickened towards the base and finely arachnoid-floccose. Lamellae crowded, thin, broadly ventricose, adnexed, whitish with a yellow tinge, turning greenish when bruised. Spores ovoid-pyriform, yellowish, 8–10 μm. Cystidia numerous at the edge, scattered on the lamellae surface, large, shape like a violin (constricted in the middle part). Context whitish, smell none.

On a willow stump in "Radotínské údolí" valley, November 1917. – It is a peculiar species related to the previous one [which is *Pholiota muricata* Fr.]. Annulus poorly developed. Lamellae turning green in my solution [which is a conservation liquid based on formaldehyde and ethanol]. The cystidia are prominent."

Material studied: holotype: Radotín, on willow, November 1917, PRC (originally bottle no. 255, the fruitbody of *P. salicina* has been transferred to a separate small bottle marked 255a). The material consists of one poorly preserved fruitbody. From the about 7 fruitbodies in bottle 255 (representing *Pholiota salicina* Velen., *Clitocybe obolus* Fr., *Omphalia rosarum* Velen., *Collybia filamentosa* Velen. and *Naucoria arvalis* Fr.), that of *Pholiota salicina* has been selected on account of the size of the fruitbody and the brown scaly pileus.

There are 4 types of spores of brown-spored agarics on the lamellae surface. As no spores connected to sterigmata could be found, it was impossible to decide which type belongs to *P. salicina*. Basidia not found (probably collapsed). Basidioles 20 × 6 μm, narrowly clavate. Cheilocystidia probably present (see Velenovský's description) but not found. Pleurocystidia 35–54 × 12–18 μm, clavate or utriform with median constriction, partly filled with a pigment. Pileus cuticle formed by spherical, oblong to broadly clavate cells, 35–45 × 22–32 μm, rarely intermixed with hyphae formed by cylindrical to narrowly barrel-shaped cells. Stipe cuticle a cutis formed by parallel 3–5 μm broad hyphae, caulocystidia absent. Clamp connections present.

Discussion: The presence of spherical elements in the pileus cuticle places *Pholiota salicina* within the family *Bolbitiaceae*. My attempts to identify the fungus at the generic and species level remained unsuccessful. Due to the presence of alien spores and the poor state of the fruitbody some important characters are lacking and, therefore, reliable identification is impossible.

Conclusion: *Pholiota salicina* Velen. is a hardly interpretable dubious species that cannot be identified. It belongs to the family *Bolbitiaceae*.

Pholiota sulphurea Velen., České houby, pars 3: 506, 1921

Translation of the original description: "Figure 80. Relatively small but beautiful species related to *Ph. squarrosa*. Pileus 3–5 cm, obtusely campanulate at first, then plano-convex, margin involute for a long time, medium fleshy, strongly viscid, smooth and lustrous when dry, golden yellow, with minute appressed yellow scales, with reddish tinge at centre when old, margin connected with stipe by rich sulphur-yellow velum when young. Stipe 6–10 cm, longer than the pileus diameter, dry, yellow, somewhat thickened and red-brown at base, with saffron-yellow scaly annulus, below it with yellow erect scales. Lamellae crowded, sulphur-yellow at first, then golden yellow for a long time, finally yellow-brown, emarginate at the stipe, almost broadly triangular, turning brown when bruised. Context sulphur-yellow, with strong resinous smell, changing brown on air. Spores obtusely ellipsoid, 5–6 μm. Cystidia big, obtuse, bulbously swollen.

On a *Picea*-stump near Třeboň in August 1915 and 1916 collected by Director Weinzettl. Also collected near Písek (Macháček), on *Pinus*-stumps at Hůra near Tehov, on *Pinus*-wood in an enclosure in Smíchov (R). August-October."

Illustration: České houby p. 505, fig. 80/2.

Material studied: 2 syntypes: Třeboň, Aug. 1915, PRC (bottle no. 91). – Písek, 19 Aug. 1915, leg. Macháček, PRC (bottle no. 339). Material in bad condition: too hard, cells mostly indistinct.

Spores 4.3–5.0 × 2.4–3.0 μm, ellipsoid in face view, sometimes slightly phaseoliform in side view, wall thin, germ pore absent. Basidia 18–21 × 4.5–6.6 μm, narrowly clavate, 4-spored. Basidioles 15–20 × 4.4 μm. Chrysocystidia numerous, present both at the edge and on lamellae surface, 25–38 × 8–11 μm, narrowly clavate, cylindrical-clavate to narrowly utriform, filled with a refractive content. Cheilo- and pleurocystidia of the same shape and size as the chrysocystidia, hyaline or with granulose or homogeneous yellow pigment, thin-walled. Pileus and stipe cuticle: structure indiscernible.

Result of the revision: = ***Pholiota flammans*** (Batsch: Fr.) P. Kumm., see also Fig. 1/8.

Discussion: All microcharacters of the fruitbodies studied (including their appearance) and most macrocharacters of *P. sulphurea* given by Velenovský (description + Fig. 80/2 in České houby) agree well with those of *Pholiota flammans*. However, there is a substantial conflict concerning the nature of pileus cuticle – Velenovský writes that it is strongly viscid which is quite untypical of *P. flammans*. According to my observations, the cuticle can be slightly sticky in moist weather but is never strongly glutinous. This deviation may be explained by the fact that characters of several species of *Pholiota* are mixed in Velenovský's description (he based it on several collections). The syntypes really represent true *Pholiota flammans*.

Conclusion: *Pholiota sulphurea* Velen. is a later synonym of *Pholiota flammans* (Batsch: Fr.) P. Kumm.

Flammula granulosa Velen., České houby, pars 3: 513, 1921.

Translation of the original description: "Tiny fungus growing individually, pileus 1–2.5 cm, convex, without umbo, flesh thin, rusty brown, mat, whole surface erinaceous-granulose thanks to the presence of vertical conical papillae. Stipe twice as longer as the pileus diameter, 3–4 mm broad, solid, firm, elastic, roughly fibrillose, usually compressed, brown in basal part, yellow-brown in upper part, without annulus or ring. Lamellae rather sparse, thin, broadly adnate, broadly ventricose, yellow-ochre at first, then of brown-flesh colour. Spores obtusely ellipsoid, usually reniformly curved, translucently yellow, 7–8 μm. Cheilocystidia big, globose, with a short attenuated peduncle. Smell absent.

On drippy hollow place of a living beech stem in forests near Jevany, September 1918. It is a peculiar fungus by its appearance and the habitat, nor similar nor related to any other fungus known."

Reproduction of an unpublished line drawing by Velenovský: Fig. 3/7.

Material studied: holotype: Jevany, 1918, PRC (bottle no. 57). The holotype consists of one moderately well-preserved fruitbody. Further specimens in bottle no. 57: *Leptoglossum muscorum* Fr., *Pluteus excentricus* Velen.

Spores 8.0–9.2(-9.5) × 4.3–4.9 μm, oblong in front view, distinctly phaseoliform in side view, wall brown, thick, 0.4–0.6 μm, germ pore minute, narrow. Basidia collapsed. Cheilocystidia mostly collapsed, poorly visible, clavate. Lamellar trama regular, made up of 5–15 μm broad hyphae, cells cylindrical to narrowly ellipsoid. Pileus cuticle formed by chains of cylindrical, narrowly ellipsoid, narrowly barrel-shaped to pyriform and elongated cells, 25–64 × 6–22 μm. Stipe cuticle a cutis of cylindrical 3–5 μm broad hyphae with nests of velar remnants formed by interwoven 3–9 μm broad hyphae, cells often curved or slightly inflated, with incrustations. Clamp connections present in all tissues.

Result of the revision: = ***Flammulaster limulatus*** (Fr.) Watling, see also Fig. 1/9.

Discussion: All characters of *Flammula granulosa* Velen. agree perfectly with *Flammulaster limulatus* (Fr.) Watling as interpreted e.g. by Kühner and Romagnesi (1953) or *F. limulatus* var. *limulatus* by Vellinga (1986) as well as with my own finds of this fungus (Holec and Pouzar 1998).

Conclusion: *Flammula granulosa* Velen. is a later synonym of *Flammulaster limulatus* (Fr.) Watling

Flammula pholiotiformis Velen., České houby, pars 3: 513, 1921.

Translation of the original description: "Appearance exactly like *Pholiota adiposa*. Pileus 4–9 cm, fleshy with watery flesh, convex, with sharp, inflexed margin, sulphur-yellow, moist, abundantly covered with appressed dark brown scales, scales large at centre, towards the margin minute and crowded, sometimes also of pink colour. Stipe longer than pileus diameter, 1–1.5 cm broad, pale yellow, smooth, glabrous, coarsely fibrillose, elastic. Lamellae sparse, not broad, thick, gradually decurrent on the stipe, yellowish. Context yellowish, slightly fetid. Spored distinctly globose, rusty, towards the base shortly attenuated, 5–6 μm. Cheilocystidia large, utriform-clavate.

Near *Pinus* stumps in forests near Sojovice by the Jizera river in July 1914. A peculiar fungus – everybody would say it is *Pholiota adiposa* but it has neither a cortina nor velum but globose spores. I would say that it is close to *Flammula gymnopodia* Bull. which rarely grows in mountainous forests."

No herbarium material exists.

Discussion: Judging the description, *Flammula pholiotiformis* is a dark-spored fungus somewhat resembling *Pholiota adiposa*. However, the decurrent lamellae and perfectly globose spores are quite untypical of *Pholiota* and related genera. *Flammula gymnopodia* mentioned by Velenovský was recently reinstalled by Reijnders (1998) as *Pholiota gymnopodia* (Bull.: Fr.) A. F. M. Reijnders. Although its lamellae are decurrent, this species has an orange-brown pileus with minute scales and broadly ellipsoid spores.

As the characters of *Flammula pholiotiformis* given by Velenovský are insufficient to judge its identity (e.g. the colour of spore print is unknown) and herbarium material is lacking, the species cannot be identified.

Conclusion: *Flammula pholiotiformis* Velen. is a hardly interpretable dubious species.

Flammula picea Velen., Novitates mycologicae: 136, 1940 ("1939")

Original description: "Dense fasciculata, 5–12 cephala, pil. 2–3 cm, cito explanato, centro minute umbonato, rigidi-carnoso, parum hygroph., citrino-flavido, nudo, sine velo. St. pil. diam. parum longior, 2 mm cr., supra incrassatus, squamulis patulis totus vestitus. Lam. confertae, cinnamomeae, postice dente adnatae, acie serrulatae (!). Sp. ovato-ellipt., pellucido-luteae 5–7. Cyst. copiosa, acicularia, recta 25–60.

Ad radices Piceae in piceto pr. Okrouhlice (distr. Prag.) 11. 1938 legit V. Vacek. Cum nulla nota eam identificare nequeo. Pileus denique leniter radiato-rugosus. Inodora."

Material studied: holotypus: Zahořany (a village near Okrouhlice), 13 Nov. 1938, V. Vacek, PRM 677004. The holotype consists of 3 well-preserved fruitbodies.

Spores (6.0-)6.7–8.0 × 4.0–5.0 μm, ellipsoid in face view, ellipsoid-ovoid to ovoid or slightly phaseoliform in side view, wall thin, pale ochre in KOH, dextrinoid, smooth, germ pore present, indistinct, about 0.6 μm broad. Basidia 20–22 × 6 μm, 4(2)-spored, cylindrical to narrowly clavate. Cheilocystidia prominent, 45–55 × 13–16 μm, lageniform to narrowly utriform with cylindrical or broadened (subcapitate) upper part. Pleurocystidia 45–58 × 12–18 μm, shape like the cheilocystidia or fusiform with broad and obtuse apex, utriform with broader medium part when young. Lamellar trama regular, of parallel to slightly flexuously interwoven 3–14 μm broad hyphae. Pileus cuticle a transition between a hymeniderm and an epithelium formed by short chains of globose, subglobose to broadly ellipsoid, 6–9 μm broad cells. Stipe cuticle formed by parallel 4–6 μm broad hyphae with upright cylindrical or filiform outgrowths and nests of mostly lageniform but also lageniform-tibiiform or rarely also narrowly lecythiform caulocystidia. Clamp connections present at least in lamellar trama.

Result of the revision: ***Pholiotina*** sp., see also Fig. 1/10.

Discussion: according to the structure of pileus and stipe cuticle, *Flammula picea* Velen. belongs to the genus *Conocybe* s.l. I have tried to identify the fungus with the key published by Meusers (1996), which is the most complete recent key of European species of *Conocybe* and *Pholiotina*. *Flammula picea* should belong to the group of *Pholiotina* with a lacking annulus. The most similar species are *Pholiotina striipes* (Cooke) Singer and *Pholiotina friesii* (Lundell) Enderle (= *P. pygmaeoaffinis* (Fries) Singer). However, there are many differing characters in *Flammula picea*, especially the shape of cystidia and caulocystidia. As I am not a specialist in this taxonomically difficult genus, the identity of the fungus should rather be revised by a specialist of the genera *Conocybe* and *Pholiotina*. For the monograph of *Pholiota*, the exclusion of *Flammula picea* from *Pholiota* is sufficient.

Conclusion: *Flammula picea* Velen. is a species of *Pholiotina*

Flammula squamulosa Velen., České houby, pars 3: 512, 1921

Translation of the original description: "Pileus 3–4.5 cm, rather fleshy, smooth, dry, applanate, with inflexed obtuse margin, with densely arranged appressed red-brown scales on a clearly yellow ground, completely red-brown at centre, context pale yellow, smell absent. Stipe of the same length as the pileus diameter, 6–8 mm broad in upper part, gradually attenuated towards base, firm, elastic, solid, fibrillose, glabrous, without velum, pale yellowish, turning blackish red-brown when bruised. Lamellae thin, broad, crowded, adnate, sulphur yellow. Spores almost uncoloured, ovoid-ellipsoid to ovoid-globose, 8 μm. Cheilocystidia small, obtusely lageniform or filiform.

On stumps near Koloděje in the Pardubice region, September 1918, collected by Dr. Schustler. It is impossible to link it with the previous one." [which is *Flammula sapinea*].

Material studied: Mnichovice, 1918, PRC (bottle no. 129). It is neither type material nor original material and consists of one moderately well-preserved fruitbody.

Spores 6.0–6.7 × 5.0–5.2 μm, broadly ellipsoid, hyaline, wall thin, smooth, with distinct apiculus, without germ pore. There are also larger spores measuring 6.7–8.8 × 5.0–6.0 μm (from 2-spored basidia ?). Basidia not found (probably collapsed). Basidioles 23–30 × 5 μm. Cheilocystidia very prominent, 40–110 × 9–22 μm, narrowly clavate-cylindrical to narrowly clavate, hyaline, wall yellow-brown, up to 0.7 μm thick. Pleurocystidia absent. Lamellar trama regular, made up of 5–20 μm broad hyphae, cells cylindrical to narrowly fusiform, at centre sometimes with ellipsoid up to 30 μm broad cells. Pileus cuticle a cutis formed by cylindrical 5–11 μm broad hyphae, terminal elements rounded at apex.

Result of the revision: = ***Tricholomopsis rutilans*** (Schaeff.: Fr.) Singer

Discussion: Most characters of *Flammula squamulosa* Velen. agree very well with the characters of *Tricholomopsis rutilans*. According to the herbarium label, the fruitbody investigated represents neither type nor original material of *F. squamulosa*. However, the fruitbody in bottle no. 129 agrees well with the description of this fungus published in České houby. It is also possible that it is the type, but Velenovský or his technical assistants routinely labelled the bottle with the name of Velenovský's most favourite locality – Mnichovice.

Conclusion: *Flammula squamulosa* Velen. is a later synonym of *Tricholomopsis rutilans* (Schaeff.: Fr.) Singer

Flammula vacini Velen., Novitates mycologicae: 137, 1940 ("1939")

Original description: "Caespitosa, polycephala, hygroph., tenax. Pil. 2–3.5 cm, cito explan., non umbon., sordide pallide fulvidus, opacus, glaber, margine membranaceo lamellas superanti. St. duplo longior, elasticotenax, concolor, 5–8 mm, farctus, saepe compressus, totus dense granulosos-paleaceus, sed sine velo et cortina. Sp. 5–6 μm, breviter ellipt., laeves, luteae, pellucidae. Cyst. copiosa, aceim dentatam efficientia, polymorpha, columniformia, clavata, ramosa, cuspidata, 50–80 μm. Lam. conf., latae, postice dente adnatae, argillaceae. Olet inamoene.

Ad truncum acerosum pr. Libšice (distr. Prag.), octob. 1939, leg. V. Vacinus. Nulli notae affinis nec similis."

No herbarium material exists.

Discussion: This is a hardly interpretable lignicolous fungus with a small sordid pale brown pileus, brown lamellae, a relatively thick and granulose-paleaceous stipe and small spores. As there is no herbarium material, it is difficult to determine its

identity or its generic position – it could be a species of the families *Strophariaceae* (*Pholiota*?), *Bolbitiaceae* (*Conocybe* s.l. ?) or *Cortinariaceae* (*Galerina* ?).

Conclusion: *Flammula vacini* Velen. is a brown-spored agaric which can not be identified. It remains a nomen dubium.

CONCLUSIONS

In the genus *Pholiota*s. str. (in the present sense), no species described by Velenovský can be considered a "good" new species. Most of his *Pholiota* and *Flammula* species belong to other genera, sometimes quite distant from *Pholiota* (e.g. *Tricholomopsis*, *Cortinarius*). However, in Velenovský's time the old broad Friesian concept of *Pholiota* and *Flammula* was abandoned only slowly, which is the reason why so many taxa described by him belong now to genera like *Galerina, Kuehneromyces, Pholiotina* or *Flammulaster*. The main problem is that most of Velenovský's new species of *Pholiota* and *Flammula* are identical with earlier described taxa. It is generally known that Velenovský underestimated or even did not know the variability of many fungal species, which led him (together with omitting contemporary literature) to describe so many new taxa based on superficial observations of macrocharacters and overestimating minor differences caused in fact by infraspecific variability. This is the reason why also his new species of *Pholiota* and *Flammula* are either identical with previously described taxa (their names are synonyms) or represent hardly interpretable species (and the names must remain nomina dubia).

ACKNOWLEDGEMENTS

This work was financially supported by the Grant Agency of the Czech Republic (Project No. 206/97/0273), the final elaboration also by research project of the Ministry of Culture of the Czech Republic (F02/98:NMPM00001). I also thank the anonymous reviewer of this paper for linguistic correction.

REFERENCES

BRANDRUD T. E., LINDSTRÖM H., MARKLUND H., MELOT J. and MUSKOS S. (1994): Cortinarius, Flora Photographica. Vol. 3. – 60 coloured plates, 35 p. Matfors.

BREITENBACH J. and KRÄNZLIN F. (1995): Pilze der Schweiz. Vol. 4. – 371 p. Luzern.

GULDEN G. (1980): Alpine Galerinas (Basidiomycetes, Agaricales) with special reference on their occurrence in South Norway at Finse on Hardangervidda. – Norw. J. Bot. 27: 219–253.

HOLEC J. and POUZAR Z. (1998): New records of rare fungi in the Šumava mountains (Czech Republic). II. – Čas. Nár. Muz., Řada přírodovědná (Journal of the National Museum, Natural History Series) 167: 61–72.

JACOBSSON S. (1990): Pholiota in northern Europe. – Windahlia 19: 1–86.

KÜHNER R. and ROMAGNESI H. (1953): Flore analytique des champignons supérieurs. – 557 p. Paris.
LANGE J. E. (1935–1940): Flora agaricina danica. – Copenhagen.
MEUSERS M. (1996): Bestimmungsschlüssel für europäische Arten der Gattungen Conocybe und Pholiotina. – Österr. Z. Pilzk. 5: 245–272.
PILÁT A. (1930): Vzácnější bedlovité houby z okolí Plöckensteinského jezera na Šumavě (Einige seltenere Agaricaceen aus der Umgebung vom Plöckensteiner See im Böhmerwalde). – Mykologia 7: 7–11, 24–32, 57–60.
PILÁT A. (1948): Velenovskýi species novae Basidiomycetum quas in opere "České houby" (Fungi Bohemiae), annis 1920–22 in lingua bohemica edito, descripsit. – Opera Botanica Čechica 6: 1–301.
REIJNDERS A. F. M. (1998): Pholiota gymnopodia comb. nov. A redescription of a forgotten species. – Persoonia 17: 113–118.
SMITH A. H. and SINGER R. (1964): A monograph on the genus Galerina Earle. – 394 p. New York.
VELENOVSKÝ J. (1920–1922): České houby. Part 1–5. – 950 p. Praha.
VELENOVSKÝ J. (1930): Mykologické příspěvky. (Mykologische Beiträge). – Mykologia 7: 55–56.
VELENOVSKÝ J. (1940): Novitates mycologicae. – 211 p. Praha ("1939").
VELLINGA E. C. (1986): The genus Flammulaster (Agaricales) in the Netherlands and adjacent regions. – Persoonia 13: 1–26.
WATLING R. and GREGORY N. M. (1993): British fungus flora: Agarics and Boleti. Vol. 7. Cortinariaceae p.p. – 131 p. Edinburgh.

CZECH MYCOL. 52 (1), 1999

Notes on the variability of Gymnopus luxurians (Tricholomataceae)

VLADIMÍR ANTONÍN[1] and JOSEF HERINK[2]

[1]Moravian Museum, Dept. of Botany,
Zelný trh 6, CZ-659 37 Brno, Czech Republic
[2]Turnovská 717/3,
CZ-295 01 Mnichovo Hradiště, Czech Republic

Antonín V. and Herink J. (1999): Notes on the variability of Gymnopus luxurians (Tricholomataceae) – Czech Mycol. 52: 41–49

The variability of *Gymnopus luxurians* is described in detail. An aberration with distinctly double edged lamellae which are connected to each other, especially when young, is described. This feature, as well as the number of lamellae do not have any taxonomic value. The world distribution of this species is also given.

Key words: Basidiomycetes, Tricholomataceae, *Gymnopus luxurians*, taxonomy, distribution.

Antonín V. a Herink J. (1999): Poznámky k variabilitě druhu Gymnopus luxurians (Tricholomataceae) – Czech Mycol. 52: 41–49

Je podrobně rozebrána variabilita druhu *Gymnopus luxurians*. Je popsána odchylka s lupeny se dvěma, v mládí navzájem spojovanými ostřími. Tento znak, stejně jako hustota lupenů, však nemá žádnou taxonomickou hodnotu. Je rovněž shrnuto celosvětové rozšíření druhu.

Gymnopus luxurians (Peck 1897) Murril 1911 was originally described (as *Collybia luxurians*) in North America. It was characterized by rather robust carpophores, a radially (innately) fibrillose pileus and a distinctly striate, mostly twisted stipe. Some years ago it was found in Europe and published as *Collybia crassipes* ss. Ricken (Noordeloos 1995). Later it was identified with *Gymnopus luxurians* (Antonín and Noordeloos 1997). In the genus *Gymnopus* it belongs to the sect. Vestipedes (Fr.) Antonín, Halling et Noordel., subsect. Vestipedes Antonín, Halling et Noordel. (Antonín, Halling and Noordeloos 1997). All European localities known at that time are summarized by Antonín and Noordeloos (1997).

In 1998 the first author received some collections of this fungus from Austria, Germany and the Czech Republic with rather distant lamellae. Moreover, a similar fungus has been found in Benin (West Africa) and in two greenhouses in the Czech Republic. However, the latter ones distinctly differ by the lamellae being connected to each other and totally closing off the interlamellar space in young specimens. Later they crack and form double lamellar edges. In the end, only a single pubescent to slightly denticulate edge can be found in old carpohores (see macrodescription). These characters, which have never been described in literature (e. g. Antonín and Noordeloos 1997; Bon and Massart 1996; Contu and La Rocca

1999; Desjardin, Hemmes and Wong 1996; Halling 1983, 1997; Hausknecht and Zuccherelli 1998), attracted us to study this species again.

We studied 20 specimens available to us in detail. These studies showed that all fungi (independent of locality – in a field or in a greenhouse, in Europe, U. S. A. or in Benin) were totally identical in all studied macro- and microfeatures, except for the double or single edge and connected or non-connected lamellae. However, we found a continual transition between carpophores with well-developed lamellar connections and carpophores without them. Therefore, this feature does not have any taxonomical value.

Studies of fresh carpophores and exsiccata showed that the number of lamellae varies very strongly from about 30 to 100, and neither this feature has any taxonomic value. In one collection from the Netherlands (Gatzen, L 99341) the carpophores are very small (pileus up to ca. 30 mm broad in dry specimens). However, this feature also fits into the variability of *G. luxurians*.

The macrodescription is based on the authors' own descriptions from the Czech Republic (greenhouses) and Benin, and descriptions by M. Beran (České Budějovice, Czech Republic) and A. Hausknecht (Maissau, Austria). Microscopical features are described from material mounted in Melzer's reagent, Congo-red, and KOH. For the basidiospores the following factors are used: E (quotient of length and width in any one spore); Q (mean of E-values).

Detailed description of *Gymnopus luxurians* (Peck) Murrill

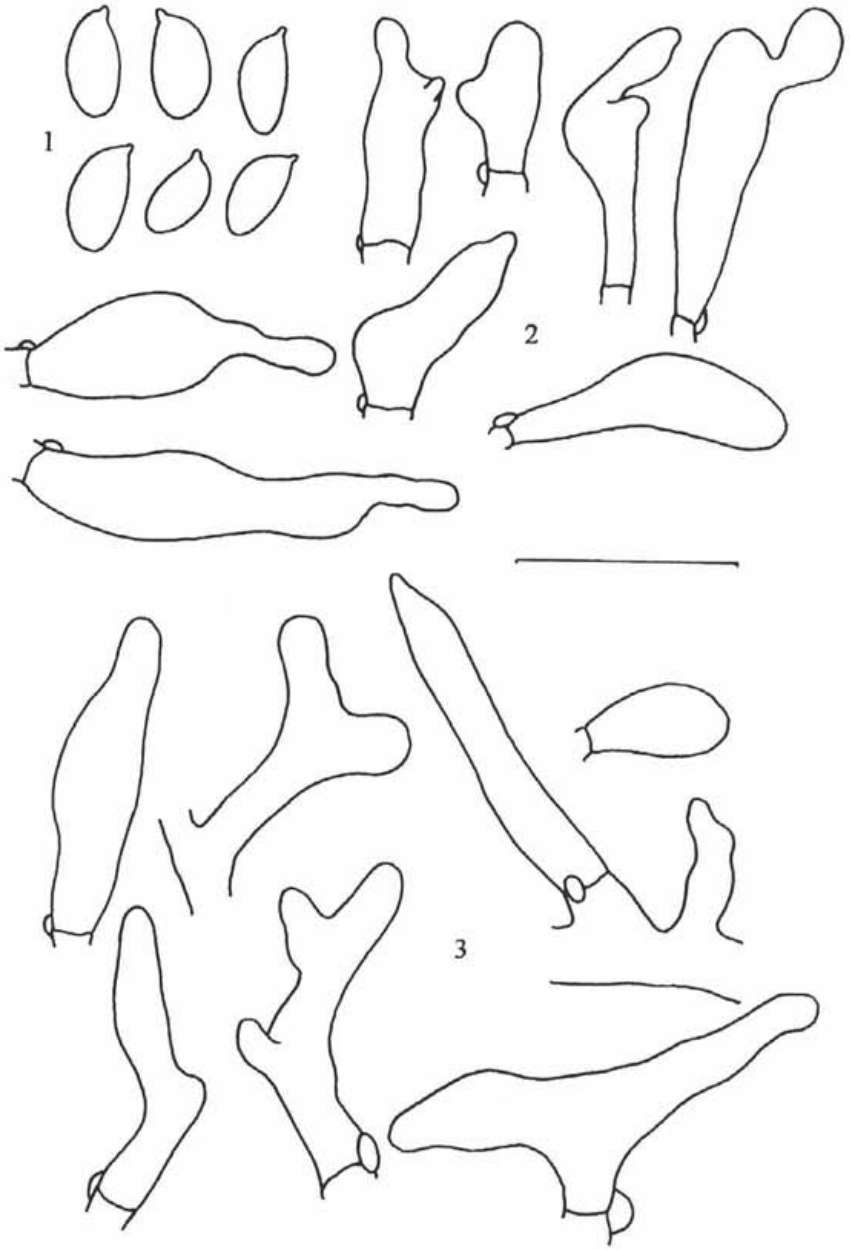
Pileus (15-)20–110(-150) mm broad, central to slightly eccentric, hemispherical to (sub)campanulate when young, then convex with a low umbo and involute margin, finally applanate to concave, with straight, often abrupt, slightly to distinctly undulate margin, non-viscid, rarely slightly sticky, very slightly hygrophanous, not translucently striate or slightly translucently striate at margin only when old, pileipellis removable (sometimes up to the centre), thin, entire when young, then pale radially innately fibrillose to striate, to slightly striate-sulcate at margin in old carpophores, not lustrous when moist, lustrous like silk when dry; dark brown to dark reddish brown (Kornerup and Wanscher 7E5–6) when young, then paler, reddish golden to brownish orange (6C7–8), paler towards margin. Lamellae close to rather distant, L = (30-)55–80(-100), with lamellulae (l = 3–4), slightly emarginate with a short tooth to narrowly adnate, cuneate-curved, then more or less horizontal, slightly intervenose when old, (2-)4–6(-8) mm broad, thin, then transversally splitting; dirty pale orangish (5A3 + greyish tinge), with reddish brown stains when old; edge concolorous, lamellae either divided in two up to 1 mm broad edges and connected to each other (a distinct "line" is present between both edges in contact) when young (interlamellar spaces are closed off), later the connection line cracks and both lamella edges start to diverge (lamellae with double

edge), finally both edges of the lamellae are attached to each other and may be coalesced (lamellae with one edge), each edge slightly to distinctly denticulate, with a simple edge. Stipe (10-)30–85 × (3-)6–10(-15) mm, cylindrical, slightly attenuate towards base but slightly clavate to fusoid at base [(6-)8–12(-18) mm], longitudinally striate, soon appressed fibrillose and strongly longitudinally striate, sometimes twisted and laterally compressed, hollow, entirely finely white floccose-pruinose when young, then glabrescent towards base; under the whitish pruina pale dirty ochraceous, brownish with tobacco tinge at base; with slight whitish to yellowish basal mycelium. Context rather elastic when young, lustrous like silk, (2-)3–6(8) mm thick, white-yellowish in pileus, solid, slightly fibrillose, almost hollow when old, elastic, white-yellowish to brownish in stipe base, pale brownish in stipe cortex, without a distinct smell or with an indistinct smell like *Marasmius oreades*, with indistinct to slightly stale or bitterish taste. Spore print yellowish-white, pale yellow to light yellow (4A2–4).

Basidiospores (8.0-)8.5–11.5(-13) × 4.0–6.0 μm, E = 1.8–2.4(-2.6), Q = 1.9–2.2, ellipsoid, subfusoid or sublacrymoid, thin-walled, non-amyloid, smooth. Basidia 24–36 × 7.0–9.0(-10.0) μm, 4-spored, clavate. Basidioles 15–36 × 2.5–9.0(-11) μm, cylindrical to clavate, sometimes subfusoid. Cheilocystidia 15–60 × 5.5–15 μm, variable in shape, cylindrical, clavate to subutriform, mostly irregular to subcoralloid, sometimes with a few apical projections or subrostrate, thin-walled. Pleurocystidia absent. Tramal hyphae cylindrical to subinflated, more or less thin-walled, smooth or finely incrusted, up to 15 μm wide. Pileipellis a cutis, made up of radially arranged, cylindrical, slightly thick-walled, mostly coarsely incrusted, up to 10(-13) μm wide hyphae, pigment greyish brownish or often dark brown to black-brown, sometimes with olivaceous tinge; with 16–55 × (3.0-)5.0–15 μm large, digitate, cylindrical to clavate, often irregular lateral projections and (sub)erect terminal cells; pale grey-brownish in KOH; contents of some hyphae yellowish ochraceous in Melzer's reagent. Stipitipellis a cutis, consisting of parallel, cylindrical, slightly thick-walled, mostly incrusted, up to 10 μm wide hyphae. Caulocystidia (8.0)20–42(-70) × 5.5–10.5(-13) μm, numerous, appressed to erect, cylindrical, clavate, sublageniform or subutriform, sometimes irregular, rarely branched, slightly thick-walled, obtuse; lateral projections of stipitipellis hyphae present. Clamp-connections abundant in all tissues. Hyphae of the connecting layer made up of cylindrical, slightly thick-walled, ± parallel or slightly interwoven, clamped, up to 6 μm wide cells with cylindrical, narrowly clavate, rarely irregular terminal cells (see Figs. 1–5).

Microchemical reactions: No part of carpophore dextrinoid or amyloid.

Macrochemical reactions: Guyajac – context becoming slightly greenish; Benzidine (1 % solution in 10 % acetic acid) – context and lamellae becoming slowly sky-blue, then darkening to blue-grey; Phenol (2 %) – context becoming slowly wine red; Pyramidon (concentrated solution) – context and lamellae



Figs. 1–3 *Gymnopus luxurians*: **1.** spores, **2.** cheilocystidia, **3.** caulocystidia. Scale bar = 20 μm.

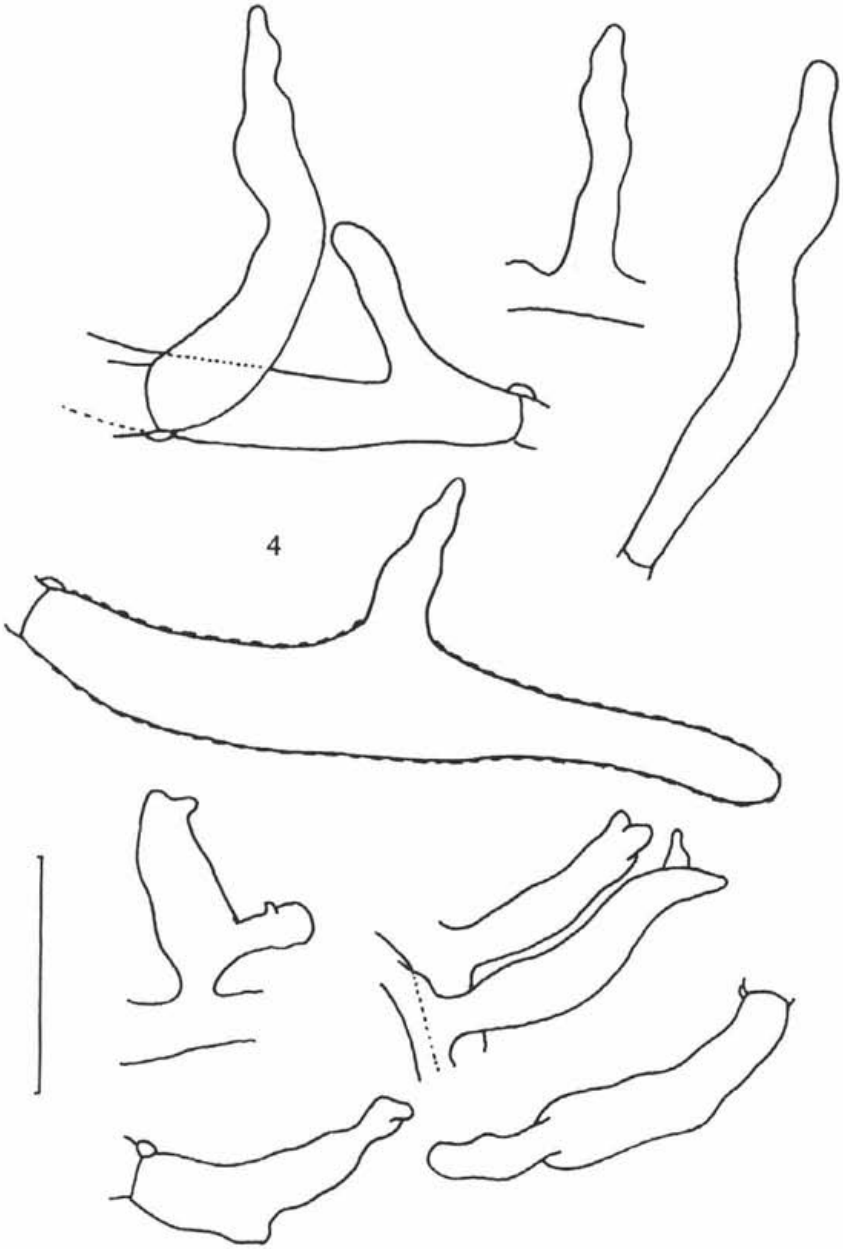


Fig. 4 *Gymnopus luxurians*: pileipellis cells. Scale bar = 20 μm.

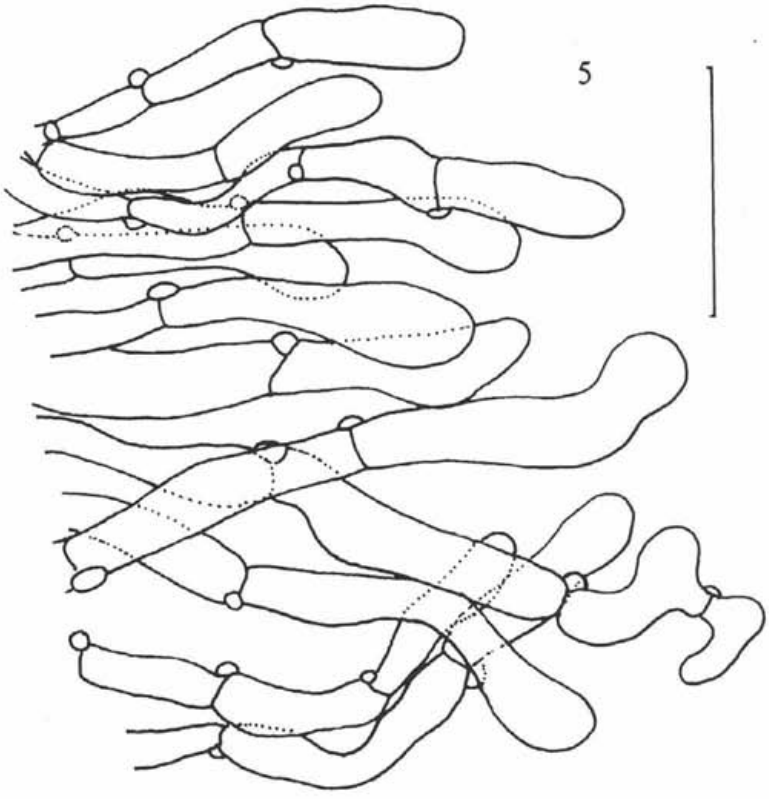


Fig. 5 *Gymnopus luxurians*: hyphae of lamellae connecting layer. Scale bar = 20 μm.

becoming slowly purple-violett, after 60 minutes changing into dirty orange; NaOH (10 %) – context and lamellae becoming quickly straw-yellow; $AgNO_3$ (10 %) – context becoming slowly grey-pink to grey-violet, later dark chestnut brown.

Ecology: Growing in fascicles on bark and woodchips (of both deciduous or coniferous trees), leaves mixed with soil, or on dead twigs and wood lying on soil, less frequently on soil among grass; probably a lignicolous fungus; it has been found both in greenhouses and in the open air.

Collections examined

AUSTRIA: Graz, Botanical garden, in a greenhouse; 30. IV. 1998 leg. H. Pidlich-Aigner (BRNM; WU).

BENIN: Ouari Maro, Borgou prov., 20. VIII. 1997 leg. V. Antonín 97.69 (BR, BRNM). – ditto, 22. VIII. 1997 leg. V. Antonín 97.90 (BR, BRNM). – Boukombe,

Atacora prov., 25. VIII. 1997 leg. A. De Kesel (BR). – Koussoukouangou, Atacora prov., 5. IX. 1997 leg. V. Antonín 97.166 (BR).

CZECH REPUBLIC: České Budějovice, city park "Stromovka", 3. VIII. 1998 leg. V. Bícha (BRNM; CB). – Praha, Botanical garden, in a greenhouse; II. 1976 leg. M. Svrček 623/76 (PRM 820173, as *Collybia dryophila* forma pileo pallide carneo). – ditto, 13. IV. 1983 leg. A. Vágner (herb. Herink 13/83). – Liberec, Stráž n. Nisou, in greenhouse of a commercial nursery, 13. IV. 1983 leg. Z. Pelda (herb. Herink 18/83). – ditto, 13. and 20. IV., and 3. V. 1983 leg. Z. Pelda (herb. Herink 17/83). – ditto, 19. VIII. 1983 leg. J. Herink and J. Sedláček (herb. Herink 138/83).

GERMANY: Speyer, nördlich Hanhofen, 21. VII. 1997 leg. W. Winterhoff 9765 (herb. W. Winterhoff).

ITALY: Ravenna, private garden, 6. IX. 1994 leg. A. Zuccherelli 624 (L 99337).

NETHERLANDS: Noord-Brabant, Eindhoven, "Philip de Jong wandelpark", 20.–28. IX. 1989 leg. H. Huyser. (L 99338). – Nijverdal, 1. VIII. 1994 leg. W. Ligterink (L 99335). – Overyssel, Ryssen, 1. VIII. 1994 leg. W. Ligterink (L 99336). – Limburg, Venlo, Water Supply Area, 21. V. 1986 leg. G. M. Gatzen (L 99341).

U. S. A.: Massachusetts, Hampshire Co., Amherst, Village Park, 27. VII. 1979 leg. R. E. Halling 2076 (L 99339). – New York, Bronx, New York Botanical Garden, 26. IX. 1989 leg. R. E. Halling 6317 (L 99340).

Gymnopus luxurians is characterized by often rather robust carpophores, an innately radially fibrillose pileus, a distinctly fibrillose-striate and often twisted stipe, the presence of variable cheilocystidia and its ecology. Some carpophores differ in having lamellae divided in two up to 1 mm broad edges connected to each other when young, later with a double edge, finally with one edge (for lamellae development sketch see Fig. 6). Other macroscopical and all microscopical features are identical with the type form. However, we also found transient forms between both extremes. This feature is often distinct (under a stronger lens) as a small ribbon along both sides of the lamellar edges while the space between them is almost smooth. This is the main reason why we consider it a character without taxonomic value. This character may be a reaction to climatic conditions (humidity? – the higher humidity, the better developed connections?) as the best developed ones were found in carpophores from greenhouses in Austria and the Czech Republic, and open air localities in New York Botanical Garden, Bronx, U. S. A. and Benin (West Africa).

Gymnopus luxurians is known in Europe from the Czech Republic, France (Bon and Massart 1996), Germany, Italy (Contu and La Rocca 1999, Hausknecht and Zuccherelli 1998), and the Netherlands, in North America from the U. S. A. (Halling 1983), and the Hawaiian Islands (Desjardin, Hemmes and Wong 1996). Photographs of this species were published by Antonín and Noordeloos (1997), Bon and

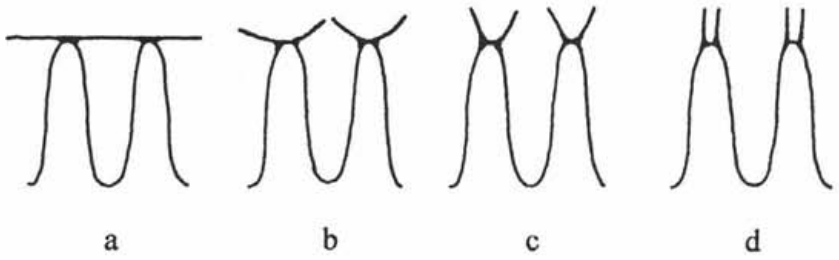


Fig. 6. Lamellae development sketch: a) young specimen, b) becoming mature, c) mature specimen, d) old specimen.

Massart (1996), Contu and La Rocca (1999), Desjardin, Hemmes and Wong (1996), Halling (1983, in black and white; 1997, in colour), Hausknecht and Zuccherelli (1998).

According to the description and a pencil drawing, a macroscopically similar fungus seems to be *Collybia tamatavae* Bouriquet described from Madagascar (Bouriquet 1942–1943). However, the original description is very short, and the double edged lamellae are not mentioned. The type specimen is not preserved in herbarium PC (Mascarell in litt.).

ACKNOWLEDGEMENTS

The authors wish to thank Mgr. M. Beran (České Budčjovice, Czech Republic), Dkfm. A. Hausknecht (Maissau, Austria), Dr. Machiel E. Noordeloos (Leiden, the Netherlands), and Prof. W. Winterhoff (Sandhausen, Germany) for kindly sending herbarium specimens and macrodescriptions. The collections made in Benin were enabled by a grant of the "Fondation pour favoriser les recherches scientifiques en Afrique". The first author (V. A.) would like to thank also Mr. André De Groote, for logistics and help during his African stay.

REFERENCES

ANTONÍN V., HALLING R. E. and NOORDELOOS M. E. (1997): Generic concept within the groups of Marasmius and Collybia sensu lato. – Mycotaxon 58: 359–368.

ANTONÍN V. and NOORDELOOS M. E. (1997): A monograph of Marasmius, Collybia and related genera in Europe. Part 2: Collybia, Gymnopus, Rhodocollybia, Crinipellis, Chaetocalathus, and additions to Marasmiellus. – Libri Bot. 17: 1–256.

BON M. and MASSART F. (1996): Deux espèces américaines découvertes dans le sud-ouest de la France. – Doc. Mycol. 26(103): 29–32.

BOURIQUET G. (1942–1943): Notes de mycologie malgache. – Bull. Acad. Malgache 25: 12–24.

CONTU M. and LA ROCCA S. (1999): Funghi della zona mediterranea insulare italiana. – Fungi non delineati 9: 1–48.

DESJARDIN D. E., HEMMES D. E. and WONG G. J. (1996): Agaricales of the Hawaiian Islands. – an internet page (www.mycena/sfsu.edu).

HAUSKNECHT A. and ZUCCHERELLI A. (1998): Ritrovamenti interessanti dal Ravennate, 5^a parte: diverse Agaricales, nuovi reperti e aggiunte a gruppi già trattari e altri. – Boll. Gruppo Micol. Bresadola 41(2): 91–134.

HALLING R. E. (1983): The genus Collybia in the Northeastern United States and adjacent Canada. – Mycol. Memoir 8: 1–148. Braunschweig.

HALLING R. E. (1997): A revision of Collybia s. l. in the Northeastern United States und adjacent Canada. – an internet page (www.websun.nybg.org).

NOORDELOOS M. E. (1995): Collybia (Fr.) Staude. – in: Bas C. and al. (eds.), Flora agaricina neerlandica 3: 106–123.

CZECH MYCOL. 52 (1), 1999

Type specimens of fungi preserved in the Herbarium of the Moravian Museum in Brno, Czech Republic (BRNM)

VLADIMÍR ANTONÍN and ALOIS VÁGNER

Moravian Museum, Dept. of Botany,
Zelný trh 6, CZ-659 37 Brno, Czech Republic

Antonín V. and Vágner A. (1999): Type specimens of fungi preserved in the Herbarium of the Moravian Museum in Brno, Czech Republic (BRNM) – Czech Mycol. 52: 51–68

A list of type specimens of fungi preserved in the herbarium of the Moravian Museum in Brno, Czech Republic containing 351 items is published.

Key words: type specimens, herbarium, Moravian museum, Brno

Antonín V. a Vágner A. (1999): Typový materiál hub v herbáři Moravského zemského muzea v Brně (BRNM) – Czech Mycol. 52: 51–68

V článku je publikován seznam typového materálu hub v herbáři Moravského zemského muzea v Brně obsahující 351 položek.

The Herbarium of the Department of Botany of the Moravian Museum in Brno, Czech Republic (BRNM) contains about 830 000 specimens; about 80 000 of them are fungi. Concerning micromycetes, the most important collectors were Eduard Baudyš (1886–1968) and Richard Picbauer (1886–1955). Except of own type specimens, a large collection of R. Picbauer contains a number of type specimens by Franz Petrak (not only from his important collection "Flora Bohemiae et Moraviae Exsiccata"). The most important macromycetes collectors were Johann Hruby (1882–1964), Karel Kříž (1907–1980) and František Šmarda (1902–1976). A list of type specimens contains 351 items now.

The lists of type specimens of species described by the most important donators (E. Baudyš, J. Hruby, Jiří Moravec, F. Petrak and R. Picbauer) are also available on an internet web page of the Moravian Museum (www.mzm.cz) in a part with information about Department of Botany.

Acanthostigma moravicum Petrak, Ann. Mycol. 22: 30, 1924. BRNM 03898/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 37, no. 1801)

Acervus lusakianus J. Moravec, Čes. Mykol. 37(4): 240, 1983. BRNM 333696 (isotype)

Aecidium viborgiae P. Henn., Hedwigia 37: 295, 1898. BRNM 115726 (syntype, in: Pl. Schlechter. Austro-Africanae)

Aleuria dalhousiensis Thind et Waraitch, Proc. Ind. Acad. Sci. 74: 269, 1971. BRNM 612408 (isotype)

Aleuria latispora J. Moravec, Čes. Mykol. 47(4): 247, 1994. BRNM sine num. (isotype)

Amanita rubens var. *areolata* Šmarda, Čes. Mykol. 2: 46, 1948. BRNM 245958 (holotype)

Amerosporium violae Baudyš et Picbauer, Pr. Morav. Přír. Společ. Brno, Sv. 3, Spis 2, F22, p. 34, 1926. BRNM 335382 (holotype)

Ascobolus densireticulatus J. Moravec, Čes. Mykol. 24: 137, 1970. BRNM 612390 (isotype)

Ascochyta bubakiana Picbauer, Ann. Mycol. 35: 142, 1937. BRNM 127426 (holotype)

Ascochyta bulgarica Bubák et Picbauer, Ann. Mycol. 35: 142, 1937. BRNM 127425 (holotype)

Ascochyta celosiae (Thüm.) Petrak, Ann. Mycol. 25: 371, 1927. BRNM 127438 [noted by Melnikov (1971) as isotype on label]

Ascochyta circaeae Bubák et Picbauer, Ann. Mycol. 35: 142, 1937. BRNM 127430 (holotype)

Ascochyta galeopsidis Eliasson, Svensk Bot. Tidskr. 9: 408, 1915. BRNM 127472 (isotype)

Ascochyta graminicola var. *diedickeana* Baudyš et Picbauer, Pr. Morav. Přír. Společ. Brno, Sv. 3, Spis 2, F22, p. 29, 1926. BRNM 340480 (holotype)

Ascochyta graminicola var. *setariae* Baudyš, Lotos 64: 53, 1916. BRNM 340481 (holotype)

Ascochyta heraclei var. *heraclei-ternati* Bubák et Picbauer, Ann. Mycol. 35: 143, 1937. BRNM 127474. (holotype)

Ascochyta menthicola Bubák et Picbauer, Ann. Mycol. 35: 143, 1937. BRNM 127506 (holotype)

Ascochyta poae-badensis Picbauer, Sborn. Vys. Šk. Zeměd. Brno D18: 22, 1931. BRNM 127519 (holotype)

Ascochyta rumicis-patientiae Picbauer, Ann. Mycol. 35: 142, 1937. BRNM 127533 (holotype)

Ascochyta sesleriae Baudyš et Picbauer, Pr. Morav. Přír. Společ., Sv. 1, Sp. 5, F5, p. 295, 1924. BRNM 340467 (holotype)

Ascochyta vodakii Bubák, Növén. Közlem. 1907: 32 (sep.), 1907. BRNM 340463

Ascochyta zavřelii-ignatii Picbauer, Verh. Naturforsch. Ver. Brünn (1937): 41, 1937. BRNM 127567 (holotype)

Ascochytella avenae Petrak, Ann. Mycol. 23: 107, 1925. BRNM 127568

Boletus satanas var. *roseodermata* F. Šmarda, Biológia 9(4): 451, 1954. BRNM 265622 (holotype)

Bovista fusca R. Dvořák, Zimní houby hadcové stepi u Mohelna, p. 6, 1930. BRNM 266925 (lectotype)

Calolepis congesta Syd., Ann. Mycol. 23: 399, 1925. BRNM 130754 (isotype)

Calopactis singularis Syd., Ann. mycol. 10: 83, 1912. BRNM 130753 (syntype, in: Fungi exotici exs., no. 88)

Camarosporium bulgaricum Petrak, Ann. Mycol. 29: 381, 1931. BRNM 05288/39

Camarosporium carpini Baudyš et Picbauer, Pr. Morav. Přír. Společ., Sv. 1, Sp. 5, F5, p. 303, 1924. BRNM 341371 (holotype)

Camarosporium kirchneri Staritz, in Diedicke, Krypt. Fl. Brandenb. 9: 680, 1914. BRNM 129467

Catacauma contractum Syd., Ann. Mycol. 23: 365, 1925. BRNM 130782 (syntype, in: Fungi in itinere costar. coll., no. 273)

Ceratosphaeria moravica Petrak, Ann. Mycol. 21: 249, 1923. BRNM 03992/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 34, no. 1669)

Cercospora exitiosa Syd., Ann. Mycol. 4: 485, 1906. BRNM 124301 and 124297 (topotypes)

Cercospora exosporoides Bubák, Ann. Mycol. 13: 33, 1915. BRNM 124298 and 124296 (syntypes)

Cercospora imperatoriae Baudyš et Picbauer, Pr. Morav. Přír. Společ., Sv. 1, Sp. 5, F5, p. 305, 1924. BRNM 341625 (holotype)

Cercospora poae Baudyš et Picbauer, Pr. Morav. Přír. Společ., Sv. 1, Sp. 5, F5, p. 304, 1924. BRNM 341626 (holotype)

Cercospora radiata var. *dalmatica* Baudyš, Öster. Botan. Zeitsch. (1914): 484, 1914. BRNM 341636 (holotype)

Cercospora raphanistri Baudyš et Picbauer, Pr. Morav. Přír. Společ., Sv. 1, Sp. 5, F5, p. 305, 1924. BRNM 341639 (holotype)

Cercosporella anemonis Baudyš, Lotos 64: 60, 1916. BRNM 336096 (holotype)

Cercosporella anethi Sacc. in Brenckle, Mycologia 10: 216, 1918. BRNM 130635 (syntype, in: Brenckle, Fungi dakotenses, no. 353)

Cercosporella linariae Baudyš et Picbauer, Pr. Morav. Přír. Společ., Sv. 1, Sp. 5, F5, p. 306, 1924. BRNM 336318 (holotype)

Cercosporella nesleana Baudyš et Picbauer, Pr. Morav. Přír. Společ., Sv. 1, Sp. 5, F5, p. 306, 1924. BRNM 336093 (holotype)

Cercosporella trolliicola Bond., in Smarods, Fungi Latvici Exs., fasc. 9, no. 444, p. 154, 1934. BRNM 130646

Cercosporina bubakii Picbauer, Ann. Mycol. 35: 147, 1937. BRNM 130803 (holotype)

Ceuthospora leguminum Syd., Ann. Mycol. 21: 176, 1923. BRNM 130796 and 130794 (topotypes)

Chaetomium fiscicolum Petrak, Ann. Mycol. 12: 45, 1915. BRNM 04695/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 23, no. 1101)

Cheilymenia aurantiacorubra Thind et Kaushal, Ind. Phytopath. 33: 428, 1980. BRNM 612409 (isotype)

Cheilymenia magnipila J. Moravec, Čes. Mykol. 22: 35, 1968. BRNM 612401 (isotype)

Cheilymenia micropila Svrček et J. Moravec, Čes. Mykol. 22(1): 37, 1968. BRNM 333697 (isotype)

Cheilymenia notabilispora J. Moravec, Čes. Mykol. 22: 36, 1968. BRNM 612404 (isotype)

Cheilymenia pseudohumarioides Dissing, J. Moravec et Sivertsen, Mycotaxon 36: 173, 1989. BRNM 612407 (isotype)

Cheilymenia theleboloides f. *magnifica* J. Moravec, Čes. Mykol. 22:38, 1968. BRNM 612378 (isotype)

Clitocybe vernalis Hruby, Verh. Naturforsch. Ver. Brünn 66: 89, 1935. BRNM 06138/39 (holotype)

Coleosporium clerodendri Diet., Engl. Jahrb. 28: 566, 1899. BRNM 52154

Collybia petrakii Hruby, Hedwigia 70: 252, 1930. BRNM 06300/39 (holotype)

Collybia pseudolacerata Hruby, Hedwigia 70: 253, 1930. BRNM 06301/39 (holotype)

Collybia similis Hruby, Hedwigia 70: 253, 1930. BRNM 06311/39 (holotype) a 06311/39 (topotype)

Coprinus stipetorum Hruby, Verh. Naturforsch. Ver. Brünn 66: 90, 1935. BRNM 06390/39 (holotype)

Coprobia hyphopila J. Moravec, Čes. Mykol. 38: 150, 1984. BRNM 612387 (isotype)

Coprobia sordida J. Moravec, Čes. Mykol. 38: 154, 1984. BRNM 612395 (isotype)

Coprotus subcylidrosporus J. Moravec, Čes. Mykol. 25: 155, 1971. BRNM 612399 (isotype)

Coronophora moravica Petrak, Ann. Mycol. 12: 476, 1914. BRNM 04037/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 14, no. 677)

Corticium baudysii Pilát, Mykologia 4: 70, 1927. BRNM 484726 (isotype)

Cryptosphaeria moravica Petrak et Sacc., Ann. Mycol. 11: 558, 1913. BRNM 04056/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 2, no. 100)

Cucurbitaria pruni-spinosae Rehm, Ascom. exsic., fasc. 52, no. 2045. BRNM 04100/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 3, no. 148) and BRNM 117411 (syntype)

Cucurbitaria rubefaciens Petrak, Ann. Mycol. 21: 242, 1923. BRNM 04096/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 34, no. 1672)

Cylindrosporium baudysianum Sacc., Ann. Mycol. 12: 296, 1914. BRNM 335461 (authentic specimen?)

Cytospora ostryae Syd., Ann. Mycol. 8: 492, 1910. BRNM 127672 (type?)

Diaporthe cydoniicola Petrak, Ann. Mycol. 13: 49, 1915. BRNM 04157/39 (syntypus, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 23, no. 1116)

Diaporthe densa Sacc., Ann. Mycol. 12: 289, 1914. BRNM 04158/39 (syntypus, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 23, no. 1117)

Diaporthe fuchsiae Petrak, Ann. Mycol. 19: 198, 1921. BRNM 04172/39 (syntypus, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 30, no. 1484)

Diaporthe genistae Rehm, Ann. Mycol. 11: 152, 1913. BRNM 04175/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 1, no. 24)

Diaporthe hranicensis Petrak, Ann. Mycol. 12: 477, 1914. BRNM 04173/39 (syntypus, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 21, no. 1045) – in Saccardo's Sylloge fungorum, it was published as *D. rhanicensis* by an error.

Diaporthe ligustri Petrak, Ann. Mycol. 13: 49, 1915. BRNM 04186/39 (syntypus, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 23, no. 1115; as *D. ligustri-vulgaris* on label)

Diaporthe pusilla Sacc., Ann. Mycol. 12: 289, 1914. BRNM 04213/39 (in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 20, no. 978)

Diaporthe recedens Sacc., Ann. Mycol. 12: 290, 1914. BRNM 04218/39 (in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 20, no. 979)

Diaporthe rhamnigena Petrak, Ann. Mycol. 13: 48, 1915. BRNM 04220/39 (syntypus, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 23, no. 1122)

Diaporthe transiens Sacc., Ann. Mycol. 11: 558, 1913. BRNM 04244/39 (in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 20, no. 980)

Dicoccum cupaniae Syd., Ann. Mycol. 23: 421, 1925. BRNM 130926 (isotype)

Didymella autumnalis Petrak, Ann. Mycol. 23: 111, 1925. BRNM 04305/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 39., no. 1918) and BRNM 117309 (syntype)

Didymosphaeria moravica Rehm, Ann. Mycol. 11: 151, 1913. BRNM 04322/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 1., no. 11)

Didymosphaeria petrakiana Sacc., Ann. Mycol. 12: 286, 1914. BRNM 04323/39 (in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 21, no. ??)

Dimerosporium pellicula Syd., Ann. Mycol. 5: 339, 1907. BRNM 130960 (syntype)

Diplodia croatica Baudyš et Picbauer, Bull. Inst. Jard. Bot. Univ. Belgrad 1: 71, 1928. BRNM 335647 (holotype)

Diplodia rhizophila Syd., Ann. Mycol. 14: 247, 1916. BRNM 127334 (topotype)

Diplodia sarajevensis Picbauer, Glasnik Zemal. Muz. Bosni i Herceg. 45: 68, 1933. BRNM 127351 (holotype)

Diplodina anthriscina Baudyš, Lotos 64: 54, 1916. BRNM 340433 (holotype)

Diplodina celastri Syd., Ann. Mycol. 14: 246, 1916. BRNM 127279 (type?), BRNM 127232 and BRNM 127228 (topotypes)

Diplodina galeopsidis Picbauer, Pr. Morav. Přír. Společ., Sv. 7, Sp. 4, F56: 13, 1932. BRNM 127243 (holotype)

Diplodina lappae Picbauer, Pr. Morav. Přír. Společ., Sv. 1, Sp. 5, F5: 296, 1924. BRNM 127256 (holotype)

Diplodina menthae Picbauer, Pr. Morav. Přír. Společ., Sv. 2, Sp. 5, F15: 158, 1925. BRNM 127258 (holotype)

Diplodina nicandrae Picbauer, Pr. Morav. Přír. Společ., Sv. 1, Sp. 5, F5: 297, 1924. BRNM 127262 (holotype)

Diplodina ocimi Picbauer, Pr. Morav. Přír. Společ., Sv. 7, Sp. 4, F56: 14, 1932. BRNM 127266 (holotype)

Diplodina origani Picbauer, Pr. Morav. Přír. Společ., Sv. 2, Sp. 5, F15: 157, 1925. BRNM 127263 (as *Phoma origani* 1922 on label)

Diplodina physocaulis Picbauer, Ann. Mycol. 35: 145, 1937. BRNM 127268 (holotype)

Diplodina richteriana Staritz, Hedwigia 53: 191, 1913. BRNM 127272

Diplodia platanicola Sacc., Ann. Mycol. 6: 562, 1908. BRNM 127322, 127325 and 127323

Dothichiza exigua Sacc., Ann. Mycol. 6: 562, 1908. BRNM 121867

Dothichiza pini Sacc., Ann. Mycol. 3: 168, 1905. BRNM 121871 (topotype)

Dothichiza sanguisorbae Baudyš et Picbauer, Pr. Morav. Přír. Společ., Sv. 1, Sp. 5, F5, p. 302, 1924. BRNM 335374 (authentic specimen?)

Dothidella diplothemii Syd., Ann. Mycol. 5: 360, 1907. BRNM 130071

Dothiorella apocyni Petrak, Ann. Mycol. 29: 374, 1931. BRNM 05025/39 (holotype)

Endodothella istrica Petrak, Ann. Mycol. 19: 115, 1921. BRNM 05460/39

Entylomella smarodsii Moesz, Ungar. Bot. Blätter 33: 49, 1934. BRNM 131000

Eriosphaeria albido-mucosa Rehm, Ann. Mycol. 11: 150, 1913. BRNM 04357/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 1, no. 1)

Eutypa moravica Petrak, Ann. Mycol. 25: 224, 1927. BRNM 04478/39 and 130583 (isotypes, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 46, no. 2257)

Fimaria virginea Svrček et J. Moravec, Čes. Mykol. 23: 158, 1969. BRNM 612392 (isotype)

Flammula paludosa Hruby, Hedwigia 70: 263, 1930. BRNM 06655/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. Ser., Lfg. 47, no. 2345)

Fusicoccum corylinum Sacc., Ann. Mycol. 12: 293, 1914. BRNM 126576 (isotype)

Fusicoccum petiolicolum Bubák, Ann. Mycol. 13: 28, 1915. BRNM 126579 (isotype)

Fusicoccum petrakeanum Sacc., Ann. Mycol. 11: 322, 1913. BRNM 126580

Galactinia moravecii Svrček, Čes. Mykol. 22(2): 90, 1968. BRNM 333850 (lectotype) and 333698 (isotype)

Galera subterranea Hruby, Verh. Naturforsch. Ver. Brünn 66: 90, 1935. BRNM 06673/39 (holotype)

Galeropsis desertorum Velen. et R. Dvořák, Mykologia 7(9–10): 106, 1931. BRNM sine num.

Geaster atratus F. Šmarda, Čes. Mykol.1: 74, 1947. BRNM 266926 and 266927 (isotypes)

Geaster sibiricus Pilát, Bull. Soc. Mycol. Fr. 51: 423, 1935. BRNM 266928 (isotype, ex PRM)

Geopyxis grandis Thind et Kaushal, Acta Bot. Ind. 9:119, 1979. BRNM 612416 (isotype)

Gloeosporium vagans Syd., Ann. Mycol. 10: 448, 1912. BRNM 122098

Gloeosporium vogelianum Sacc., Ann. Mycol. 6: 562, 1908. BRNM 122101

Gnomonia robertiani Petrak, Ann. Mycol. 23: 122, 1925. BRNM 04542/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 42, no. 2095)

Godroniopsis nemopanthis Groves, Mycologia 29: 71, 1937. BRNM sine num. (syntype)

Gorgoniceps kuitopnsis P. Henn., Ergebn. Kunene-Sambesi Exped., p. 167, 1902. BRNM 119420 (syntype)

Greletia marchica D. Benkert et J. Moravec, Mycol. Helvet. 2: 88, 1986. BRNM 612383 (paratype)

Greletia reticulosperma Donadini et Riousset, in Donadini, Doc. Mycol. 16: 53, 1986. BRNM 612398 (isotype)

Guignardia steppani Petrak, Ann. Mycol. 18: 111, 1920. BRNM 04554/39 (isotype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 25, no. 1232, as *Laestadia steppani* on label)

Guignardia sudetica Petrak, Ann. Mycol. 19: 104, 1921. BRNM 04552/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 30, No. 1497) and BRNM 117169 (syntype)

Gymnopus brassicolens var. *pallidus* Antonín et Noordel., A monograph of Marasmius, Collybia and related genera in Europe 2: 77, 1997. BRNM 603934 (isotype)

Gymnosporangium aurantiacum Syd., Ann. Mycol. (1904): 28, 1904. BRNM 114381 (syntype, in: Pacific slope fungi, no. 3716)

Gymnosporangium malyi Picbauer, Glasnik Zemal. Muz. Bosni i Herceg. 41: 32, 1929. BRNM 114348 (holotype) and 121864 (topotype)

Hainesia viburni Petrak, Ann. Mycol. 23: 116, 1925. BRNM 121863

Hainesia zavřelii-ignatii Picbauer, Verh. Naturforsch. Ver. Brünn (1937): 42, 1937. BRNM 121862 (holotype)

Hebeloma fallax Hruby, Verh. Naturforsch. Ver. 66: 91, 1935. BRNM 06758/39 (holotype)

Hebeloma punctatiforme Hruby, Hedwigia 70: 268, 1930. BRNM 06764/39 (holotype)

Helminthosporium anthyllidis Baudyš, Lotos 64: 81, 1916. BRNM 341654 (holotype)

Helminthosporium bornmülleri P. Magn., Hedwigia 38: 73, 1899. BRNM 76926 (topotype)

Helminthosporium poae Baudyš, Lotos 64: 81, 1916. BRNM 341648 (holotype)

Helminthosporium setariae Lind, Dan. Fungi, p. 527, 1913. BRNM 124472 and 124471 (duplicates of type?)

Helotium limogenum Petrak, Ann. Mycol. 25: 277, 1927. BRNM 04564/39 (syntypus, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 46, no. 2262)

Helvella branzeziana Svrček et J. Moravec, Čes. Mykol. 22: 87, 1968. BRNM 612385 (isotype)

Hendersonia andropogonis Baudyš et Picbauer, Pr. Morav. Přír. Společ., Sv. 2, Sp. 5, F15, p. 159, 1925. BRNM 341355 (holotype)

Hendersonia bulgarica Bubák et Picbauer, Ann. Mycol. 35: 146, 1937. BRNM 129504 (holotype)

Hendersonia convolvuli Baudyš et Picbauer, Bull. Inst. Jard. Bot. Univ. Belgrad 1: 72, 1928. BRNM 341359 (holotype)

Hendersonia crataegi Brenckle, Mycologia 10: 217, 1918. BRNM 129509 (syntype, in:Brenckle, Fungi dakotenses, no. 436)

Hendersonia fiedleri var. *maior* Baudyš et Picbauer, Pr. Morav. Přír. Společ., Sv. 2, Sp. 5, F15, p. 161, 1925. BRNM 341363 (holotype)

Hendersonia sarmetorum var. *salicis-capreae* Baudyš et Picbauer, Pr. Morav. Přír. Společ., Sv. 1, Sp. 5, F5, p. 303, 1924. BRNM 341352 (holotype)

Hendersonia ucrainica Petrak, Ann. Mycol., 19: 71, 1921. BRNM 129542

Herpotrichia moravica Petrak, Ann. Mycol. 13: 45, 1915. BRNM 04598/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 20, no. 969)

Humaria coprogena Sacc., Ann. Mycol. 12: 291, 1914. BRNM 04621/39 (in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 24, no. 1177)

Humaria petrakii Sacc., Ann. Mycol. 12: 291, 1914. BRNM 04634/39 (in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 21, no. 1050)

Hydrocybe nucicolor Hruby, Hedwigia 70: 270, 1930. BRNM 06857/39 (holotype) a 06858/39 (topotype) – obě jen výtrusný prach

Hysteropeltella moravica Petrak, Ann. Mycol. 21: 10, 1923. BRNM 128676

Inocybe cinnabarina Hruby, Hedwigia 70: 276, 1930. BRNM 06980/39 (holotype)

Inocybe geophylla f. *alba* Hruby, Hedwigia 70: 277, 1930. BRNM 06998/39 (holotype), 06999/39 and 07000/39 (paratypes)

Inocybe laevigata f. *depallens* Hruby, Folia Crypt. 1: 1091, 1932. BRNM 07005/39 (holotype)

Inocybe laevispora Hruby, Hedwigia 70: 278, 1930. BRNM 07004/39 (holotype)

Inocybe moravica Hruby, Hedwigia 70: 279, 1930. BRNM 07012/39 (holotype)

Inocybe similis Hruby, Hedwigia 70: 280, 1930. BRNM 07029/39 (holotype), 07028/39 and 07030/39 (paratypes)

Inocybe tristis Hruby, Hedwigia 70: 280, 1930. BRNM 07032/39 (holotype)

Inocybe velenovskyi Hruby, Hedwigia 70: 281, 1930. BRNM 07033/39 (holotype)

Inocybe velenovskyi f. *incrassata* Hruby, Hedwigia 70: 281, 1930. BRNM 07035/39 (holotype)

Jafneadelphus olivaceofuscus Svrček et J. Moravec, Čes. Mykol. 27: 131, 1973. BRNM 612388

Kalmusia epimelaena Sacc., Ann. Mycol. 12: 290, 1914. BRNM 04707/39

Keisslerina moravica Petrak, Ann. Mycol. 17: 74, 1919. BRNM 04708/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 27, no. 1350)

Lactarius albocremeus Z. Schaefer, Čes. Mykol. 12: 211, 1958. BRNM 242123

Lactarius cookei Z. Schaefer, Čes. Mykol. 14: 236, 1960. BRNM 242330 (authentic specimen?)

Lactarius tatrorum Z. Schaefer, Čes. Mykol. 12: 211, 1958. BRNM 243369 (holotype), 243368 (authentic specimen)

Lasiobotrys implexa Picbauer, Glasnik Zemal. Muz. Bosni i Herceg. 39: 164, 1929. BRNM 130470 (holotype)

Lepiota cristata f. *pseudoexcoriata* Hruby, Verh. Naturforsch. Ver. Brünn 66: 94, 1935. BRNM 07206/39 (holotype)

Leptonia calcarea Hruby, Verh. Naturforsch. Ver. Brünn 66: 93, 1935. BRNM 07248/39 (holotype)

Leptosphaeria atropurpurea Petrak, Ann. Mycol. 25: 286, 1927. BRNM 04778/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 46, no. 2265)

Leptosphaeria bulgarica Petrak, Ann. Mycol. 29: 368, 1931. BRNM 04782/39. (holotype)

Leptosphaeria carneomaculans Petrak, Ann. Mycol. 25: 287, 1927. BRNM 04786/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 46, no. 2266)

Leptosphaeria galeopsidicola Petrak, Ann. Mycol. 25: 289, 1927. BRNM 04812/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 46, no. 2267)

Leptosphaeria huthiana Staritz, Verhandl. Bot. Ver. Brandenb. 60: 79, 1913. BRNM 117618

Leptosphaeria malyi Picbauer, Glasnik Zemal. Muz. Bosni i Herceg. 45: 66, 1933. BRNM 117629 (holotype)

Leptosphaeria onagrae Rehm, Ann. Mycol. 11: 398, 1913. BRNM 117662

Leptosphaeria petrakii Sacc., Ann. Mycol. 12: 287, 1914. BRNM 04844/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 24, no. 1182) and 117668 (syntype)

Leptosphaeria priuscheggiana Petrak, Ann. Mycol. 16: 225, 1918. BRNM 117671

Leucoscypha subimmersa Thind et Kaushal, Bot. Notiser 132: 461, 1979. BRNM 612413 (isotype)

Locellina californica Earle, Bull. N. Y. Bot. Gard. (1904): 299, 1904. BRNM 131186 (syntype)

Macrosporium malvae-vulgaris Eliasson, Fungi Upsal., in Bidrag Kungl. Svenska Vet.-Akad. 22(3), 12: 18, 1897. BRNM 131194

Marasmius anisocystidiatus Antonín, Desjardin et Gsell, Mycol. Helvetica 5: 33, 1992. BRNM 553313 (isotype)

Marasmius favrei var. *sorbi* Antonín, A monograph of Marasmius, Collybia and related genera in Europe 1: 61, 1993. BRNM 553320

Marasmius heinemannianus Antonín, Belg. Journ. Bot. 131(2): 127, 1998. BRNM 612544 (isotype)

Marasmius ingratus f. *polytrichorum* Hruby, Hedwigia 70: 295, 1930. BRNM 07318/39 (holotype)

Marasmius skalae Antonín, Mycol. Helvetica 3: 38, 1988. BRNM 359162

Marasmius teplicensis Antonín, Čes. Mykol. 46: 209, 1992. BRNM 553318 (holotype), 553319 (topotype)

Marceleina donadinii Astier et J. Moravec, Mycotaxon 30: 490, 1987. BRNM 612389

Marcelleina benkertii J. Moravec, Mycotaxon 30: 487, 1987. BRNM 612400 (isotype)

Marcelleina brevicostatispora J. Moravec, Čes. Mykol. 25: 198, 1971. BRNM 612403 (isotype)

Marsonina moravica Picbauer, Verh. Naturforsch. Ver. Brünn (1937): 43, 1937. BRNM 122167 (holotype)

Melanconium gelatosporum H. Zimm., Verhandl. Naturf. Vereines Brünn 52: 111, 1913. BRNM 04941/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., no. 669)

Melanops cruenta Petrak, Ann. Mycol. 25: 226, 1927. BRNM 04954/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 45, no. 2211)

Melastiza carbonicola J. Moravec, Čes. Mykol. 26: 78, 1972. BRNM 612380 (isotype)

Melastiza flavida Thind et Kaushal, Bot. Notiser 132: 459, 1979. BRNM 612414 (isotype)

Meliola linocierae Syd., Ann. Mycol. 12: 550, 1914. BRNM 130461 (syntype, in: Sydow, Fungi exotici exs., no. 375)

Metasphaeria caricis-muricatae Petrak, Ann. Mycol. 22: 79, 1924. BRNM 04965/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 35, no. 1731)

Metaspaheria clypeotecta Petrak, Ann. Mycol. 23: 129, 1925. BRNM 05008/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 42, no. 2094)

Metasphaeria ebulina Petrak, Ann. Mycol. 25: 235, 1927. BRNM 04974/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 46, no. 2278)

Metasphaeria silvularum Petrak, Ann. Mycol. 21: 244, 1923. BRNM 04978/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 34, no. 1678)

Metasphaeria typhoidis Petrak, Ann. Mycol. 21: 245, 1923. BRNM 04979/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 34, no. 1679)

Microcera curta Sacc., Ann. Mycol. 7: 437, 1909. BRNM 124119 and 124120 (topotypes)

Microdiplodia cornicola Petrak, Ann. Mycol. 19: 286, 1921. BRNM 127381

Microdiplodia ruthenica Petrak, Hedwigia 65: 281, 1925. BRNM 127385 and 127384

Microthyriella rubi Petrak, Ann. Mycol. 21: 15, 1923. BRNM 04986/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 34, no. 1681)

Microthyrium moravicum Petrak, Ann. Mycol. 23: 88, 1925. BRNM 04990/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 39, no. 1933) and BRNM 122593 (syntype)

Mycena cupressina Antonín et Maas G., Persoonia 16(4): 545, 1998. BRNM 612470 (isotype)

Mycosphaerella apocynica Petrak, Ann. Mycol. 29: 366, 1931. BRNM 05025/39 (holotype)

Mycosphaerella baudysiana Picbauer, Pr. Morav. Přír. Společ., Sv. 2, Sp. 5, F15, p. 155, 1925. BRNM 335521 (holotype)

Mycosphaerella hranicensis Petrak, Ann. Mycol. 19: 75, 1921. BRNM 05053/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 25, no. 1240)

Mycosphaerella omphalosporoides Petrak, Ann. Mycol. 23: 71, 1925. BRNM 05070/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 41, no. 2007)

Mycosphaerella sarothamni Petrak, Ann. Mycol. 22: 57, 1924. BRNM 05083/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 38, no. 1860)

Mycosphaerellopsis moravica Petrak, Ann. Mycol. 19: 112, 1921. BRNM 05101/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 30, no. 1475)

Naemospora castaneae Bres., Ann. Mycol. 6: 47, 1908. BRNM 121774 and 121775

Naucoria setipes Hruby, Hedwigia 70: 307, 1930. BRNM 07545/39 (holotype)

Nitschkia moravica Niessl, in Paul, Verhandl. Naturf. Vereines Brünn 47: 139, 1908. BRNM sine num.

Octospora gigantea Thind et Waraitch, Proc. Ind. Acad. Sci. 74: 271, 1971. BRNM 612405 (isotype) a 612406 (paratype)

Octospora kilimanjarensis J. Moravec, Czech Mycol. 49: 150, 1997. BRNM 612379

Omphalina serotina Hruby, Hedwigia 70: 312, 1930. BRNM 07612/39 (holotype)

Ophiobolus dracocephali-altaijensis Murashkinskij, Trudy Sibir. Sel. Choz. Akad. Omsk 5: 33, 1925. BRNM 117727 (syntype)

Ophiobolus ponticus Petrak, Ann. Mycol. 29: 371, 1931. BRNM 05156/39

Orphanomyces hungaricus Vánky et Gönczöl, Bot. Notiser 131: 247, 1978. BRNM 347559 (isotype)

Ovularia cortusae Picbauer, Sborn. Vys. Šk. Zeměd. D18: 27, 1931. BRNM 118779

Ovularia vogeliana Sacc. et Syd., Ann. Mycol. 2: 194, 1904. BRNM 118851, 118853 and 118852 (syntypes?)

Patinella moravica Petrak, Ann. Mycol. 21: 297, 1923. BRNM 05339/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 34, no. 1685)

Peziza apiculata var. *flavobrunnea* Donadini, Bull. Soc. Mycol. Fr. 93: 177, 1977. BRNM 612394 (isotype)

Peziza crassipes var. *kilimanjarensis* J. Moravec, Čes. Mykol. 32: 70, 1978. BRNM 612391 (isotype)

Peziza pseudosterigmatizans J. Moravec, Čes. Mykol. 37: 248, 1983. BRNM 612402 (isotype)

Peziza vagneri J. Moravec, Čes. Mykol. 28: 223, 1974. BRNM 612393 (isotype)

Pezizella culmigena Sacc., Ann. Mycol. 12: 292, 1914. BRNM 05189/39 (in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 24, no. 1191)

Phaeosphaerella scirpicola Earle, Bull. N. Y. Bot. Gard. (1904): 293, 1904. BRNM 131319 (syntype, in: Pacific slope fungi, no. 212)

Phaneroascus quercinus Baudyš, Glasnik Zemal. Muz. Bosni i Herceg. 30(1918): 320, 1919. BRNM 340251 (holotype)

Phillipsia ranomafanensis J. Moravec, Czech Mycol. 50: 23, 1997. BRNM 612538

Phoma djakovensis Bubák et Picbauer, Ann. Mycol. 35: 141, 1937. BRNM 126634

Phoma lupinella Sacc., Ann. Mycol. 12: 296, 1914. BRNM 341385 (authentic specimen?)

Phoma oleracea f. *arabidis* Baudyš et Picbauer, Bull. Inst. Jard. Botan. Univ. Belgrad 1: 70, 1928. BRNM 341416 (holotype)

Phoma physocaulis Bubák et Picbauer, Ann. Mycol. 35: 141, 1937. BRNM 126707

Phoma roripae Baudyš et Picbauer, Pr. Morav. Přír. Společ., Sv. 2, Sp. 5, F15, p. 156, 1925. BRNM 341424 (holotype)

Phoma sherardiae Died., Krypt. Fl. Brandenb. 9: 897, 1915. BRNM 126748 (a type duplicate?)

Phoma subcurvata Bubák et Picbauer, Ann. Mycol. 35: 141, 1937. BRNM 126733

Phomopsis thuyae Died., Krypt. Fl. Brandenb. 9: 275, 1912. BRNM 126837 (a type duplicate?)

Phomatospora insignis Petrak, Ann. Mycol. 23: 136, 1925. BRNM 05194/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 42, no. 2069)

Phyllachora atro-maculans Syd., Ann. Mycol. 11: 264, 1913. BRNM 130324 (syntype, in: Sydow, Fungi exotici exs., no. 132)

Phyllosticta allii Baudyš, Glasnik Zemal. Muz. Bosni i Hercceg. 30(1918): 327, 1919. BRNM 341463 (holotype)

Phyllosticta anthyllidis Baudyš, Lotos 64: 51, 1916. BRNM 341654 (holotype)

Physalospora cugancoides Petrak, Ann. Mycol. 22: 59, 1924. BRNM 05236/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 38, no. 1873)

Physoderma bohemicum Sacc., Ann. Mycol. 12: 295, 1914. BRNM 334635 (autentic specimen?)

Phyllachora baphispora Syd., Ann. Mycol. 24: 386, 1926. BRNM 130323 (syntype, in: Fungi in itinere costar. coll., no. 227)

Phyllosticta balcanica Bubák et Picbauer, Ann. Mycol. 35: 139, 1937. BRNM 126875 (holotype)

Phyllosticta bubakiana Picbauer, Ann. Mycol. 35: 140, 1937. BRNM 126884 (holotype)

Phyllosticta hranicensis Petrak, Ann. Mycol. 12: 471, 1914. BRNM 126960

Phyllosticta jahniana Petrak et Sacc., Ann. Mycol. 13: 131, 1915. BRNM 126969 (syntype, in: Jahn, Plantae Bohem.)

Phyllosticta ranunculicola Bubák et Picbauer, Ann. Mycol. 35: 140, 1937. BRNM 127049 (holotype)

Phyllosticta senecionis-nemorensis Bubák et Picbauer, Ann. Mycol. 35: 140, 1937. BRNM 127061 (holotype)

Plasmopara isopyri Skalický, Preslia 26: 132, 1954. BRNM 334801 (paratype)

Pleospora bulgarica Petrak, Ann. Mycol. 29: 370, 1931. BRNM 05257/39

Pleospora hrubyana Petrak, Ann. Mycol. 29: 369, 1931. BRNM 05288/39

Pleospora kurdistanica var. *stachydina* Picbauer, Pr. Morav. Přír. Společ., Sv. 7, Sp. 11, F63: 2, 1932. BRNM 117856 (holotype)

Pleospora nabeleki Picbauer, Pr. Morav. Přír. Společ., Sv. 7, Sp. 11, F63: 2, 1932. BRNM 117855 and 117857 (isotypes)

Pleospora xerophylli Petrak, in Syd. et Petrak, Ann. Mycol. 20: 180, 1922. BRNM 117768 (syntype, ex herb. Weir, no. 6894)

Pleurocolla tiliae Petrak, Ann. Mycol. 22: 15, 1924. BRNM 10133/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 38, no. 1877)

Pleurophoma salicina Bubák et Picbauer, Ann. Mycol. 35: 143, 1937. BRNM 131353

Pleurostromella ligustrina Petrak, Ann. Mycol. 21: 219, 1923. BRNM 131354

Puccinia actaeae-elymi E. Mayor, Ann. Mycol. 9: 361, 1911. BRNM 110945 (syntype, in: Sydow, Uredineen, no. 2458)

Puccinia adenostegiae Arthur, Bull. Torrey Bot. Club 1902: 231. BRNM 111348 (syntype, in: Pacific slope fungi, no. 223)

Puccinia baudysii Picbauer, Bull. Inst. Jard. Botan. Univ. Belgrad 1: 63, 1928. BRNM 339465 and 339466

Puccinia bornmülleri P. Magn., Verhandl. Zool. Bot. Gesell. Wien 49: 94, 1899. BRNM 111455

Puccinia confinis Syd., Ann. Mycol. 18: 154, 1920. BRNM 111915, 111916 and 111914 (topotypes, collected one month earlier than mentioned by the original diagnosis)

Puccinia cryptandri Ell. et Barth., Erythea (1897): 47, 1897. BRNM 112030 (syntype)

Puccinia graminis var. *macrospora* Baudyš, Lotos 64: 29, 1916. BRNM 339648 (holotype)

Puccinia kusanoi Dietel, Engler Jahrber. 27: 568, 1900. BRNM 52294

Puccinia nitidula Transchel in Transchel and Serebrian, Mycoth. Ross., fasc. 3–4, no. 158–159, 1911. BRNM 114171 (syntype)

Puccinia panciciae Picbauer, Sydovia 3: 149, 1949. BRNM 128131 (holotype)

Puccinia pumilae-coronatae H. Paul., in Poeverlein et Schoenau, Krypt. Forsch. Bayer. Bot. Gesell. Erforsch. Heim. Flor 2(1): 65, 1929. BRNM 339536

Puccinia taraxaci-serotini Picbauer, Pr. Morav. Přír. Společ., Sv. 4, Sp. 9, F41: 493, 1927. BRNM 09630/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 45, no. 2222)

Pulparia verrucispora Donadini et Mornier, in Donadini, Rev. Mycol. 40: 260, 1976. BRNM 612384 (isotype)

Pulvinula niveoalba J. Moravec, Čes. Mykol. 23(4): 231, 1969. BRNM 333700 (isotype)

Pyrenochaete convolvuli Bubák et Picbauer, Ann. Mycol. 35: 143, 1937. BRNM 131381 (holotype)

Pyrenophora moravica Petrak, Ann. Mycol. 21: 243, 1923. BRNM 05389/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 34, no. 1696)

Pyrenostigme siparunae Syd., Ann. Mycol. 24: 370, 1926. BRNM 131404 (syntype, in: Fungi itinere costar. coll., no. 211)

Quaternaria moravica Sacc. et Petrak, Ann. Mycol. 12: 288, 1914. BRNM 05402/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 20, no. 988) and BRNM 120039 (syntype)

Ramularia achyrophori-uniflori Baudyš et Picbauer, Pr. Morav. Přír. Společ., Sv. 3, Sp. 2, F22, p. 35, 1925. BRNM 336299 (holotype)

Ramularia bubakiana Picbauer, Ann. Mycol. 35: 147, 1937. BRNM 123653 (holotype)

Ramularia bulgarica Bubák et Picbauer, Ann. Mycol. 35: 147, 1937. BRNM 120643

Ramularia lappulae Picbauer, Sborn. Vys. Šk. Zeměd. D13: 25, 1929. BRNM 123858 (holotype)

Ramularia linariae Baudyš et Picbauer, Pr. Morav. Přír. Společ., Sv. 1, Sp. 5, F5, p. 304, 1924. BRNM 336318 (holotype)

Ramularia rhei Allesch., Hedwigia 35: 34, 1896. BRNM 123984

Ravenelia baumiana P. Henn., Bot. Ergebnisse Kunene Sambesi Exped., p. 157, 1902. BRNM 115641

Rhabdospora astragalicola Baudyš et Picbauer, Pr. Morav. Přír. Společ., Sv. 1, Sp. 5, F5, p. 302, 1924. BRNM 335178 (holotype)

Rhabdospora euphrasiae Picbauer, Sborn. Vys. Šk. Zeměd. D7: 21, 1927. BRNM 129563 (holotype)

Rhabdospora hranicensis Petrak, Ann. Mycol. 19: 291, 1921. BRNM 129599 (syntype)

Rhabdospora melampyricola Petrak, Hedwigia 65: 306, 1925. BRNM 129567 (holotype)

Rhabdospora pulsatillae Syd., Hedwigia (1900): 129, 1900. BRNM 52325 (syntype)

Rhabdospora securinegae Syd., Hedwigia (1899): 139, 1899. BRNM 129585 (syntype, in: Sydow, Mycotheca marchica, no. 4877)

Rhynchosphaeria zimmermannii Petrak, Ann. Mycol. 12: 476, 1914. BRNM sine num. (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 14, no. 693)

Rhodocollybia giselae Neville et Antonín, Czech Mycol. 50: 182, 1998. BRNM 612543 (isotype)

Saccobolus subcaesariatus J. Moravec, Čes. Mykol. 24: 141, 1970. BRNM 612386 (isotype)

Scolecotrichum compressum Allesch., Hedwigia 35: (34), 1896. BRNM 131423 (topotype)

Scutellinia fimicola J. Moravec, Čes. Mykol. 22(1): 39, 1968. BRNM 333699 (isotype)

Scutellinua insignispora Svrček et J. Moravec, Čes. Mykol. 22: 156, 1968. BRNM 612382 (isotype)

Scutellinia minutella Svrček et J. Moravec, Čes. Mykol. 22: 156, 1968. BRNM 612381 (isotype, dupl. ex PRM)

Scutellinia phymatodeus Kaushal et Kaushal, Biblioth. Mycol. 91: 594, 1983. BRNM 612411 (isotype)

Scutellinia totaranuiensis J. Moravec, Mycotaxon 58: 233, 1996. BRNM 599298 (holotype)

Septomyxa tulasnei ssp. *vogeli* Sacc., Ann. Mycol. 7: 436, 1909. BRNM 131569 and 131571 (topotypes)

Septoria altajensis Murashkinskij, Trudy Sibir. Sel. Choz. Akad. Omsk 5: 35, 1925. BRNM 117948 and 117947 (syntypes)

Septoria anthyllidis Baudyš, Österr. Botan. Zeitschr. (1914): 484, 1914. BRNM 335190 (holotype)

Septoria baudysiana Sacc., Ann. Mycol. 12: 296, 1914. BRNM 335217

Septoria bosniaca Picbauer, Glasnik Zemal. Muz. Bosni i Herceg. 45: 68, 1933. BRNM 118014 (holotype)

Septoria carthami Murashkinskij, Mitteil. Westsibir. Abt. Russ. Geogr. Ges. 5: 3, 1926. BRNM 118045 (syntype)

Septoria diedeckeana Baudyš et Picbauer, Pr. Morav. Přír. Společ., Sv. 1, Sp. 5, F5, p. 299, 1924. BRNM 335230 (holotype)

Septoria gentianicola Baudyš et Picbauer, Pr. Morav. Přír. Společ., Sv. 1, Sp. 5, F5, p. 300, 1924. BRNM 118210 (holotype)

Septoria flava Baudyš, Lotos 64: 55, 1916. BRNM 335241 and 335247

Septoria ligustrina Sacc., Ann. Mycol. 12: 294, 1914. BRNM 118284

Septoria moeszii Smarods, Schedae Fungi Latvici Exs., fasc. 5, no. 236, p. 76, 1932. BRNM 118340 (syntype)

Septoria oenanthis Picbauer, Verhandl. Naturf. Vereines (1937): 41, 1937. BRNM 118355 (holotype)

Septoria phleina Baudyš et Picbauer, Pr. Morav. Přír. Společ., Sv. 3, Sp. 2, F22, p. 30, 1926. BRNM 335298 (holotype)

Septoria picbaueri Baudyš, Pr. Morav. Přír. Společ., Sv. 1, Sp. 5, F5, p. 298, 1924. BRNM 118401 (holotype)

Septoria schlechteriana P. Henn., Hedwigia 37: 295, 1898. BRNM 118519

Septoria strambergensis Picbauer, Pr. Morav. Přír. Společ., Sv. 3, Sp. 2, F22, p. 31, 1926. BRNM 335314 (holotype)

Septoria thermopsidis Murashkinskij, Trudy Sibir. Sel. Choz. Akad. Omsk 5: 35, 1925. BRNM 118589 and 118590 (syntypes)

Septoria vaccinii-uliginosi Bubák et Picbauer, Ann. Mycol. 35: 144, 1937. BRNM 118629

Sowerbyella crassisculpturata J. Moravec, Mycotaxon 23: 492, 1985. BRNM 312328

Sowerbyella fagicola J. Moravec, Čes. Mykol. 27: 66, 1973. BRNM 612397 (isotype)

Sowerbyella polaripustulata J. Moravec, Mycotaxon 23: 493, 1985. BRNM 312327

Sphaerella cinnamomicola Frag. et Cif., Estac. Moca Ser. Bot. 11: 18, 1928. (Hongos Paras. y sapr. Rep. Domin., Ser. 11–15) BRNM 117192

Sphaerella rhoina Sacc., Ann. Mycol. 6: 561, 1908. BRNM 117266 and 117268 (topotypes)

Sphaerella vogeli Syd., Ann. Mycol. 6: 480, 1908. BRNM 117290 (topotype)

Spooneromyces helveticus Breitenbach et Kränzlin, in Schumacher et J. Moravec, Nord. J. Bot. 9: 428, 1989. BRNM 612396 (isotype)

Sporisorium chrysopogonis Vánky, Mycotaxon 18(2): 327, 1983. BRNM 347596 (isotype)

Stagonospora bubakii Picbauer, Ann. Mycol. 35: 145, 1937. BRNM 129605 (holotype)

Staganospora caricicola Baudyš, Lotos 64: 57, 1916. BRNM 335348 (holotype)

Staganospora chenopodii Baudyš et Picbauer, Pr. Morav. Přír. Společ., Sv. 3, Sp. 2, F22, p. 32, 1926. BRNM 335347 (holotype)

Strickeria dorycnii Baudyš et Picbauer, Bull. Inst. Jard. Bot. Univ. Belgrad 1: 66, 1928. BRNM 335647 (holotype)

Stropharia coronilla f. *subcoronilla* Hruby, Hedwigia 70: 335, 1930. BRNM 10062/39 (holotype)

Tetraploa divergens Tracy et Earle, Bull. Torr. Bot. Club (1895): 198, 1895. BRNM 335483 (isotype, ex herb. U. S. Dept. of Agriculture)

Trematosphaeria piskorzii Petrak, Ann. Mycol. 25: 366, 1927. BRNM 05600/39 (syntype, in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 46, no. 2298)

Tricharina bisetosa Thind et Kaushal, Ind. J. Mycol. Pl. Path. 9: 229, 1979. BRNM 612412 (isotype)

Tricharina narkandensis Thind et Kaushal, Kavaka 7: 49, 1979. BRNM 612415 (isotype)

Tricholoma ionides f. *grisea* Hruby, Hedwigia 70: 341, 1930. BRNM 09884/39 (holotype)

Tricholoma terreum var. *album* Antonín et Vágner, Acta Mus. Moraviae, Sci. biol. 82(1997): 36, 1998. BRNM 612376 (holotype), 612377 (isotype)

Trichophaca tumidosa Thind et Kaushal, Kavaka 7: 47, 1974. BRNM 612410 (isotype)

Uromyces scleropoae Baudyš et Picbauer, Bull. Inst. Jard. Bot. Univ. Belgrad 1: 63, 1928. BRNM 336830 (holotype) a 336831 (isotype?)

Ustilago aegilopsidis Picbauer, Pr. Morav. Přír. Společ., Sv. 7, Sp. 11, F63: 3, 1932. BRNM 122742 (holotype)

Ustilago heleochloae Vánky et Gönczöl, Bot. Notiser 131: 274, 1978. BRNM 347738 (isotype)

Valsa venustula Sacc., Ann. Mycol. 12: 288, 1914. BRNM 05728/39 (in: Petrak, Fl. Bohem. et Morav. Exs., II. ser., Lfg. 20, no. 987)

Xerocomus armeniacus var. *lutcolus* Engel et Antonín, Schmier- und Filzröhrlinge s.l. in Europa, p. 221, 1996. BRNM 603886 (isotype)

Xylogramma bulgaricum Petrak, Ann. Mycol. 27: 407, 1929. BRNM 05759/39

Zygospermella setosa Cain, Mycologia 27: 227, 1935. BRNM sine num. (syntype)

Zythia quercicola Baudyš, Pr. Morav. Přír. Společ., Sv. 5, Sp. 5, F15, p. 161, 1925. BRNM 335353 and 121887 (syntypes)

ACKNOWLEDGEMENTS

I wish to thank to Dr. Zdeněk Pouzar (National Museum, Prague) for reviewing the manuscript and valuable notes, and the Ministry of Culture of the Czech Republic for supporting this project (KZ 97 P01 OMG 071).

CZECH MYCOL. 52 (1), 1999

Occurrence of vesicular arbuscular mycorrhizae (VAM) in coastal habitats of Bahrain

Q. MANDEEL*) and J. GUL

Department of Biology, College of Science, University of Bahrain,
P. O. Box 32038, State of Bahrain

Mandeel Q. and Gul J. (1999): Occurrence of vesicular arbuscular mycorrhizae (VAM) in coastal habitats of Bahrain – Czech Mycol. 52: 69–79

The occurrence of vesicular arbuscular mycorrhizae (VAM) in the rhizosphere soil and roots of wild and cultivated plants were investigated in coastal habitats in Bahrain. Soils were generally highly saline, with salt crusts on the top layer, low in total soluble salts, slightly alkaline and poor in organic matter. The slide length method was used to quantitatively estimate VAM infection in roots and the wet-sieving and decanting methods were used to isolate VAM spores from the rhizosphere soil. All the recorded isolates in this survey represent one species of *Glomus mosseae*, which is recorded for the first time from the hot, arid desert environment of Bahrain. The abundance of VAM in soil and roots revealed an irregular distribution pattern and generally vesicular colonization and arbuscular infections were less frequent, when compared to similar desert systems. Spores were also present in low numbers in the cortex of some plants. When compared to wild flora, cultivated plants revealed a high VAM infection rate. The results indicate that salinity may have a detrimental effect upon mycorrhizal establishment, distribution and abundance in such habitats.

Key words: Vesicular arbuscular mycorrhizae (VAM), wild plants, Bahrain, arid environment, salinity.

Mandeel Q. a Gul J. (1999): Výskyt vesikulárně arbuskulárních mykorrhiz (VAM) v pobřežních stanovištích Bahrajnu – Czech Mycol. 52: 69–79

V pobřežních stanovištích Bahrajnu byl sledován výskyt vesikulárně arbuskulárních mykorrhiz (VAM) v rhizosféře půdy a na kořenech planých a pěstovaných rostlin. Půdy byly většinou silně zasolené se solnou krustou na povrchu, s nízkým obsahem rozpustných solí, slabě alkalické a chudé na organické látky. Metoda průsečíková byla použita ke kvantitativnímu vyhodnocení infekce na kořenech a metody vlhkého sita a dekantační byly použity k izolaci VAM výtrusů z rhizosféry půdy. Všechny hodnocené izoláty v tomto výzkumu representovaly pouze jediný druh *Glomus mosseae*, který je zde poprvé zaznamenán z teplého aridního prostředí pouští Bahrajnu. VAM byly kvantitativně vyhodnoceny a porovnány s podobnými pouštními ekosystémy. Mykorrhizace pěstovaných rostlin byla shledána podstatně vyšší než u rostlin planých. Výsledky prokazují, že zasolení půd má škodlivý vliv na mykorrhizu na těchto stanovištích.

INTRODUCTION

Bahrain is a small island nation consisting of an archipelago of 33 small islands situated in the Arabian Gulf, 25 km off the eastern coast of the Saudi Arabian

*) Author to whom all correspondent should be send.

peninsula (26° 16'N, 50° 37'E). The total land area of the main island is about 695 km^2 with a central rocky core completely surrounded by a narrow coastal plain. The seashores cover an area of approximately 276 km^2 and are widest in the north and west and narrowest in the east and south. The central area is mainly low-lying and barren limestone rock covered with saline sand, which supports only the hardiest desert vegetation. The highest point of Bahrain is the Jebel Al-Dukhan (Smoky Mountain), which rises to 134 m above sea level. Most oil and gas wells are in this area. Major urbanization, agriculture and housing are situated in the northern and middle regions of the main island, where fresh spring water, wells and fertile soil are found. The wild vegetation cover of the main island is mainly composed of halophytic flora, such as *Zygophyllum qatarense*, *Halocaemum strobilaceum*, *Suaeda vermiculata*, mangrove trees of *Avicennia marina* and the salt tolerant cultivated date palm trees of *Phoenix dactylifera* (Abbas and El-Oqlah 1992).

In the rhizosphere soil of plants living in saline and stressful ecosystems, microbial activities, diversity and population are critical for their survival. Survey studies on VAM, members of soil-inhabiting microorganisms, are basically focused on cultivated plants, with less attention to wild flora. Although these fungi are obligatory symbionts with plant roots, they occur worldwide in a wide spectrum of host plants, ecological habitats, climatic zones and soils of various physiochemical types and structure, including the extreme and arid environment (Stahal and Christensen 1991). Reports on the role of VAM fungi in improving plant resistance to drought and salinity are well documented in the literature (Ellis et al. 1985; Hang et al. 1985; Bethlenflavay et al. 1988; Puppi and Brass 1990). An understanding of activities of microbial communities in general, and VAM fungi in particular, is an essential factor in the global understanding of such harsh and extreme ecosystems. However, little information is available on the occurrence and distribution of VAM in arid deserts and, indeed, no studies of this kind are available in Bahrain.

The present report is an attempt to survey the abundance and distribution of VAM fungi in the natural flora and in non-cultivated plants in the coastal habitats of an arid environment of Bahrain.

MATERIALS AND METHODS

Climate

Bahrain, like the Arabia mainland, falls into the North African-Eurasian climate province. The main island has a typical Saharo-Arabian climate, characterized by hot humid summers and mild winters with low annual rainfall.

Soil

Doornkamp et al. (1980) divided the soils of Bahrain island into five major groups: cultivated solonchak, natural solonchak, regosols, raw mineral soils, and rock dominated areas. Both types of solonchak soils are located mainly in the coastal areas, extending inwards as far as the beginning of the backslopes. The regosols, raw mineral soils and rock dominated areas are mainly found in the central and southern parts of the island. The soils are formed of Holocene and Pleistocene sedimentary rocks. The soils are moderately to highly saline with low fertility, being poor in organic matter content (<0.05–1.51 %) and nutrient level. The water holding capacity is also low and the available moisture being about 2.6%. Most soils are calcareous, gypsiferous and coarse in texture.

Coastal Plains

The coastal plain is the most cultivated and part portion of the main island and consequently, its surface has been drastically modified by man for several thousands of years (Doornkamp et al. 1980). In addition, the coastal plain is divided into five parts:

1 Northern coastal plain: plain consisting of an area of subdued topography stretching from the northern boundary of the main backslope. Its soil is of aeolian origin and composed of sand and silt. Agriculture, urbanization and industrialization have obscured its original form.

2 Western coastal plain: narrow strip between Al-Budayyi and Al-Zallaq with a total distance of 18 km. Much of this length has gypseous sand and gravel mantled slopes. Shores are undisturbed and consist of gentle slopes. Fresh water springs and wells are available to support intensive farming activities.

3 South-west sabkha: area of which soil surface is covered with a salt crust and vegetation is scarce, except for halophytic plants. The soil contains gypsiferous solonchak and sabkha subgroups. Natural solonchak soils are usually quartz-gypsiferous sand, salt pan and marine mudflats; all have a high water table.

4 South sabkha: area forming the tail of the mainland. The surface consists of fine shell gravel embedded in silty, fine to medium gypseous calcareous quartzose sand. Similar to the south-west sabkha, halophytic plants are growning on top of the salty crust surface.

5 East coast south of Sitra: consisting of a continuous raised beach ridge which forms a distinct inner edge to the coastal deposits against the hardrock of blackslope. The beach is composed of loose, layered shelly gravelly quartoze calcareous sand.

Sample Collection

Soil and plant samples were collected from various locations representing different coastal habitats to include wild flora and cultivated plants, all within the central and northern part of the main island. The selection of samples depended upon the accessibility of the site. Except for mangroves, collections were made, from wetland approximately 10–15 m away from the seashore. Sample collection took place from September 1996 to January 1997.

Soil and plant roots were collected simultaneously from each site. Using a clean shovel and hand-trowel, soil was removed gently around the root ball and the roots were carefully loosened from the soil without injuring the fine rootlets before the entire plant was lifted. The roots were separated from the stem using a clean hand-cutter and then placed in sterile plastic bags. In the laboratory, the roots were thoroughly washed under running tap water until they were almost clean from adhering soil particles, blotted dry between two layers of paper towel and fixed in F. A. A. solution until further assessment.

For each plant sample, three composite soil samples, each of 2 kg, were collected. Each sample consisted of about 10 subsamples (20 kg), taken with a clean hand-trowel, approximately 10–15 m apart, from the upper 15–20 cm of the soil profile. The subsamples were combined, placed in polyethylene bags, labeled, transported to the lab, air dried for three days and subsequently stored at 5 °C until processed, within one week.

Soil Analysis

For the assays, the composite soil samples were thoroughly hand-mixed in plastic bags under sterile conditions and divided into two parts. One part was stored at 5 °C, the other was used for chemical analysis.

Soil pH and electrical conductivity (Scm^{-1}) were determined in a 1:5 soil: water extract using a JENWAY Water Analyzer (Model PW1). Organic matter content (%) was determined by ashing 100 g of air-dried soil in a furnace at 600 °C for 1 hr, and calculating the difference in weight. Total soluble salts (TSS) were measured by mixing 20 g of soil with 100 ml distilled water, filtering and evaporating the filtrate in an oven at 105 °C. The dry residue was then weighed and the TSS calculated (Jackson 1958). Data were averaged from three soil sample replicates.

Isolation of VAM Spore

VAM mycorrhizal spores from soil samples were isolated by the wet sieving and decanting technique (Gerdeman and Nicolson 1963).

Assessment of VAM Infection

Roots were cleaned in KOH and stained (Koske and Gemma 1989). The slide length method (Giovannetti and Mosse 1980) was used to determine root colonization.

RESULTS

Sampling and Soil Analysis

A list of plant species, soil types and groups and chemical analyses are all summarized in Table 1. Samples were collected mainly from the central-northern part of the mainland and represent only sites accessible for collection. Wild plants are mostly perennials, in the form of shrubs, and are located in the physiographic zone of the coastal lowlands.

Cultivated plants in the form of herbs, except for date palms, are all located in the upper backslopes, whereas sunflower plants are located in the interior basin. The soil types of sampled plants are quite diverse and the texture of soil samples is generally, in the range, of sandy to loamy. High temperatures, low rainfalls and precipitation and poor vegetation cover, mainly dominated by halophytic plant species and high soil salinity, would classify the area as a harsh-arid ecosystem. A general trend is observed in soil analyses for the various samples collected from soil groups and subgroups (Table 1). In addition, soil of cultivated plants has a higher organic matter content, slightly higher soil pH and lower salinity when compared to soils of wild plants. The highest average soil pH (9.7) was recorded in the soil of *Helianthus annuus* and the lowest pH (8.0) in the soil of *Zygophyllum qatarense*. Electrical conductivity (salinity) fluctuated greatly among the soil of various plants, ranging from as low as 320 Scm^{-1} in the soil of *Tetrapogon villosus* to as high as 9140 Scm^{-1} in the soil of *Zygophyllum qatarense*. The average organic matter content ranged from 0.72 % to 11.11 % in the soil of wild plants and from 6.25 % to 13 % in cultivated crops. The lowest average total of soluble salts was recorded in the soil of *Suaeda maritima* and *Avicennia marina* (1.2 %) the highest was found in the soil of *Typha domingensis* (3.31 %).

VAM Identification

All the recovered isolates during this study represent one endophytic species identified as *Glomus mosseae*. The fungus is characterized by having a pale yellow septate mycelium (20 μ broad) with extensive hyphal branching. Chlamydospores are globose with 2–3 protective layers attached terminally to a funnel shaped hyphae. At maturity, the spore contents are separated from the attached hyphae

by a septum. Germination is through a subtending hyphae. Vesicles and arbuscules are also produced.

VAM Recovery and Distribution

The percentage of VAM vesicles, arbuscules and hyphae from plant roots and spores recovered from soil samples of wild and cultivated plants are shown in Table 2. The recovery and abundance of VAM in plant roots and soil is generally low with irregular distribution patterns. In some plants, data revealed the complete absence of VAM activity during the study period. In general, however, VAM recovery was higher in cultivated plants when compared to wild plants.

Of the wild flora, *Aeluropus lagopoides* showed the highest percentage of spore (5.2 %), hyphae (3.1 %) and arbuscule (0.36 %) infection. However, the maximum percentage of vesicle formation was observed in *Pennisetum divisum*. In cultivated plants, the highest vesicle formation and hyphae colonization was reported in *Helianthus annuus* (15.6 %) and (73.03 %) respectively. The highest arbuscule formation (3.6 %) and spore population (2.34 %) was noted in *Phoenix dactylifera*.

A quantitative comparison among the various plant families representing wild and cultivated plants for the presence of VAM is shown in Fig 1 A and B. The family Poaceae revealed the highest VAM infection followed by Avicenniaceae in wild flora. In cultivated plants, the family Compositae exhibited the maximum VAM colonization rate.

Discussion

It has been established that VAM mycorrhizal fungi can withstand various environmental stresses including high pH and salinity, in particular (Stahal and Williams 1986; Pacovsky 1986). However, under certain circumstances such environmental stresses prevent VAM establishment (Porter et al. 1987). It has also been shown by Cockerelle et al. (1993) that VAM infection is higher in reclaimed soils compared to non-reclaimed soils. Another study indicated that VAM infection was generally lower in seedlings from beach (coastal) soils; significantly fewer arbuscules and vesicles were found in such plants.

The same findings were observed during the present study. As indicated in Table 2, VAM colonization was either low or absent in the roots of both cultivated and wild plants. In the roots of some cultivated and wild plants, VAM infection was higher irrespective of the fact that pH and salinity levels were high in the soil samples of these plants, *Pennisetum divisum* and *Aeluropus lagopoides*. While in some other plants, like *Foeniculum vulgare, Lycopersicon esculentum* (cultivated) and *Pennisetum divisum* (wild), VAM infection is absent due to very low salinity levels, but with these plants the soil pH was higher (Tables 1 and 2). These

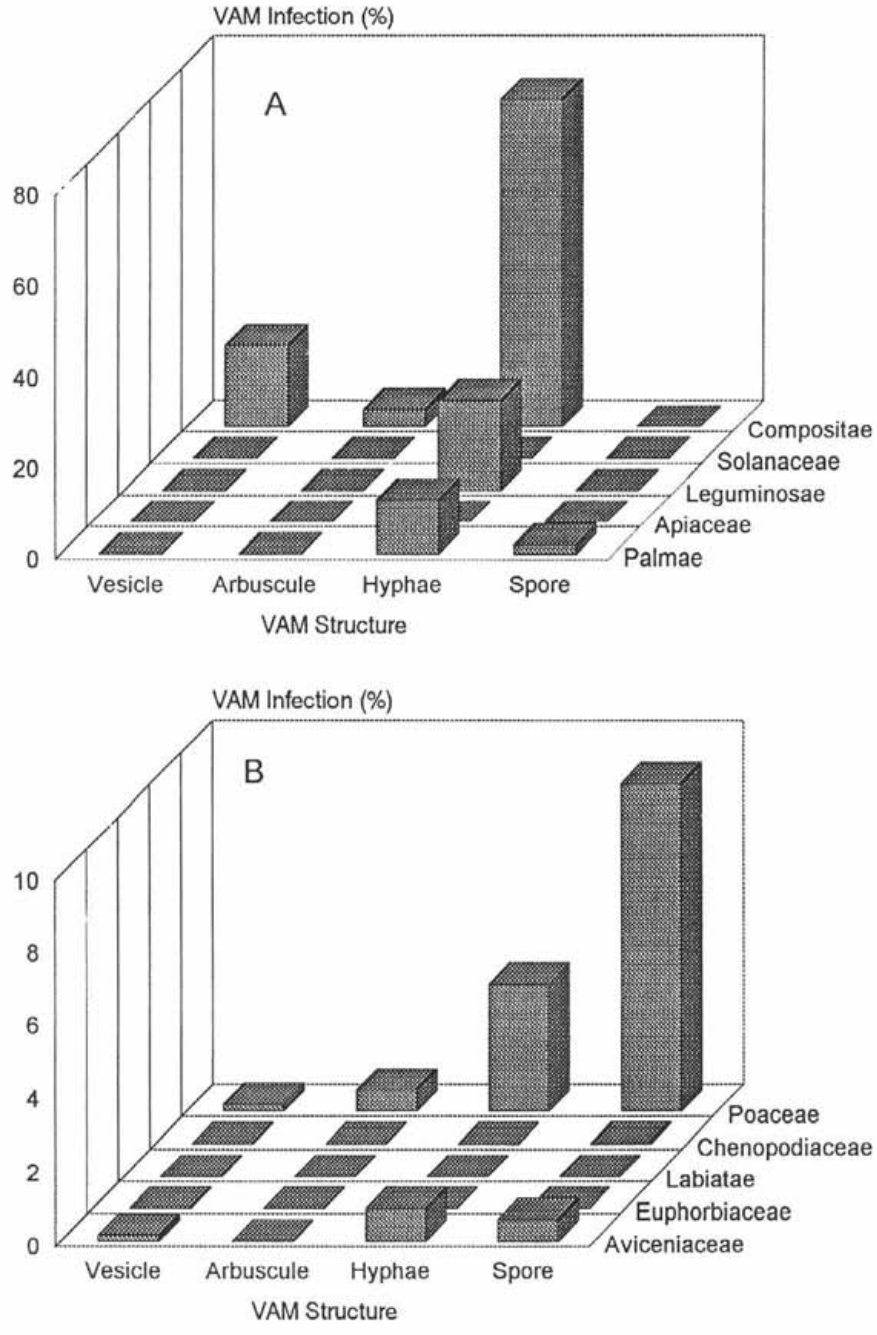


Fig. 1 Percentage of VAM infection in various plant families in (A) cultivated soil and (B) non cultivated soil.

contradictory findings suggest that some VAM infected plants can withstand the stress of salinity, but higher pH and salinity levels prevented VAM establishment (Gul 1994).

Ietswaart et al. (1992) have shown that mineral nutrition and seasonality have a profound influence on VAM establishment. According to their observations, there was a low infection rate in winter compared to the summer season. The sampling in the present study was also carried out in winter, thus indicating a lower percentage of VAM infection in the roots.

There are some reports which indicate the influence of organic matter on VAM establishment. John et al. (1983) showed that VAM hyphae were longer in some chambers having a treatment with organic matter than in those containing only sand. In another experiment, Hepper and Warner (1983) showed that *Trifolium repens* was colonized by VAM fungi when grown in soil treated with organic matter, while those remain uninfected which were sterile.

The results of the present study are in accordance with the simillar findings. The roots of some plants, such as *Aeluropus lagopoides*, *Suaeda maritima* (wild), *Phoenix dactylifera* and *Medicago sativa* (cultivated) (Table 2) were found to be mycorrhizal and a higher percentage of organic matter was found. On the contrary, the roots of *Lycopersicon esculentum* and *Tetrapogon villosus* (cultivated) showed no infection, although there was a high content of organic matter. This may be due to the fact that salinity and pH are higher in these samples, *i.e.* 11.5 and 9.4 (*Tetrapogon villosus*), and 12.00 and 8.8 (*Lycopersicon esculentum*), respectively (Tables 1 and 2), thereby inhibiting VAM establishment.

During the present study an interesting difference was noted regarding spore morphology. It was observed that spores from wild habitats were smaller in size and thick-walled, while those from cultivated habitats were larger in size and thin-walled. This reflects the effects of spore morphology in response to changes in environmental factors (Stahal and Christensen 1991).

When compared on a family basis, it was found that among groups of non-cultivated higher plants, the family Poaceae showed all the four physiological structures of VAM mycorrhizae, and the spore percentage was highest in this family. On the other hand, in the case of cultivated groups, the family Asteraceae (Compositae) showed the highest percentage of hyphal infection and a very low percentage of spore infection. This observation is indicative of the fact that mycorrhizal fungi may be more active in cultivated habitats, while it may be a resting phase in noncultivated plants.

In general, the data of the present study showed some contradictory results. However, it clearly indicates a lower percentage of vesicular infection in plants growing under natural conditions in the coastal habitats of Bahrain. It thus could be stated that the soils of Bahrain, both cultivated and wild, were poor in VAM

Table 1 Characteristics of sampling sites and their soil analyses.

Plant Taxa	Growth Pattern	Physiographic Zone	Soil Group	Soil sub Group	Location	Soil Analyses			
						pH	Saliniy μ Scm^{-1}	OM	TSS
NON-CULTIVATED SOIL									
Sporobolus arabicus	Grass	Coast low land	Misc. land categories	Sandy	Manama	8.7	1232	1.68	2.3
Salvia aegyptiaca	Shrub					8.5	70	2.8	1.33
Schimus sp.	Grass					8.6	5920	1.44	1.39
Aeluropus lagopoides	Shrub		Natural solonchak		Zallaq	8.2	1160	11.11	1.15
Zygophyllum qatarense	Shrub			Sebk-has		8.0	9140	2.9	1.70
Typha domingensis	Shrub					8.3	1100	2.59	3.28
Phragmites communis	Grass		Cultivated solonchak		Sanad	9.0	1360	2.90	1.28
Suaeda maritima	Shrub			Loamy		8.6	1540	10.70	1.2
Avicennia marina	Shrub					8.6	1540	10.70	1.2
Pennisetum divisum	Bush				Budayia	8.7	3600	0.72	1.42
Salsola vermiculata	Shrub		Misc. land categories	Undiff. distrub ground		9.07	5920	1.43	1.12
CULTIVATED SOIL									
Phoenix dactylifera	Tree	Upper back slope	Cultivated solonchak	Loamy	A'Ali	9.0	1020	12	2.22
Tetrapogon villosus	Shrub					9.4	320	11.5	2.10
Foeniculum vulgare	Herb				Buri	9.0	2200	12.0	1.23
Lycopersicon esculentum	Herb					8.8	2200	12.00	1.23
Medicago sativa	Herb		Regosol	Aeolian sand	Dumistan	8.9	1350	13.00	2.03
Helianthus annuus	Herb	Interior basin	Mics. land categories		Isa Town	9.7	800	6.25	3.31

Table 2 Mean ± S. E. of VAM infection in noncultivated and cultivated plants.

Plant Taxa	Growth Pattern	Vesicle	Arbuscule	Hyphae	Spore
NON-CULTIVATED SOIL					
Sporobolus arabicus	Grass				2.0±0.5
Salvia aegyptiaca	Shrub				
Schimus sp.	Grass				
Aeluropus lagopoides	Shrub	0.014±0.01	0.315±0.08	3.105±0.6	5.23±2.2
Zygophyllum qatarense	Shrub				
Typha domingensis	Shrub				0.09±0.04
Phragmites communis	Grass				
Suaeda maritima	Shrub				
Avicennia marina	Shrub	0.036±0.02		0.9±0.22	0.36±0.17
Pennisetum divisum	Bush	1.162±0.54			0.63±0.11
Salsola vermiculata	Shrub				
Average		0.08±0.03	0.021±0.001	0.267±0.03	0.571±0.14
CULTIVATED SOIL					
Phoenix dactylifera	Tree		3.6±0.76	18.59±3.3	2.34±0.23
Tetrapogon villosus	Shrub				
Foeniculum vulgare	Herb				
Lycopersicon esculentum	Herb				
Medicago sativa	Herb			13.50±4.3	0.04±0.007
Helianthus annuus	Herb	15.58±2.77	1.77±0.24	73.03±4.87	
Average		2.22±0.34	0.76±0.11	16.67±3.65	0.4±0.16

infection and do not show a precise response to pH, salinity and organic matter in the soil.

REFERENCES

ABBAS J. A. and EL-OQLAH A. A. (1992): Distribution and communities of halophytic plants in Bahrain. – J. Arid Env. 22: 205–218.

BETHLENFALAVAY G. J., THOMAS R. S., DAKESSION S., BROWN M. S. and AMES R. N. (1988): Mycorrhizae in stressed environment, effects on plant growth, endophyte development, soil stability and soil water. – In Whitehood E. E. (eds.), Arid lands today and tomorrow, Westview Press, Boulder, USA.

COCKRELLE J. R., BIONDI M. E. and KIRBY D. (1993): Vesicular arbuscular mycorrhizal recolonization of grasses on a reclaimed strip mine in North Dakota prairie. – Naturalist 25 (25): 161–172.

DOORNKAMP J. C., BRUNSDEN D. and JONES D. K. C. (1980): Geology, Geomorphology and Pedology of Bahrain. – Geo. Abstract: Norwich, U. K. 443 p.

ELLIS J. R., LARSON H. J. and BOOSALIS M. G. (1985): Drought resistance of wheat plants inoculated with vesicular arbuscular mycorrhizae. – Plant Soil 86: 369–378.

GERDEMAN J. W. and NICOLSON T. H. (1963): Spores of mycorrhizal endogene species extracted from soil by wet sieving and decanting. – Trans. Brit. Mycol. Soc. 46(2): 235–244.

GIOVANNETTI M. and MOSSE B. (1980): An evaluation of techniques for measuring vesicular arbuscular mycorrhizal infection in roots. – New Phytol. 84: 489–500.

GUL J. (1994): Comparative morphological study of VAM in medicinal plants of the salt range and Margalla Hill. – M. Phil. Dissertation, Department of Biological Sciences, Quaid-L-Azam University, Islamabad, Pakistan.

HEPPER C. M. and WARNER G. L. (1983): Role of organic matter in growth of a vesicular arbuscular mycorrhizal fungus in soil. – Trans. Brit. Mycol. Soc. 81: 155–156.

IETSWAART J. H., GRIFFIOEN W. A. J. and ERNST W. H. O. (1992): Seasonality of VAM infection in three populations of Agrostis capillaris (Gramineae) on soil with or without heavy metals enrichment. – Plant and Soil 139: 67–74.

JACKSON M. L. (1958): Soil analysis. – Constable and Co., London, 498 p.

KOSKE R. E. and GEMMA J. N. (1989): A modified procedure for staining roots to detect VA mycorrhizae. – Mycological Research 92: 486–505.

PACKOVASKY R. S. (1986). Micronutrient uptake and distribution in mycorrhizal of phosphorus of sterilized soybeans. – Plant and Soil 95: 379–388.

PORTER W. M., ROBSON A. D. and ABBOTT L. K. (1987): Factors controlling distribution of vesicular arbuscular mycorrhizal fungi in relation to soil pH. – J. Appl. Ecol. 24: 663–672.

PUPPI G. and BRASS A. D. (1990): Nutrient and water relations of mycorrhizal white clover. – Agric. Ecosyst. Env. 29: 317–322.

STAHAL P. D. and WILLIAMS S. E. (1986): Oil shale process water affects activity of vesicular arbuscular mycorrhizal fungi and Rhizobium 4 years after application to soil. – Soil Biol. & Biochem. 18: 451–455.

STAHAL P. D. and CHRISTENSEN K. (1991): Population variation in the mycorrhizal fungus Glomus mosseae. Breadth of environmental tolerance. – Mycol. Res. 95: 300–307.

JOHN T. V., COLEMAN D. C. and REID C. P. P. (1983): Association of vesicular arbuscular mycorrhizal hyphae with soil organic particles. – Ecology 64: 957–959.

CZECH MYCOL. 52 (1), 1999

Record of Cerebella sp. in Czech Republic and of Cerebella andropogonis in Brazil

SYLVIE PAŽOUTOVÁ and RENÁTA KOLÍNSKÁ

Laboratory of Physiology and Genetics of Filamentous Fungi,
Institute of Microbiology, Czech Academy of Sciences,
142 20 Prague, Czech Republic

Dedicated to Prof. R. F. N. Langdon

Pažoutová S. and Kolínská R. (1999): Record of Cerebella sp. in Czech Republic and of Cerebella andropogonis in Brazil. – Czech Mycol. 52: 81–88

Cerebella sp. is reported from spike of *Festuca arundinacea* colonized by *Claviceps purpurea* in Trutnov, Czech Republic (1998). Spores were 2–3 celled with stalk cell, brown, with smooth cell walls and sized 11.1–13.9 × 12.0–14.5 μm. Rarely, 4-celled spores about 21 × 12 μm were found. Sporodochia were formed in cultures on potato carrot agar and corn-steep agar. *Cerebella andropogonis* Ces. was collected on *Brachiaria* sp. colonized by *Claviceps sulcata* at Sete Lagoas (Minas Gerais, Brazil 1996). Spores were 2–7 celled, with stalk cell, dark brown, sized 15–22 × 14–20 μm, their cell wall was slightly verrucose or smooth and thicker than that of Trutnov sample.

Key words: *Cerebella*, *Claviceps*, micromycetes, Czech Republic, Brazil

Pažoutová S. a Kolínská R. (1999): Nález Cerebella sp. v České republice a Cerebella andropogonis v Brazilii. – Czech Mycol. 52: 81–88

Cerebella sp. byla nalezena v květu *Festuca arundinacea* kolonizovaném *Claviceps purpurea*. (Trutnov, ČR, 1998). Spóry o velikosti 11.1–13.9 × 12.0–14.5 μm byly 2–3 buněčné, s bazální buňkou, hnědé, s hladkými bunččnými stěnami. Vzácně se vyskytovaly čtyřbuněčné spóry (cca 21 × 12 μm). Kultury na bramboro-mrkvovém agaru a půdě s kukuřičným výtažkem sporulovaly. Sporodochia *Cerebella andropogonis* Ces. byla nalezena na trávě *Brachiaria* sp. napadené *Claviceps sulcata* (Sete Lagoas, Minas Gerais, Brazílie, 1996). Spóry byly 2–7 buněčné s bazální buňkou, tmavohnědé, o rozměrech 15–22 × 14–20 μm. Jejich buněčná stěna byla slabě drsná nebo hladká a silnější než u trutnovského vzorku.

INTRODUCTION

Cerebella is dematiaceous hyphomycetous genus without known teleomorph. Type species *Cerebella andropogonis* forms typical black convoluted (hence the generic name) sporodochia on the developing sclerotia, sphacelia or honeydew droplets of various *Claviceps* species (Langdon 1955; Ellis 1971). Its morphology resembles that of *Epicoccum*, so that Schol-Schwarz (1959) suggested transfer of *C. andropogonis* into this genus as *Epicoccum andropogonis*. However, this combination was not accepted by later authors.

The marked black sporodochia indicate well the occurrence of ergot species that could otherwise pass unnoticed. Although Tulasne (1856) already recognized

Cerebella as an ergot hyperparasite, there are numerous literature records, even the recent ones, that consider *Cerebella* plant parasite (McDonald 1923; Lenné 1990).

Cerebella collections were found in herbaria under different species and generic names, sometimes also misplaced among Ustilaginales. Langdon (1952, 1955) made a detailed revision of the herbarium collections of *Cerebella* and found that it is only one species that colonizes different ergots in different parts of world. He described it as species typical for all tropics and subtropics.

European collections originate mostly from southern regions. *Cerebella andropogonis* was first collected in Italy on *Andropogon tener* (Rabenhorst Herbar. Mycol. – ii. 284). There are two Voss' collections on *Molinia coerulea* near Ljubljana (today's Slovenia) in 1878 that are deposited at Kew Herbarium as isotypes (180827 and 180828) labeled *Sorosporium vossianum*. All these specimens were later revised by Langdon (1955) as *Cerebella andropogonis*, with conidia size range 15–22 × 13–18 μm. A record was made in Romania (1980) on ergotized *Cynodon dactylon* (Herbarium Mycologicum Romanicum, Constantinescu and Negrean Fasc. – 60 2968).

In the North America, *Cerebella* distribution was concentrated on the states surrounding Mexican Gulf (in the USA in states of AL, AR, FL, GA, KS, LA, MD, MS, NC, OK, SC, TX and VA) and did not exceed 40 N of latitude (Sprague 1950; Parris 1959; Anonymus 1960).

One of the samples that were mentioned in Langdon's studies but not revised was the collection of Picbauer (1938) under the name *Cerebella moravica* Picb. (Moravia, Czech Republic). As the source journal is not widely available, the original Latin description is presented:

Cerebella moravica Picbauer 1938

Stromatibus pulvinatis, cerebriformibus (tremellaceiformibus), thallo lichenis Synechoblasti vel Leptogii similibus, 2–5 mm diam., brunneo-atris. Glomerulis globosis vel subglobosis, primo unicellularibus, deinde segmentatis, ac e 2–5 segmentis compositis, 13–15.5 μ diam, rarius ovoideis, plerumque 23 μ longis ac 15.5 μ latis, brunneololuteolis, ad septa plus minusve constrictis, levibus vel minute asperulis. Cellulis irregularibus a lateribus mutua pressione angulatis, supra convexis.

Habitat ad spicas vivas *Alopecuri aequalis* Sobol. Ad oppidum Kroměříž Moraviae. Mense septembre profesor Ignatius Zavřel legit.

The fungus was observed on *A. aequalis*, most probably colonized by *Claviceps purpurea* and its desription falls well with *C. andropogonis* except for the spore size.

Present paper describes *Cerebella* sp. from the outskirts of the town Trutnov (northeastern part of Bohemia, Czech Republic) in comparison to *C. andropogonis* specimen from Brazil, typical of species.

Materials and Methods

Herbarium specimens examined:

Cerebella sp. – from sphacelial stage of *C. purpurea* on *Festuca arundinacea*, Trutnov, Czech Republic August 1998, coll., isol. and det. S. Pažoutová; *Cerebella andropogonis* – on sphacelial stage of *C. sulcata* colonizing *Brachiaria* sp., Sete Lagoas, Minas Gerais, Brazil, June 1997, coll. and det. S. Pažoutová according to Ellis (1971).

Isolate examined:

Cerebella sp. – as above. The pure culture was isolated from the spores plated on potato dextrose agar and is deposited at the Institute of Microbiology, Prague.

Cerebella sp. isolate was maintained on RK agar slants (g/l: sucrose 30, corn steep (60%) 20, KH_2PO_4 20, agar 20, pH 6.50) and subcultured every 5–6 months. The plate cultures were incubated on potato dextrose agar, potato carrot agar and RK agar. The formation of spores was induced by exposition to UV-light from common germicidal tubes for 1–2 weeks. The microscopical conidia measurements were done under oil immersion (objective 90x, eyepiece 12.5x).

Results

Cerebella sp.

The fungus was found in August 1998 on ergotized (*C. purpurea*) spikes of tall fescue (*Festuca arundinacea*) on the open and dry meadow between the railway and the Zvonková street in Trutnov, Zelená louka. The grass was ergotized only weakly, mostly *Lolium* sp. and some plants of *Festuca arundinacea*, *Elytrigia repens* and *Dactylis* sp. were colonized. In the area of approx. 100 × 200 m, only single occurrence of *Cerebella* was found.

Description

The species forms the typical black convoluted sporodochium (Fig. 1). Our observation revealed only smooth brown spores (Fig. 2), constricted at the septa,

often with stalk cell attached. The spore consisted mainly from 2–3 cells, rarely from 4 cells. The spore dimensions were 11.1–13.9 × 12–15.5 μm, four-celled spores were 20–23 × 11–13 μm. The morphology of conidiophores and conidiation corresponded to that depicted in Ellis (1971).

Colonies on PDA after 7 days in 24 °C were 4.5–5 cm in diameter, with grey-white dispersely lanose mycelium, and intense reddish-brown pigmentation of agar. No formation of sporodochia was observed.

Colonies on potato carrot agar after 7 days in 24 °C were 5–5.5 cm in diameter, pale grey-brown, with reddish-brown agar pigmentation. Mycelium was dispersely lanose with some white to grey vertical synnemata. Small nonconvoluted sporodochia were formed in sectors and circles. The size and shape of spores was identical to the one found on plant specimen.

Colonies on RK agar were 4 cm in diameter, compact, covered by white-grey fluffy mycelium tinged grey-green, especially around the circular sporodochia. The sporodochia were cerebriform, like the natural ones. However, spores were 2–5 celled and their dimensions were 10–15 × 15.2–22.9 μm

Shortly after the isolation, we were able to induce sporulation of *Cerebella* sp. only in potato-carrot agar cultures using UV-light. Sporulation was more intensive on the plates with thinner medium layer. The conidia were identical to these from original sporodochium on natural substrate. However, cultures maintained for one year on RK slants sporulated readily without exposition to UV light on potato carrot agar as well as on RK agar, but no sporulation occurred on potato dextrose agar. The sporulation in cultures grown initially in 24 °C was also stimulated by the transfer to 10 °C.

Cerebella andropogonis Ces. 1851

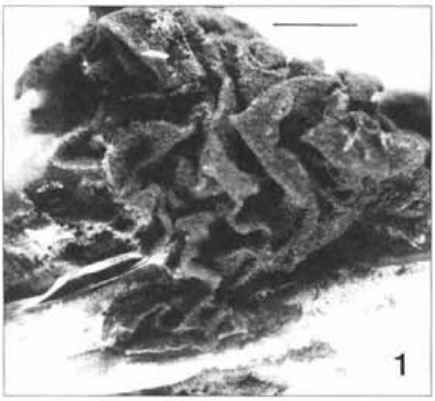
Botan. Ztg. 9: 669

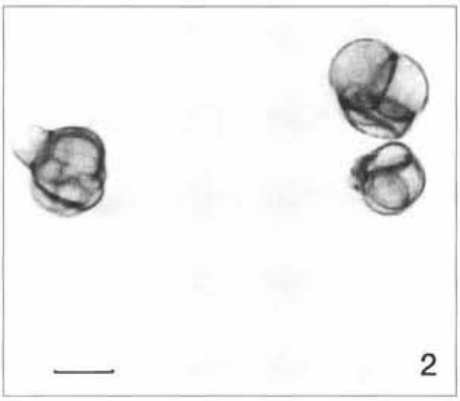
The spores from sporodochium (Fig. 4) of the Brazilian specimen were sized 15–22 × 14–20 μm and dark brown, their cell wall was thicker than in the Czech sample and 5–7 celled spores were no exception (Fig. 5). Their appearance was smooth or slightly verrucose, the conidiophore morphology was identical to that described in Ellis (1971).

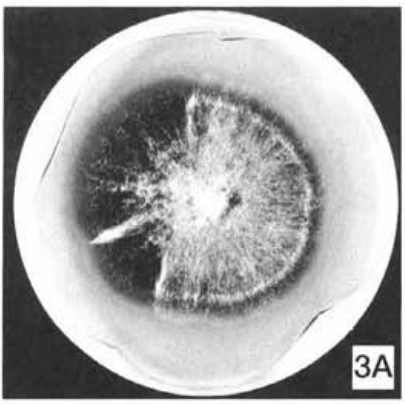
Unfortunately, the spores of Brazilian sample were no more capable of germination so no comparison of the cultures has been possible.

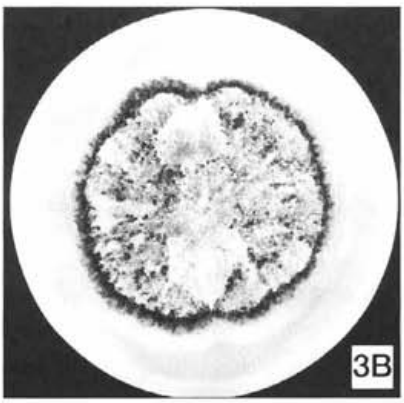
DISCUSSION

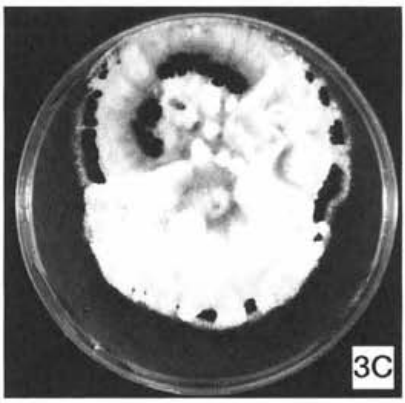
The Brazilian specimen is typical example of *C. andropogonis*. Langdon's review (1955) mentioned Brazilian record already from 1937 together with records



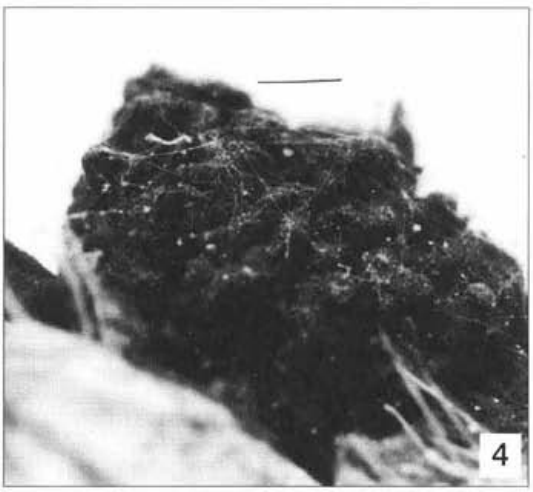


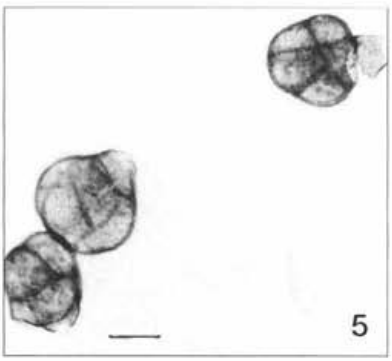






Figs. 1–3 *Cerebella* sp.
1. Sporodochium on ergotized fescue spikelet. Scale = 2 mm. **2.** Spores from sporodochium. Scale = 10 μm. **3.** Morphology of colonies (1 wk old) on potato dextrose agar (A), potato carrot agar (B) and RK agar (C) (90 mm in diam.). Note small black sporodochia formed radially and in sectors on PCA and compact circles of sporodochia on RK agar.





Figs. 4–5 *Cerebella andropogonis* Ces.
4. Sporodochium on ergotized *Brachiaria* spikelet. Scale = 2 mm. **5.** Spores from sporodochium. Note the single conidium of *Claviceps sulcata*. Scale = 10 μm.

from further South American countries. The specimen was included in this study for direct comparison of spore morphology.

The question may be raised whether the genus *Cerebella* is monotypic or not. Langdon (1955) commented on *C. moravica* and two other specimens that were unavailable for his study that "although from their descriptions they may well be *C. andropogonis*, confirmation or otherwise of this has not been possible" but did not reject their species status. Formally, the Picbauer's description meets International Code of Botanical Nomenclature standards for valid species description made before 1958, where the existence of type is not mandatory, so on this basis it cannot be rejected. Also there are differences in spore size and the unusual locality where it was found.

Both Czech collections (*C. moravica* and *Cerebella* sp.) have smaller spores than *Cerebella andropogonis* (summarized range given by Langdon is 15–30 × 13–22 μm). Picbauer (1938) found the spores of *C. moravica* 2–5 celled, mostly 13–15.5 μm in diameter, only rarely elongated (23 × 15.5 μm), smooth or slightly rough and brown-yellowish in color. Spores of *Cerebella* sp. were similar. Langdon (1955) supposed that specimens with spores under 15 μm and with attached stalk

cells are immature. The conidia in our cultures, however, did not increase their size after longer incubation. From the comparison of spores formed on potato carrot and RK plates it is obvious, that the nutrients influence the spore size substantially. Therefore, the spore size seems to be of limited taxonomic value in *Cerebella*. It may well be speculated that *C. purpurea*, producing less honeydew in comparison with *Claviceps* species from the warm regions does not support full development of *Cerebella* conidia.

On the other side, there are more differences between typical *C. andropogonis* morphology and the appearance of the Czech specimens. The cell walls of *Cerebella* sp. conidia were thinner than in the Brazilian sample of *C. andropogonis* and on the drawings in Ellis (1971). Picbauer neither commented about the thickness of the cell walls of his specimen nor any picture was included, but the difference of our fungus from *C. andropogonis* from Brazil is clearly visible. Also, Langdon (1952) observed verruculose and smooth spores in *Cerebella* collections, the latter occurring mainly in the cultures. Czech specimens of *Cerebella* sp. had smooth or mostly smooth spores.

It may well be possible that Picbauer's and our fungus are the same species *C. moravica*, different from *Cerebella andropogonis*. Unfortunately, the type specimen does not exist in the herbarium of Picbauer (catalogued at present in Moravské zemské muzeum, Brno, BRNM) so that the direct comparison of both fungi is no more possible. Therefore we classify our collection only on generic level as *Cerebella* sp.

Another comment is related to the present locality. It is well known, that southern Moravia is a place, where some of the species common only in the southern regions of Europe can be found. From this point of view, the first record of *Cerebella* near Kroměříž in 1938 was expectable. However, the present record is about 200 km more to the north and in higher altitude. The relationship to the climate warming is suspected.

Acknowledgements

Thanks are due to Dr. Alena Kubátová for critical reading of the manuscript. The work was supported by the grants 206/97/0611 and 522/99/0517 from the Grant Agency of the Czech Republic.

References

Anonymus (1960): Index of plant diseases in the United States. U. S. Dept. Agric. Handbook No. 165. – Washington, D. C., 531 p.

Ellis M. B. (1971): Dematiaceous Hyphomycetes. – Commonwealth Mycological Institute, Kew, Surrey, England, 608 p.

LANGDON R. F. N. (1952): Studies on ergot. –. PhD. Thesis, University of Queensland, Australia, 216 p.
LANGDON R. F. N. (1955): The Genus Cerebella. – Mycological Papers 61: 1–18.
LENNÉ J. M. (1990): A world list of fungal diseases of tropical pasture species. – Phytopathological Papers 31: 1–162.
MCDONALD J. (1923): Report of the mycologist. – Annual Report of Kenya Department of Agriculture: 81–85.
PARRIS G. K. (1959): A revised host index of Mississippi plant diseases. – Mississippi State University, Botanical Department Miscellaneous Publications 1: 1–146.
PICBAUER R. (1938): Addenda ad floram Čechoslovakiae mycologicam. Pars VIII. – Verhandlungen des Naturforschenden Vereines in Brünn 69: 44–45.
SCHOL-SCHWARZ B. (1959): The genus Epicoccum Link. – Trans. Brit. Mycol. Soc. 42: 149–173.
SPRAGUE R. (1950): Diseases of cereals and grasses in North America. Ronald Press, New York, 538 p.
TULASNE L. R. (1856): Selecta Fungorum Carpologia (Paris) 2, 132.

Czech mycol. 52 (1), 1999

Professor RNDr. Bronislav Hlůza, CSc. – 70 years

Jiří Lazebníček

On March 8^{th}, 1999, Professor RNDr. Bronislav Hlůza, CSc., chair of the Departement of Natural Sciences and Cultivation of the Pedagogical Faculty of Palacký University in Olomouc, celebrated his seventieth birthday.

Personal data of professor Hlůza, including his activities up to the year 1987, with a list of his publications on fungi until the beginning of the year 1988, were published in Česká mykologie (Czech Mycology) 34: 173–174, 1980, in Zpravodaj vlastivědné společnosti muzejní v Olomouci No. 21–22: 29–30, 1985, and in Česká mykologie (Czech Mycology) 43: 110–114, 1989.

In the following paragraphs an account is given of professor Hlůza's activities, along with his mycological publications from the years 1989–1999.

Two years ago (1997), lecturer RNDr. B. Hlůza was appointed professor of botany. Professor Hlůza was a guest lecturer at the University of Kiel (FRG) in the year 1995. In 1992 he ended 30 years of continuing pedagogical and professional cooperation with the Pädagogische Hochschule in Halle, Germany, due to changes in the German education system.

In the last 11 years, B. Hlůza collaborated with teachers of the Marie Curie Sklodowska University in Lublin, Poland. He was (1989 – till this time) a member of the Scientific Council of the Pedagogical Faculty of Palacký University in Olomouc and from 1998 is a member of the editorial board of the PU Journal (Žurnál UP). During the last 20 years he has been director of the project "Mapping of Poisonous Fungi in the Czech Republic" of the Czech Scientific Society for Mycology.

Professor Hlůza is a member of several scientific and professional organizations; since 1997 he has been a member of the board member of the Czech Scientific Society for Mycology.

Professor Hlůza works as an authorized expert in the toxicology of fungi. He collaborates with the Institute of Forensic Medicine and Medical Law of the Faculty of Medicine of Palacký University, Olomouc, by reviewing the causes of poisonings by larger fungi. He is chairman of the commission for the sale of mushrooms by the District Hygienic-Epidemiologic Station, Olomouc, and member of a similar commission in Přerov.

Prof. Hlůza devotes much time to mushroom collectors from the general public as an officer of a mycological advice bureau. As a member of the Natural History section of the Museum and its Natural History Society, Olomouc, he yearly conducts several botanical and mycological excursions. Together with the present author he exhibits during the year both well-known and newly collected and identified mushrooms and fungi. The exhibition is open to the general public in the

exposition centre of the Museum of Natural History, Olomouc. Professor Hlůza and the present autor co-organized an extensive exhibition of fungi in October 1998, in the Castle of Tovačov. Contributions came from many friends from Tovačov, Troubky nad Bečvou and other municipalities.

B. Hlůza collaborates with managers of the Protected Landscape Areas of Litovelské Pomoraví, Bílé Karpaty and Jeseníky, on mycofloristic research in these areas. He collaborates with the Museum of Natural History, Olomouc, and the Natural History Museum in Šumperk. He participated in 12 grants, including projects of the Fund for the Development of Universities, the Ministry of Education, Palacký University and the Pedagogical Faculty of Palacký University, Olomouc.

Professor Hlůza received a golden medal "For meritorious service at Palacký University" in the year 1994.

B. Hlůza has the extraordinary ability to expand the time in a day to 48 hours, or 730 days a year. He is a master in his many activities, thanks to his immense diligence and modesty, and especially thanks to his wife's comprehension.

Professor Hlůza is presently very active, both in pedagogical acitivities and mycological tasks. He actively selects tasks for the Faculty and contributes also to international scientific relations. Let us wish him good health and a lot of success!

Below is a summary of professor Hlůza's professional activities in the years 1989–1999. His mycological bibliography up to 1988 was published in Česká mykologie 43:110–114, 1989.

1989

K rozšíření muchomůrky císařky (Amanita caesarea) v Československu. – In: Kotlaba F. et Šebek S. (red.), Sborn. ref. "Aktuální rozšíření některých druhů řas, mechů, lišejníků a hub v Československu". Čs. věd. Společ. Mykol., Praha, p. 15–21.

1990

Bibliografický index 1.–12. roč. České Mykologie (1947–1958). – Acta Univ. Palack. Olom., Fac. Paedag., Biologica 6, p. 9–50, Olomouc.

Rozšíření a ekologie závojenky jarní – Entoloma vernum Lundell na Moravě. – Čas. Morav. Muz. Brno, Vědy Přír., 75: 133–141 (s V. Antonínem).

1992

Muchomor cesarski (Amanita caesarea (Scop.: Fr.) Pers.) zagrozony gatunek we florze grzybów Czieskiej Republiki. – In: Streszcenia referatów i plakatów z Konf. "Roslina i czlowiek", p. 176. (49. Zjazd Polsk. Towarz. Botan., 1.–5.9.1992, Kielce).

Vstepne uwagi o florze grzybów wielkoowocnikowych (macromycetes) Kazimierskiego Parku Krajobrazowego. – Fol. Soc. Sci. Lublinensis, od. 34, 1992 (s M. A. Chmiel a Z. Flisinskou).

1993

Ekologie a rozšíření čirůvky tygrované Tricholoma pardalotum Herink et Kotlaba v Československu. – Čas. Morav. Muz. Brno, Vědy Přír., 77(1992): 89–97 (s V. Antonínem).

Rozšíření a ekologie muchomůrky jízlivé – Amanita virosa (Fr.) Bertillon v České republice. – Čas. Morav. Muz., Brno, Vědy Přír., 78: 57–67 (s V. Antonínem).
Mykologická problematika na 49. sjezdu Polskiégo towarzystwa botanicznego (PTB) – 1.–5. IX. 1992, Kielce. – Mykol. Listy, Praha, 49: 19 (s B. Salatou).

1994

Jiří Lazebníček – 60th birthday. – Czech Mycol., Praha, 47(4): 311–318.
K 60. narozeninám ing. Jiřího Lazebníčka. – Mykol. Listy, Praha, no. 53: 25–27.
Contents and index of generic and specific names of fungi in Vol. 46 (1992). – Czech Mycol., Praha, 47(1): 3–19.

1995

Contents and index of generic and specific names of fungi in Vol. 47 (1993–1994). – Czech Mycol., Praha, 48(1).
Mycogeographical and ecological characteristics of Amanita phalloides (Fr.)Link in the Czech Republic.– Acta Mus. Moraviae, Sci. Nat., 79: (1994):65–71.

1996

Mykologické listy – obsah a index č. 1–50 (1980–1993).– Mykol. Listy, Praha, příloha, 61 str.
Rozšíření a ekologie hřibu nachovýtrusného – Porphyrellus porphyrosporus na Moravě a ve Slezsku. – Acta Mus. Moraviae, Sci. Nat. 80: 73–86, 1996 (1995) Brno (s V. Antonínem).
Příspěvek k poznání hub navrhované přírodní rezervace Pod Trlinou. – In: Vlastivědný sborník "Severní Morava", Šumperk, sv. 72/1976, p. 35–46. Okresní vlastivědné muzeum Šumperk. (S B. Holínkem a M. Zmrhalovou).

1998

Index Mykologických listů č. 51–60. – Mykol. Listy, Praha, č. 63: 8–28 (1997).
Návrh na červený seznam ohrožených druhů hub v CHKO Litovelské Pomoraví. Příroda, Praha, 12: 171–176.
Květena okolí Loštic. – In: Goš V. [red.] a kol. (1998): Loštice, město a jeho obyvatelé, 87 p., Loštice. P. 6–7.
Sympózium polských mykologů. – Mykol. Listy, Praha, č. 65:24–25 (s E. Matejko-Gosztyla).

1999

The contents and bibliographical index of Vol. 1–8 of the journal Mycologia (Praha) 1924–1931. – Czech Mycol. 51 (4): 207–271.
Otravy houbami. – In Sborn. "Ostravské toxikologické dny a dny forenzních věd". (Sborn. Prací soudně-lékařských konferencí), Ostrava, p. 79–82 (s A. Kosatíkem a K. Zedníkovou).

CZECH MYCOL. 52 (1), 1999

The decease of Dr. Josef Herink

FRANTIŠEK KOTLABA and ZDENĚK POUZAR

Dr. Josef Herink
Photo 28. 4. 1997 by F. Kotlaba

Czech mycological science has suffered a serious loss by the death of Dr. Josef Herink – one of the few oldest Czech mycologists – who initiated in 1945 the foundation of the Czechoslovak (now Czech) Scientific Society for Mycology, originally named the Czechoslovak Mycological Club.

Josef Herink was born in Prague on December 26, 1915, and died there (post-operative embol) on August 20, 1999 at the age of 83 years; he was buried at the Old Cemetery in Mladá Boleslav, N. Bohemia. He studied medicine at the Charles University in Prague but stayed with his family and worked as a physician (MUDr.), a specialist in internal medicine, mostly in two North Bohemian towns, Turnov and chiefly Mnichovo Hradiště.

He was active in several branches of medicine and mycology. As regards mycological taxonomy, J. Herink described three new species of agarics, viz. *Lentinellus pilatii* Herink 1953, *Inocybe crocifolia* Herink 1954 and *Rhodophyllus viridulus* Herink 1955. At the generic level, he proposed the following genera: *Neohygrocybe* Herink 1958, *Camarophyllopsis* Herink 1958 and *Gliophorus* Herink 1958 from which *Camarophyllopsis* is now commonly used. In addition, he proposed several new combinations.

During his many years of lasting mycological activity, J. Herink thoroughly studied many species of macromycetes, for instance *Hypholoma coprinifacies, Baeospora myriadophylla, Cystoderma paradoxum*, some species of *Agaricus, Armillaria, Cortinarius, Entoloma, Lepiota* s.l., *Mycena, Omphalina*, etc. and published "small monographic works" on them. Particularly important is his paper on the variation of *Helvellella gabretae*; on the basis of this study, the species was merged with *Pseudorhizina sphaerospora*. J. Herink studied in detail rich fresh material of the bolete *Xerocomus moravicus* (Vacek) Herink and his paper significantly spread knowledge of this species among the European mycological community. He devoted his whole life to his beloved genus *Lepiota* s.l., on which he published several papers (1954, 1961, 1962, 1975). In the last months he intended, with co-authors or alone, to write some papers on several interesting macromycetes but his death hindered this project.

J. Herink systematically improved the method of macrochemical reactions in the agarics and boleti for years. He used it as a diagnostic feature not only for the identification of species but also for their delimitation. He applied a number of chemical compounds, which he always took with him, and systematically applied when making the descriptions. Chemical reactions in species of the genus *Lactarius* were so attractive to him that he elaborated a method of proceeding specifically with milk reactions (1956, 1957).

One of the aims of J. Herink was to find characters in the agarics and boleti to identify species macroscopically, without using the microscope. For this purpose, he looked for very small differences in smell, taste, consistency, discolouration of context after bruising or cuting, as well as other features. Microscopical characters were applied in the last phase of the final preparation of the description and formation of a taxonomic concept. When using this method, he was able to identify many species in the field at sight (*"prima facie"*), on exhibitions of fungi or during lectures. He also systematically studied in detail the colour of fungal spore prints.

His whole life J. Herink collected data on the distribution of fungal species (macromycetes) in the former Czechoslovakia. He succeeded, e.g., in collecting rich data on the distribution of *Hygrophorus marzuolus* in Czechoslovakia, where this species reaches part of the northern boundary of its European distribution area (published 1949, 1951).

He founded the documentation methods of recording distribution data of larger fungi. With herbarium specimens, he provided also descriptions of the carpophores or notes on such characters, which disappear when drying. Simultaneously, he consistently numbered all his records of fungi in the field and the same number was included with herbarium specimens. He used this method from the thirties up to the end of this century – this is almost 60 years of documentation of macromycetes in the Czech and Slovak Republics. During his long life he accumulated a great number of herbarium specimens, a part of which is preserved in the herbarium of the Mycological Department of the National Museum, Prague, PRM (Czech Republic).

J. Herink was active in nature conservancy organisation. He systematically studied the mycoflora of some nature reserves, especially Boubín Virgin Forest and Karlštejn National Nature Reserve. J. Herink was also a co-author of Red Data Book Nr.4 (cryptogamic plants) of the Slovak and Czech Republics (1995), for which he elaborated 20 species of agarics and boleti (illustrated with paintings of his younger brother, the painter Jan Herink).

During his long life, Josef Herink prepared a large number of lectures for members of the Czechoslovak (Czech) Scientific Society for Mycology (shortly Society), devoted not only to agarics and boleti but also to fungal poisonings and nature conservation. These mostly dealt with special scientific problems and were not just elementary lectures. At the end of World War II, he systematically studied the taxonomy of boleti and he submitted a key to the identification of the species based on diagnostic features ascertained by himself. Herewith he influenced the concept of this group of fungi in the former Czechoslovakia. In the fifties,

he thoroughly revised Velenovský's new species of *Lepiota* (s.l.) with the results summarized in a lecture in which he also informed our mycologists about the distinguishing characters of the species in this genus. His last lecture (on the genus *Clitocybe*) was delivered to the Society in Brno, and later also in Prague, only about three months before his death. Since seventies, he accompanied his lectures with nice coloured slides of fungi.

The Society, as well as the former State Nature Conservancy, organized a number of field excursions on which J. Herink took part. At these occasions, he taught many mycologists know to recognize various agarics, bolcti and other macromycetes, common as well as rare ones.

A special part of J. Herink's activity was the study of poisonings by fungi, where he was able to use his profession as a physician combined with his great knowledge of fungal toxicity and its treatment. This line of his study resulted in his best– known book under the title "Poisonings by fungi" (1958), which is a separate edition of a large chapter from the book by Vondráček V, Riedl O.: Clinical toxicology (1st edition 1954; the last and edition 5 in 1980). The texts in this book are accompanied by precise paintings of poisonous fungi by Jan Herink. Josef Herink also wrote the entry "Fungi" in a Medical Encyclopedia (1st edition 1967, 2nd edition 1982). For a number of years, he was also head of the Chemical Laboratory of the District Health Service at Kosmonosy near Mladá Boleslav.

J. Herink worked intensively from 1947 up to his last months on the editorial board of the scientific journal Česká mykologie (now Czech Mycology), of which he was one of its founders. In the first volumes of this journal, he wrote bibliographical contributions and later during his entire membership biographies of Czech mycologists. Nearly all his scientific contributions were published in this journal in Czech languague with summaries in Latin, French, German or English. It must regreted that he did not write more papers as his knowledge on the Agaricales, especially, was really enormous.

To the honour of Dr. Josef Herink, the following species of fungi have been named: *Agaricus herinkii* Wasser 1996, *Conocybe herinkii* Svrček 1996, *Coprinus herinkii* Pilát et Svrček 1967, *Gymnopus herinkii* Antonín et Noordeloos 1996 and *Sepultaria herinkii* Svrček 1948.

Dr. Josef Herink, a Honorary President of the Czech Scientific Society for Mycology, will be commemorated not only for his great contributions in mycology and medicine but also for his brilliant intellect, righteous character and honesty in every life situation.

Publications by J. Herink from 1986 (except reviews)

(For the preceding bibliographies up to 1985, see Kříž 1976, Pilát 1966 and Svrček 1986).

(Addition for 1974: Taxonomie und Nomenklatur der Gattung Armillaria (Fr. ex Fr.) Staude. – Čes. Mykol., Praha, 28: 121–122)

1986
Osmdesát let Emila Horníčka (Octogenario Emil Horníček ad salutem!). – Čes. Mykol., Praha, 41: 251–254.
Nejsevernější lokalita hřibu příživného v Čechách (Nördlichste Lokalität von Xerocomus parasiticus in Böhmen). – Mykol. Listy, Praha, no. 22: 14–15.
Herink J., Pouzar Z.: Šedesát let mykologa Svatopluka Šebka (Svatopluk Šebek sexagenarius). – Čes. Mykol., Praha, 41: 165–176.

1987
K osmdesátinám Anny Pilátové (Octogenariae Anna Pilátová ad salutem!). – Čes. Mykol., Praha, 42: 176–177.
Zjišťování výskytu otrav houbami v ČSR (The survey of mushroom-poisoning in Czechoslovakia). – Mykol. Listy, Praha, no. 28: 18–19.
Semerdžieva M., Cvrček Z., Herink J., Hlůza B., Hruška L., Kuthan J., Šimůnek J., Štětková A.: Statistik der Pilzvergiftungen in den Jahren 1985 und 1986 in vier Bezirken der böhmischen Länder. – Čes. Mykol., Praha, 42: 222–226.

1989
Rozšíření některých vybraných Boletales a Agaricales /The distribution of some selected Boletales and Agaricales/: Agaricus phaeolepidotus, Buchwaldoboletus lignicola, Cystolepiota bucknallii, Hygrophorus capreolarius a Russula viscida. – In: Kotlaba F., Šebek S./red./, Aktuální rozšíření některých druhů řas, mechů, lišejníků a hub v Československu, p. 24–27, Praha.

1990
MUDr. Jan Zdeněk Cvrček – 75 let (75. anniversarium MUDr. Jan Zdeněk Cvrček ad salutem!). – Čes. Mykol., Praha, 44: 183–175.

1993
Herink J., Kotlaba F.: Dr. Zdeněk Pouzar sexagenarian. – Czech Mycol., Praha, 47 (1993–1994): 89–100.
Herink J.: Přehled současných poznatků o patogenezi a patofyziologii otravy muchomůrkou zelenou (Amanita phalloides). – Čas. Lék. Čes. 132(15): 452–455.

1995
Boletaceae, Hygrophoraceae, Melanophyllum eyrei, Chamaemyces fracidus, Cystolepiota bucknallii, Lepiota ignicolor, Leucoagaricus pilatianus, Russulaceae. – In: Kotlaba F. (red.), Červená kniha 4, ohrozených a vzácnych druhov rastlín a živočichov SR a ČR, p. 53–58, 85–88 et 103–109, Príroda, Bratislava.

REFERENCES

KŘÍŽ K. (1976): Šedesátiny MUDr. Josefa Herinka (MUDr. Josef Herink sexagenarius). – Čes. Mykol., Praha, 30: 58–61.
PILÁT A. (1966): K padesátinám MUDr. Josefa Herinka (Ad honorem annorum mycologi Josephi Herink, medicinae universalis doctoris, quinquaginta). – Čes. Mykol., Praha, 20: 111–116.
POUZAR Z. (1996): Eighty years of Dr. Josef Herink. – Czech Mycol., Praha, 48 (1995–1996): 233–235.
SVRČEK M. (1986): K sedmdesátinám MUDr. Josefa Herinka (Septuagenario MUDr. Josephus Herink ad salutem). – Čes. Mykol., Praha, 40: 101–104.

Czech Mycology, published by the Czech Scientific Society for Mycology. Graphic design by B. Bednář, PISCES. Typeset by TEX. Printed by Čihák Press, Praha 10. Distributed by the Czech Scientific Society for Mycology, P.O.Box 106, 111 21 Praha 1, and Kubon & Sagner, P.O.Box 340108, 80328 München, Germany. Annual subscription: Vol. 52, 1999–2000 (4 issues), US $ 86,–, DM 136,–

Podávání novinových zásilek povoleno Ředitelstvím pošt Praha čj. NP 105/1994 ze dne 4. 2. 1994.

INSTRUCTIONS TO AUTHORS

Preparation of manuscripts. Manuscripts are to be submitted in English, German or French. The text of the manuscript should be written on one side of white paper (A4, 210 × 297 mm) with broad margins (maximum 30 lines per page). Each manuscript must include *an abstract* (in English) not exceeding 100 words and a maximum of five key words. The paper will be followed by an abstract in Czech (or Slovak). The journal is responsible, however, for the translation of abstracts into Czech for foreign authors. Please send *two copies* of the typescript. The authors are asked to submit diskettes with *the accepted manuscripts* prepared on personal computers. The files should be in ASCII format, graphs in Excel. Both HD and DD/3.5″ and 5.25″ diskettes are acceptable.

Illustrations and tables. All tables, black and white photographs and figures (in black indian ink on a separate sheet) combined with the legends should be self-explanatory. Legends to the figures must be typed on a separate sheet. Colour photographs can be accepted but the authors will be responsible for the costs. All drawings or a photographs of microstructures should be provided with a scale. All illustration should be submitted as *the original drawing and one clear* copy. Output from computer graphics programmes produced on plotters or laser printers is quite acceptable. The dimension of any figure should not exceed 180 × 260 mm in size. References to illustrative matter in the text should normally in parentheses, e.g. ... spore sizes (Table 1) and ... as shown in Fig. 2 ... Figs. 1–5 ... Map 1 ...

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

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

Moravec J. (1984): Two new species of Coprobia and taxonomic remarks on the genera Cheilymenia and Coprobia (Discomycetes, Pezizales). – Čes. Mykol. 38: 146–155. (*journal article*)

Ryvarden L. (1978): The Polyporaceae of North Europe, Vol. 2. Inonotus-Tyromyces. – 507 p. Oslo. (*book*)

Tommerup I. C., Kuek C. and Malajczuk N. (1987): Ectomycorrhizal inoculum production and utilization in Australia. – In: Sylvia D. M., Hung L. L., and Graham J. H. (eds.), Proceedings of the 7th North American Conference on Mycorrhizae, p. 93–295, Gainesville.

The references *in text* should be Moravec (1984), or (Moravec 1984); or Kühner and Romagnesi (1974); When there are three or more authors use the form Tommerup et al. (1987).

Manuscript evaluation. All manuscripts will be reviewed by two reviewers, and the authors informed about their acceptance, rejection or necessary revisions within two months. If a manuscript is returned for revision, the authors should submit a revised version within three months.

Authors should preferably have their English language texts approved by a native – English speaker.

Proof corrections. Proofs of the paper will be sent to authors together with the original manuscript. If not returned within three weeks, the proof correction will be carried out by the editor. The principal author will receive 30 reprints free of charge.

Correspondence. All correspondence concerning the journal should be sent to the following address: Czech Mycology / Česká mykologie, National Museum, Department of Mycology, Václavské náměstí 68, 115 79 Praha 1, Czech Republic. Phone: 02/24497259 or 96151284

Czech Mycology, published by the Czech Scientific Society for Mycology. Graphic design by B. Bednář, PISCES. Typeset by TEX. Printed by Čihák Press, Praha 10. Distributed by the Czech Scientific Society for Mycology, P.O.Box 106, 111 21 Praha 1, and Kubon & Sagner, P.O.Box 340108, 80328 München, Germany. Annual subscription: Vol. 52, 1999 – 2000 (4 issues), US $ 86,–, DM 136,–

Podávání novinových zásilek povoleno Ředitelstvím pošt Praha čj. NP 105/1994 ze dne 4. 2. 1994.

CZECH MYCOLOGY / ČESKÁ MYKOLOGIE

is an international scientific journal publishing papers in all aspects of mycology including taxonomy, ecology, physiology and mycofloristics as well as mycological topics in forestry, agriculture and medicine. Czech Mycology will publish full length papers and short communications reporting original research which make a significant contribution to mycology. Review articles are also published.

Accredited with the International Association for Plant Taxonomy for the purpose of registration of new names of fungi.

CONTENTS