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OBSAH

Mycoflora of large-scale greenhouse plantation of salad cucumbers

Houby kultur salátových okurek ve velkoplošných sklenících

Jan Kuthan

In the course of the years 1988 - 1991 the author used to visit large-scale greenhouses at Paskov near Ostrava (NE Moravia, Czechoslovakia) and surveyed not only the abundant growth of particularly higher fungi there, but in 1989 he tried to summarize the weight of biomass of the most frequent species. The results of the observation of biomass, frequency, abundance and phenology are presented in the tables. Altogether 95 macrofungi taxons, 1 species of *Hyphomycetes* and 1 species of *Myxomycetes* were recorded and they are given in the systematic summary, potentionally with comments.

V průběhu let 1988 - 1991 autor navštěvoval velkoplošné skleníky v Paskově u Ostravy (SV Morava, Československo) a sledoval zde nejen hojný výskyt převážně vyšších hub, ale v roce 1989 se pokusil vyhodnotit i množství biomasy nejčastěji se vyskytujících druhů. Výsledky pozorování biomasy, frekvence, abundance a fenologie jsou uvedeny v tabulkách. Celkem zde bylo zjištěno 95 taxonů vyšších hub, 1 druh *Hyphomycetes* a 1 druh hlenky, které jsou uvedeny v systematickém přehledu, zčásti doplněném komentářem.

At Paskov near Ostrava (NE Moravia, Czechoslovakia) a modern complex of large-scale greenhouses heated by outlet heat from a near cellulose factory produces especially vegetables and flowers for the industrial centres in the vicinity. The main production is centralized in 10 separate units of 11.000 sq.meters each, some smaller greenhouses are used for special production or other applications (e.g. reproducing insects used for biological repressing mischievous parasites). About 90% of the production (about 2000 t per a year) are salad cucumbers, tomatoes, red pepper, lettuce, kohlrabi, and chinese cabbage, the rest are flowers (e.g. carnations, lilies, and fresias). In winter chicory buds are produced in three special halls, and for the rest of year the rooms are used for cultivation of champignons. Soil is preparated and mixed for all units in a central plant, only substratum for champignon hotbeds is imported. Air-conditioning, heating, watering, and partly also fertilizing in all main units is automated according to a given programme.

Pest are destroyed biologically: insects (as *Tetranychus urticae, Frankliniella occidentalis, Trialeurodes vaporarium,* etc.) by predatory mites (*Phytoseiulus persimilis* and *Amblyseiulus mackenzii*), and/or by parasitizing wasps (*Engarsia formosa*); phytopathological fungi as *Fusarium* etc. by intensive steaming of soil, or by inoculation of soil with special cultures of lower fungi or bacteria (e.g. *Trichoderma viride, Bacillus subtilis*); weeds by manual weeding and strewing remnants of bark and bast from the waste of the cellulose factory (processing coniferous wood only) among the rows. Fungicides and herbicides are only exceptionally applied at the first stage of cultivation, instead insecticides inhibitors of evolution stages of greenhouse-moths (*Trialeurodes vaporarium*) are applied if necessary. Tests, too, are made with insects parasitizing fungi (*Isaria,* *Beauveria, Spicaria, Hymenostilbe* species), but, because of the possible problems and danger for human health (mainly at the attendants), just isolated smaller greenhouse units were used.

During some informative visits in February and March 1988 almost 30 species of higher fungi were occasionally found in the plantations of salad cucumbers, often in a large number of fruit-bodies. In the units with the plantations of lettuce, kohlrabi, and chinese cabbage, as well as with flowers, occurence of higher fungi was very low probably because of the lower temperature, soil and air humidity, and lower contents of organic matter (straw, cow-dung) in the soil. In the plantations of tomatoes and red pepper besides the same type of used soil the rows are mostly covered with a black plastic foil for repressing weeds - higher fungi are also repressed in this way, though here probably by the increased carbondioxyde contents in air under the foil.

The rich and diverse fungus flora which occurred in the salad cucumber plantations suggested me a scheme of systematic observations of these greenhouse fungi, namely not only from the point of view of an identification of these larger fungi growing there, but also of a study of successions, frequency, abundance, and quantity of individual species biomass. Therefore I decided to watch a complete season of cucumber cultivation in one unit of the greenhouse complex from the moment of planting seedlings to the final liquidation of the rows after the last harvest.

In late January (16th - 24th, 1989, two units 2.2 ha) of salad cucumbers (*Cucumis sativus* L., ads. Corona) were planted. A plantation in rows on a higher layer of straw (so called "Multsch-type" cultivation) and soil with fertilizers (16.5 kg of combined fertilizer, 1.5 kg ammoniumphosphate and 3.3 kg kaliumsulphate for a row about 30 sq.m.) was used. Later treatments were:

- Previcur spraying against diseases caused by fungi (e.g. *Colletotrichum orbiculare, Fusarium oxysporum* f. *melonis, Cladosporium cucumerianum, Botryotinia fuckeliana, Sclerotinia scletiorum,* etc.).
- Intensive watering by spray, partly with liquid fertilizers Ca-N or Mg-N, too,
- DAM Vegaflor - combined liquid fertilizer with trace elements,
- Ammoniumnitrate - a nitrogen fertilizer and Cererit - a combined fertilizer, both in the amount of about 3 kg per a row in every treatment (every 15 days),
- Carbondioxyde gas - for intensification of the growth of plants.

Very good yields of cucumbers were obtained with this technology, though the nitrate contents in the products were apparently higher. The occurrence of fusariosis was also high owing to higher humidity of air and soil, as well as the rich occurrence of fruit-bodies and separate species of higher fungi. As it will be noted later, in the next years 1990 and 1991, this technology was forsaken: a greater part of artificial fertilizers was compensated by cow-dung and watering was essentially reduced. The nitrate contents in cucumbers lowered (at the cost of a certain decrease of the yield, partly substituted by reduced occurrence of fusariosis), but, as the main change, the former abundance of higher fungi disappeared.

In the time between January, 18 and May 13, 1989, 18 observations were realized (every 5 - 6 day) in the greenhouse unit No. 6 and No. 8. In the unit No. 6 the occurrence of various species of higher fungi, frequency and abundance of fruit-bodies, quantity of biomass, and succession of selected species were studied during the whole season. Particularly fruit-bodies of separate species for determination and herbarium specimens were collected in the unit No. 8 planted a week later and cultivated in the same method. Because of the great similarity of the fungus-flora in both units some statistical investigations for the biomass evaluation (e.g. the number of fruit-bodies growing gregariously on one place - presumably from one sole mycelium - determination of the medium weight of a fruit-body, etc.) were also realized in the above mentioned unit. An aim of minimum disturbance in the growth was pursued with this method and by counting fruit-bodies in the unit No. 6. Certainly, if one species occurred in the unit No. 6 only, it was collected and deposited as a herbarium specimen; a few species that occurred only in the unit No. 8 were noted in the general list, but not used for statistics.

Some positive and negative influences of fertilizing, increased temperature, watering, etc. at the fructification of these saprophytic fungi were observed. The main results can be seen in the graphs and in the tables. A rich forming of fungal fruit-bodies was observed mainly during the first weeks after the cucumber planting. It may be supposed that the reason consisted in the abundance of fresh organic matter in the substratum (straw, remnants of bark and bast), in high soil humidity (though the soil was still well loose and aerated at the same time), and in appropriate air humidity and temperature. The soil temperature was not recorded because the isolated system was in a direct relation to the air temperature and it changed though the temperature of soil was still some degrees lower. The soil reaction was between pH 6.5 - 6.7, in the next years, when cow-dung instead of straw and artificial fertilizers was applied, the soil reaction was little higher (pH 6.7 - 6.9).

The intensive watering, fertilizing, and increase daily medium humidity and temperature produced rather negative effect as well as increasing the shade of soil (microclimate) by the cucumber plants. Later, when the watering process carried out by spraying from above was changed to direct watering the rows by water hoses togeather with a stabilization of air humidity and temperature on a higher but regular level, fruit-body forming of almost all the fungus species was restrained or entirely stopped. The fructification climax of various species was noted at diverse time, in some special cases two climax in one species (or genus) were observed. During the last two visits realized in May, 1989, the appearance of fruit-bodies and the number of growing species was very low, therefore (and because of a greater devastation of the plantation by the harvest) the observations were then stopped although the plantation was fully liquidated two weeks later at the end of May.

Under this conditions some fungi formed a great number of fruit-bodies (e.g. *Peziza vesiculosa, Coprinus urticaecola, Leucocoprinus birnbaumii, Panaeolus subbalteatus,* etc.), in other cases giant fruit-bodies (with cap diameter to 15 cm in *Leucocoprinus birnbaumii* and in *Leucocoprinus cretatus,* and 22 cm in *Pluteus petasatus*) were noted. A yellow surface mycelium of *Leucocoprinus birnbaumii* with primordia covered more than one sq.m. in numerous places. Some species formed only very few fruit-bodies, only 1 specimen of *Entoloma undatum* was found two times. Certain fungi species fructificated on the rows, some others outside the rows under the heating tubes only where more woodrests were present (e.g. *Pluteus petasatus, Hohenbuehelia rickenii, Leucoagaricus meleagris, Hypholoma fasciculare, Pholiota gummosa,* etc.), some were found both on the rows and under the heating tubes (e.g. *Leucoagaricus bresadolae, Leucocoprinus cepaestipes,* etc.), some on the border of the unit where the temperature was lower.

One visit to two units with more than 400 rows represented a walk about 8 km long under conditions of a "tropical rainy forest", scratched by the ragged surface of cucumber leaves. Therefore it was not easy to evaluate exactly the frequency of an individual fungus species and the number of their fruit-bodies. For evaluation of fruit-bodies and their biomass, partly a simple count was used, partly also statistics- a calculation based on the average number of fruit-bodies in one place (in one tuft, in a group evidently growing from one mycelium) received empirically.

The results are shown in the table No. 1. The observations concerning phenology are partly shown on the graphs No. 2 - 5, partly, together with observations concerning successions in different species or groups, are given in the conclusion to the general part of this contribution. The biomass of the species with a value greater than 0.10 g per sq.m. is given in the table No. 2. All this values were obtained in the unit No. 6 where 54 species of macromycetes and 1 of *Hyphomycetes* could be identified in 1989.

Not without an interest was also the comparison of the results in the unit No. 6 and No. 8 with two other units (No. 3 and No. 5) planted with cucumbers at the end of February, 1989. Only fertilized soil (without a straw layer of the "Multsch - type" cultivation) was applied there, and in some sections of the units inoculation of soil with *Trichoderma viride* or *Bacillus subtilis* against fungal pest (especially *Fusarium*) was used. In those separate sections *Fusarium* was almost fully surpressed, but also the appearance of saprophytic macromycetes (with exception of some solitary tufts of *Hohenbuehelia rickenii*) was reduced nearly to zero.

Two other units (No. 9 and No. 10), after the harvest of lettuce and kohlrabi, were planted with salad cucumbers on fertilized soil without straw, a part of the unit No. 9 was also planted with red pepper (*Capsicum*). Heating and watering was a little different (lower temperature and humidity), the used Dutch variety Samar of cucumbers is highly resistant against the CMV (*Cucumis* virus), WMV (Watermelon virus), SCAB (*Cladosporium cucumerianum*), mildew (*Sphaerotheca cucumis*), leaf-spots (*Corynespora capsicola*), and also against the dangerous mould *Perenoplasmopara cubensis*. The obtained results were very good concerning the conditions of the cucumber plants, but the number of macromycetes low, though some new species for the locality were found here. The main reason consisted probably in a lack of straw in the rows and regime of watering and air-conditioning. The fungus *Sclerotinia sclerotiorum* (Lib.) De Bary forming sclerotia in dying stalks was observed on plants of *Capsicum annuum* L., but this fungus was not found on cucumbers anywhere in this locality.

In 1990 I planned to continue in the same investigations as in 1989 (a repetition). However, an intensive steaming of the rows has been executed before the cucumber planting was realized at the first week of February (units No. 7 and No. 9). The rows with straw and soil ("Multsch-type") were covered with specieal canvas and steamed several hours by overheated steam (130 - 140°C on the output). It is also possible that the soil was partly contamined with inoculated lower fungi from the test executed in 1989 in consequence of the central preparation and homogenization of the soil in the object.

Whatever the cause was, the occurrence of macromycetes (but also *Fusarium*) in both units was - probably in concequence of steaming - perspicuously lower in 1990. Some species which appeared abundantly in 1988 and 1989 were no more registered in 1990, in some other cases the number of fruitbodies was distinctly reduced. Therefore the study of frequency and abundance of fructification had to be abandoned, only some subsidiary observations of medium number and average weight of one fruit-body for getting more exact evaluation of biomass were made. But from the other point of view it is necessary to emphasize that 28 species of macromycetes and 1 of *Myxomycetes* not recorded there before were collected in 1990 partly among cucumber rows, partly also in other plantations. Some species which occurred in 1988 and 1989 with only few fruit-bodies could be found in 1990 with a large number (e. g. *Volvariella speciosa, Conocybe* sp. div., etc.) of fruit-bodies, therefore it was also possible to give a greater precision to the determination and observation of some earlier collections.

In a greater part of units visited in 1988 to 1990 salad cucumbers were planted together with other units with tomatoes, lettuce, red pepper, etc., where fungi occurred only occasionally, total 85 taxons were found. 12 taxons of macromycetes (mainly *Conocybe* sp.) were collected as new in 1991.

The situation in 1991 was the worst of all the years when the observations were made. The use of straw was fully excluded, only soil and cow-dung were applied on the rows, and the cucumbers in rows were watered by "drop-watering" when the water is transported in thin hoses with small perforations directly to the seedlings and sprayed in permanent drops. The intensity of watering may be changed by water pressure in the plastic hoses. With this system the surface of the rows is dry and soil is watered in the immediate vicinity of the plants; fertilizers may be added to water. It is not necessary to strew remnants of bark and bast among the rows because the main sense of this technology is to save water and fertilizers and to reduce air humidity as well as to keep the areas between the rows dry for the manipulation and the harvest. Though the temperature of air was nearly the same as before, the dry environment and the absence of organic matter surplus in substratum caused a general decline of fungi occurrence. In February and March, 1991. I visited the unit No. 4 with red pepper and tomatoes, more times. Only very few species of last year's abundant occurrence (e. g. *Leucocoprinus birnbaumii, Peziza vesiculosa, Panaeolus subbalteatus, Hohenbuehelia rickenii*) were found in the units with cucumbers. Some species of *Conocybe* and *Coprinus*, not collected there before as well as two species of *Discomycetes*, were found in 1991 especially on insufficiently crushed and distributed bits of cow-dung.

More than 95 taxons of higher fungi, 1 species of *Hyphomycetes*, and 1 of *Myxomycetes*, were collected during the years 1988-1991, all inside the greenhouses in plantations of cucumbers and other vegetables. Outside the greenhouses but inside the enterprise *Morchella conica* and *Pholiota lenta* were also found, both species on remnants of bark and bast from the waste of the cellulose factory applied as strewing under decorative coniferous shrubs.

The mycoflora recorded inside the greenhouse units at Paskov may be roughly divided into three groups:

1. Characteristic species of greenhouses not occurring (or only exceptionally) in the nature: e. g. *Clitocybe augeana, Clitopilus passeckerianus, Leucocoprinus birnbaumii, L. cretatus, Conocybe intrusa*, partly also *Bolbitius coprophilus* and *B. variicolor*, etc.
2. Species of gardens, composts, and fertilized soil containing remnants of straw, plants, dung, etc.: *Agrocybe molesta, Agrocybe praecox, Conocybe* sp. div., *Coprinus* sp. div., *Lepista sordida, Panaeolus subbalteatus, Peziza vesiculosa, Volvariella speciosa, Leucoagaricus leucothites*, etc.
3. Species growing on waste wood, sawdust, and rotten straw mostly in the nature: e.g. *Bolbitius vitellinus, Hohenbuehelia rickenii, Hypholoma fasciculare, Leucocoprinus bresadolae, Pluteus petasatus, P. depauperatus, Sphaerobolus stellatus, Cyathus olla, Crucibulum laeve*, etc.

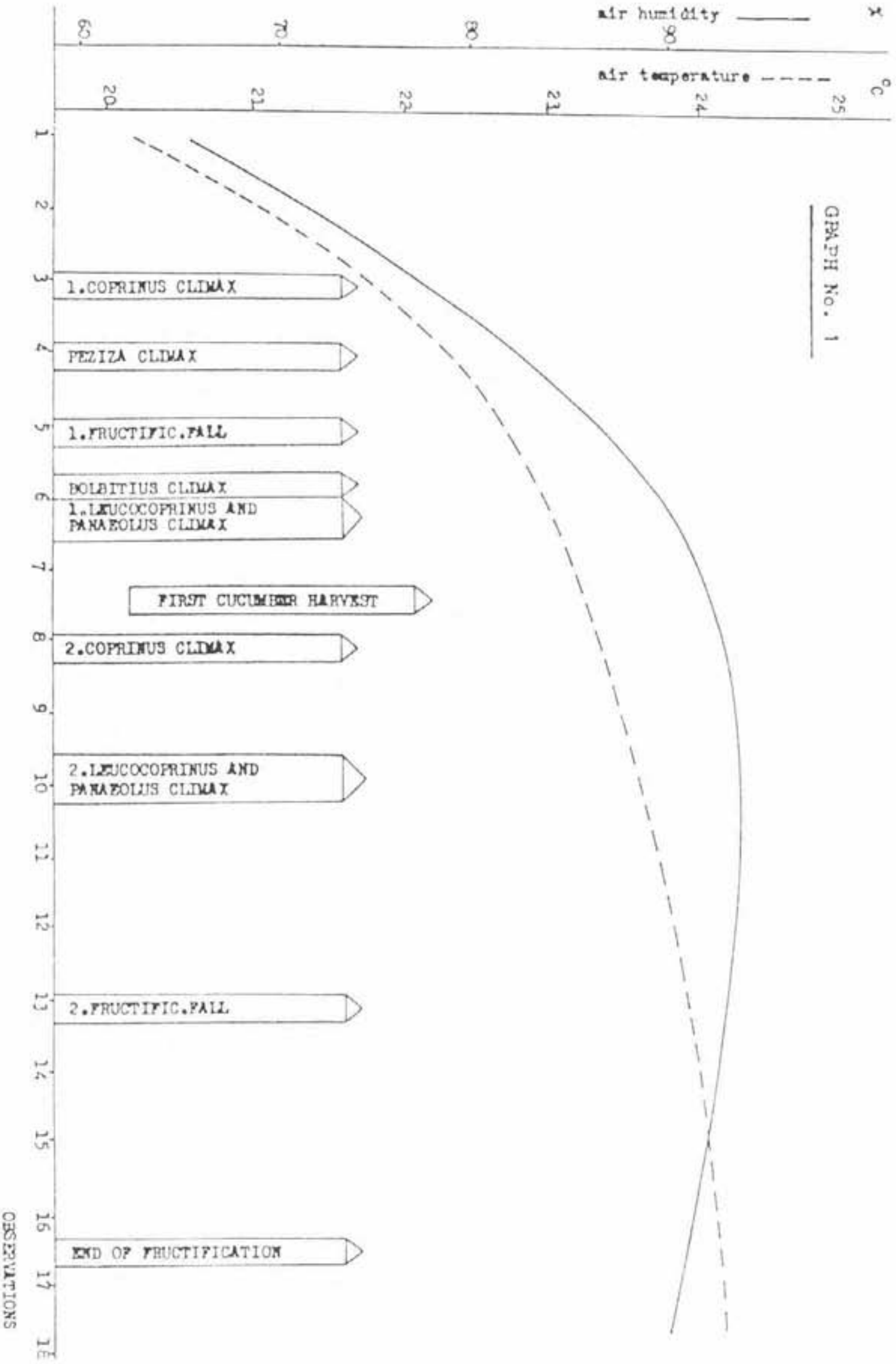
It is necessary to notify that only in 1988 and in 1989 such an abundance of higher fungi was observed. The cause of it consisted in very rich substratum (especially organic

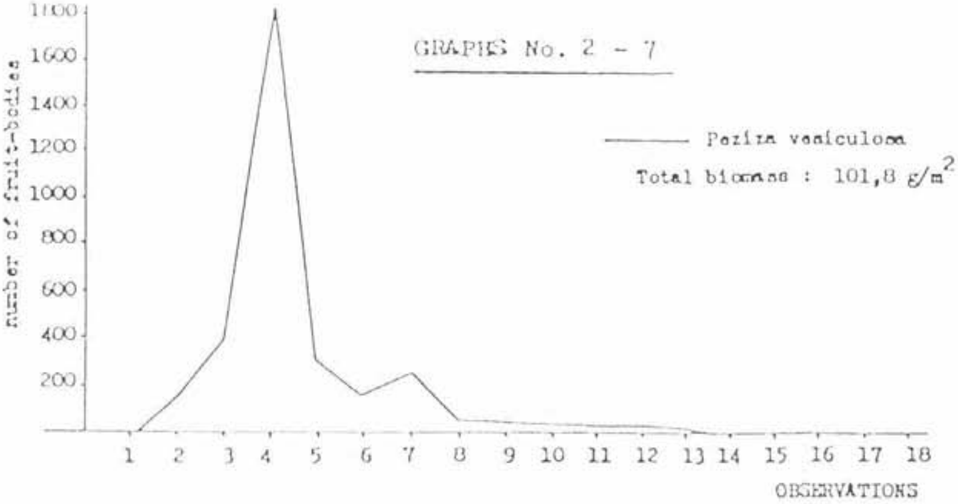
TAB. No. 1 Species observed during the campaign in 1989		Number of fruit-bodies (FB) - unit No. 6 gathered by simple addition - AD, by statistics - S																		Total number of FB / average weight of 1 FB	Total weight of FB in g Biomass g/ sg. m
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		
AGROCYBE gibberosa	AD														12	48	6			66 7,26	479,2 0,04
AGROCYBE pediades	S			20	40	80	20	120	100	60	20									460 3,30	1518,0 0,14
BOLBITIUS coprophilus	S		20	30	80	1480	350	90	80	80	20	10								2240 2,20	4828,0 0,44
BOLBITIUS variicolor	AD		4	14	37	21		5	19	13										115 2,54	292,1 0,03
BOLBITIUS vitellinus	S		210	700	280	140	70	35				35								1470 1,29	1896,3 0,17
CLITOCYBE augeana	AD				5	17	6	8				6								42 10,35	434,7 0,04
CLITOPILUS passeckerianus	AD			6	4	21	16	3												50 2,07	103,5 0,009
CONOCYBE huijsmanii	AD														14	32	8			54 0,63	43,0 0,003
CONOCYBE macrocephala	S					8	24	32	48	48	64	48	40	48	32	64	24	16	24	496 0,55	272,8 0,02
CONOCYBE lactea	AD									3	4	10	6	2						25 0,40	10,0 0,001
COPRINUS callinus	S	20	180	1000	160	100	40	80	460	760	640	580	100	400	60	120	20			4740 0,10	474,0 0,04
COPRINUS cinereus	S		48	360	296	104	96	80	64	48	24									1120 3,13	3505,6 0,32
COPRINUS cothurnatus	S			20	30	20	50	60	380	80	60	40	10							750 0,30	225,0 0,02
COPRINUS flocculosus	S			24	36	24	48	96	312	48	36	60	36	12						732 1,76	1288,3 0,12
COPRINUS friesii	AD		25	40	45															110 0,16	17,6 0,002

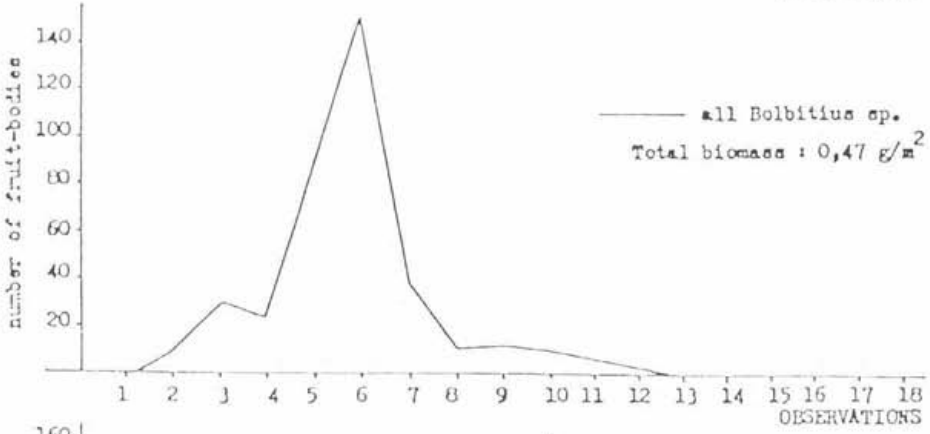
COPRINUS S lagopus		20	80			40	460	280	40	80	30	40	20			35	25		1140 0,32	364,8 0,03
COPRINUS S marculentus		60	140	60	20	20	40	280	20										640 0,16	102,4 0,01
COPRINUS S patouillardii	8	48	336	64	48														504 0,12	60,5 0,005
COPRINUS AD radiatus		3		14		6	10	18	2										53 0,31	16,3 0,001
COPRINUS S urticaecola		2500	25000	25000	5000	250	1000	500											61500 0,03	1845,0 0,17
HOHENBUEHELIA S rickenii	10	15	30	35	120	140	130	70	50	30	15	10	20	5		15	10	20	730 38,25	27022,5 2,54
LEUCOACARICUS AD bresadolae			8		25	59	145	130	45	21	10	17	5						465 21,35	9927,8 0,90
LEUCOACARICUS AD leucothites						6	21	3		5									35 23,82	833,7 0,08
LEUCOACARICUS AD subcretaceus				3	8	3	25	13	2	5	7	3							69 27,50	294120,0 0,17
LEUCOCOPRINUS S birnbaumii		60	240	2160	4980	11580	7500	3300	1380	8640	7200	2280	2820	540	180	360	60	120	51600 5,70	479,2 26,74
LEUCOCOPRINUS AD cepaestipes						31	76	19	71	58	22								277 7,11	1969,5 0,18
LEUCOCOPRINUS AD cretatus						7	49						3	9	21	27	5		121 9,80	1185,8 0,11
LEUCOCOPRINUS S denudatus					15	30	60	90	120	75	60	60	60	30	30	45	30	15	720 0,28	201,6 0,02
LEUCOCOPRINUS S lilacinogranulosus				20	20	20	40	120	80	40	340	120	80	20					900 3,82	3438,0 0,31
PANAEOLUS S subbalteatus		210	570	600	1740	2160	840	1220	2450	1160	360	270	1410	270	240	90	40	30	13690 2,66	36415,4 3,31
PEZIZA S vesiculosa		6750	19900	91000	13800	7400	11450	2150	1300	100	800	600	400						156650 5,50	861025,0 78,28
PSATHYRELIA S prona					10	20	10	10	20	30	40	10							150 0,09	15,6 0,001
PSILOCYBE S physaloides						240	150	60											410 1,25	512,5 0,05
VOLVARIELLA AD speciosa					6	8	20			5	14	6							59 27,54	1624,9 0,15
VOLVARIELLA S volvacea										60	120	60							240 21,30	5112,0 0,46

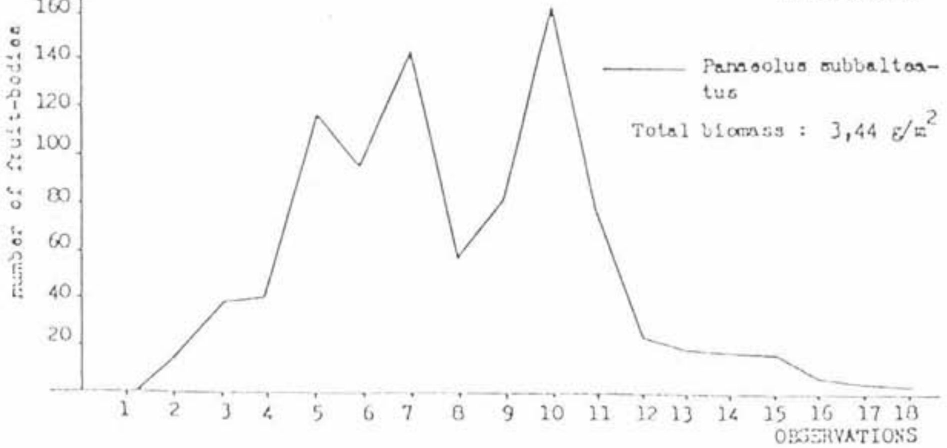
Table No. 2:
List of species according to their specific biomass

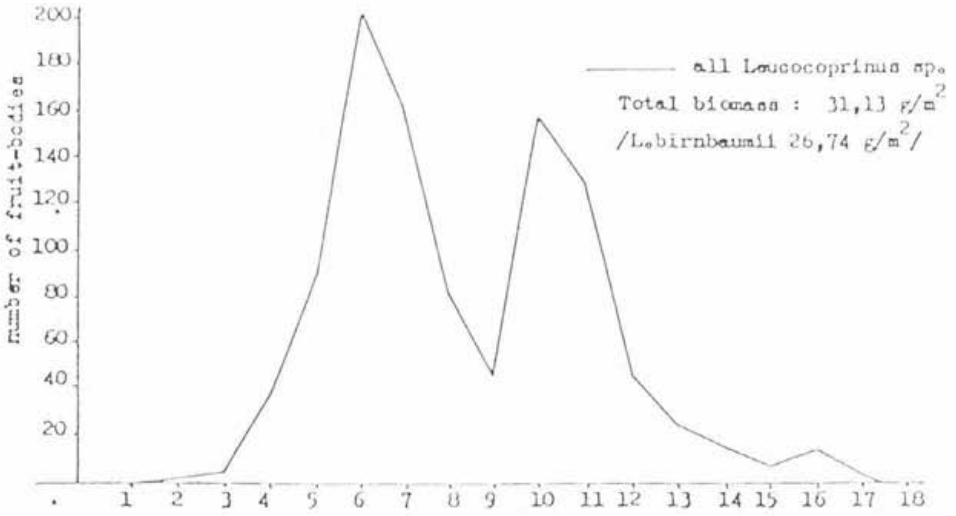
	g per sq.m
Peziza vesiculosa	78,28
Leucocoprinus birnbaumii	26,74
Panaeolus subbalteatus	3,31
Hohenbuehelia rickenii	2,54
Leucoagaricus bresadolae	0,90
Volvariella volvacea	0,46
Bolbitius coprophilus	0,44
Coprinus cinereus	0,32
Leucocoprinus lilacinogranulosus	0,31
Leucocoprinus cepistipes	0,18
Leucoagaricus subcretaceus	0,17
Bolbitius vitellinus	0,17
Coprinus urticaecola	0,17
Volvariella speciosa	0,15
Agrocybe pediades	0,14
Coprinus flocculosus	0,12
Leucocoprinus cretatus	0,11
all other species less than	0,10


air humidity ——
%
60
70
80
90
air temperature - - - -
°C
20
21
22
21
24
25
GRAPH No. 1
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
OBSERVATIONS
1.COPRINUS CLIMAX
PEZIZA CLIMAX
1.FRUCTIFIC.FALL
BOLBITIUS CLIMAX
1.LEUCOCOPRINUS AND PANAEOLUS CLIMAX
FIRST CUCUMBER HARVEST
2.COPRINUS CLIMAX
2.LEUCOCOPRINUS AND PANAEOLUS CLIMAX
2.FRUCTIFIC.FALL
END OF FRUCTIFICATION

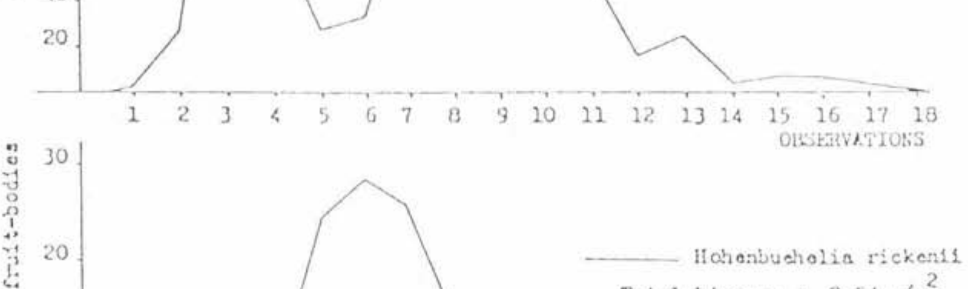

GRAPHS No. 2 - 7
number of fruit-bodies
1800
1600
1400
1200
1000
800
600
400
200
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
OBSERVATIONS
Peziza vesiculosa
Total biomass : 101,8 g/m²


number of fruit-bodies
140
120
100
80
60
40
20
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
OBSERVATIONS
all Bolbitius sp.
Total biomass : 0,47 g/m²


number of fruit-bodies
160
140
120
100
80
60
40
20
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
OBSERVATIONS
Panaeolus subbalteatus
Total biomass : 3,44 g/m²


number of fruit-bodies
200
180
160
140
120
100
80
60
40
20
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
all Leucocoprinus sp.
Total biomass : 31,13 g/m^2
/L.birnbaumii 26,74 g/m^2/


number of fruit-bodies
160
140
120
100
80
60
40
20
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
OBSERVATIONS
all Coprinus sp.
Total biomass : 1,44 g/m^2
/C.cinereus : 0,36 g/m^2/


number of fruit-bodies
30
20
10
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
OBSERVATIONS
Hohenbuehelia rickenii
Total biomass : 2,54 g/m^2

matter), high humidity of soil and air, and corresponding high temperature in the units. The situation in the fructification is perspicuously given in the table No. 1. Phenology of separate species and dynamism of fruit-body forming of 35 species noted here can also be seen here. The rest, namely 20 species, were observed in the unit No. 6 during less than three visits only; during mere two visits: *Coprinus phaeosporus* (30 fruit-bodies), *Coprinus* cf. *pseudoradiatus* (12), *Crucibulum laeve* (165), *Cyathus olla* (64), *Galerina* sp. *"calidarium"* (19), *Hypholoma fasciculare* (27), *Pholiota gummosa* (32), *Pluteus petasatus* (27); and during only one visit: *Agrocybe molesta* (8), *Bolbitius lacteus* (6), *Clitocybe gallinacea* (4), *Conocybe intrusa* (20), *Coprinus heterocomus* (6), *C. sclerocystidiosus* (8), *Entoloma undatum* (1), *Gymnopilus penetrans* (7), *Lepista sordida* (9), *Psathyrella atomata* (33), *Sphaerobolus stellatus* (about 50), and *Volvariella taylori* (9).

All the recorded species are discussed or described in the following list. If not especially mentioned, all the species were collected and determinated by the author (J. K.). The specimens of all collected and just determined species are deposited in the herbarium BRNM.

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List of species collected in greenhouses of Sempra enterprise at Paskov in 1988 - 1991

Myxomycetes

Fuligo cinerea (Schw.) Morg. - unit No. 10, on soil, straw and withered leaves around cucumber plants, 22. III., 28. III., and 31. III. 1980, not in the herbarium.

Ascomycetes

Cheilymenia theleboloides (Alb. et Schw.: Pers.) Boud. - unit No. 3, on insufficiently crushed and distributed bits of cow-dung on the rows with cucumbers, 5. III. 1991, det. J. Moravec.

Coprobia granulata (Bull.: Mérat) Boud. - unit No. 3, on the same substratum as *Ch. theleboloides*, 18. III. 1991, rev. J. Moravec. The las two mentioned species were noted only in 1991 after the change in planting technology when straw in the base of rows was substituted by cow-dung.

Hypomyces perniciosus Magn. - unit No. 6, on fruit-bodies of *Leucocoprinus birnbaumii,* 9. II. 1989; and it the unit No. 8, on the same fungus, 15. III. 1989, both det. V. Holubová-Jechová; - unit No. 10, on fruit-bodies of *Hohenbuehelia rickenii,* 8. II. 1990. Observed also in 1991. - This species, a member of the family *Hypocreaceae*, is a dangerous parasitizing fungus in champignon (*Agaricus*) cultures. The fungus stage with chlamydospores is denominated as *Mycogone perniciosa* (Magn.) Cost. et Duf.; a kindered species with red chlamydospores - *Mycogone rosea* Link - was declared as an originator of the "molle" disease causing deformation of the fruit-bodies of cultivated champignons. *H. perniciosus* was probably introduced into the cucumber plantations at Paskov by the applied champignon substratum mixed to soil. It is interesting that only two species of macromycetes of about 95 species growing in the greenhouses at Paskov were parasitized with this fungus and that the occurrence of such fruit-bodies was relatively low. I suppose that the climatic conditions in these greenhouses are not evidently favourable enough for this parasite, and that the occurrence of insects - the main vector of this infection - is intensively suppressed in the cucumber plantations as well.

Peziza vesiculosa Bull.: St. Am. - actually the most abundant fungus in cucumber plantations with the "Multsch-type" technology in 1988 and 1989, as can be clearly seen on the observed biomass quantity of this species in the unit No. 6. It was possible to find fruit-bodies growing solitary, in small or larger groups, and also in dense tufts on straw or on soil of the row, the appearance of fruit-bodies, too, was as different as possible. They were crowded in groups of small fruit-bodies with yellow brown colour, in dense tufts of patelliforme apothecia of a different diameter, and one could also find solitary growing cupuliform apothecia of wax yellow colour with and elongated stipe-form basis (also called *Peziza hortensis* Crouan), and also very great plane to concave, leather to tobacco brown or broadly cup-shaped (to 12 cm in diam.) avellaneous fruit-bodies. During more number of my visits there I could not convinced myself that I collected only different forms in shape and colour of one species, nevertheless both J. Moravec and M. Svrček confirmed coincidently all the forms as *Peziza vesiculosa.* Of the material returned back to me by the above mentioned determinators four specimens are in BRNM; - unit No. 3, on straw and soil, 4. III. 1988; - unit No. 6, on the same substratum, 10. III. 1989, both det. J. Moravec; - unit No. 7, on soil, 28. II. and 15. III. 1990, both det. M. Svrček. In 1990 the occurrence of this species was lower (probably because of the absence of straw and a little higher pH value), and during some visit in 1991 I was not able to find any fruit-bodies of *Peziza vesiculosa* on the dry surface of the rows due to the "drop-watering".

Sclerotinia sclerotiorum (Lib.) De Bary - unit No. 9., in dying and often broken stalks of

Capsicum annuum L. (sclerotia), 15. III. 1990. The sclerotia were found in the place where the stalk was just partly, coloured brown grey, and often broken here, they were black and up to 12 µm long and about 4 - 5 µm in diam. In a Petri-cup with moist paper at a room temperature small light brown yellow apothecia (5 - 7 µm high and 2 - 3 µm in diam.) grew up from these sclerotia. According to the technicians from the greenhouses this fungus occurred on tomatoes as well but I myself could not find it there on this plant. In the nature I collected this species on sun-flowers, on maize and on iris.

Aphyllophorales

Schizophyllum commune Fr.: Fr. - unit No. 5, on straw in rows before planting of seedlings, 23. II. 1990. Though many species of *Aphyllophorales* (mainly *Polyporales* s. l.) are reported to grow in greenhouses, at Paskov only *Schizophyllum commune* was noted. The reason is very simple: Nowadays greenhouses are constructed of only iron, concrete, and glass, instead of wood. The wastes of bark and bast strewed among rows are an acceptable substratum for lignicolous gilled fungi and some small *Gasteromycetes*, but evidently not for *Aphyllophorales. Schizophyllum commune* is an ubiquitous species growing not only on stems and branches of trees, but also on manufactured wood as parquets, boards pressed from wood-splinters, raw cellulose or old paper used as insulation in building industry, and also on plant rest as vacant spikes of maize.

Agaricales

Tricholomataceae

Clitocybe augeana (Mont.) Sacc. - units No. 6 and 8, on soil and wastes of wood, mainly under the heating tubes, solitary or in small groups, 9. II., 15. II., and 8. III. 1989; also in the unit No. 7, on the same substratum, 15. III. 1990. Fruit-bodies with the cap not over 3 - 4 cm in diam.; cap flat or slightly convex, light yellow on the top when young, becoming yellow brown in maturity. The smell of the flesh faintly farinaceous in young fruit-bodies only, smell of the old fruit-bodies was probably covered by unpleasant "greenhouse" smell observed in more species at old age. I suppose it is an effect of liquid fertilizers or other spraying and/or of water used for watering.

Clitocybe gallinacea (Scop.: Fr.) Lange - unit No. 10, on soil under the heating tubes and on the border of rows with cucumbers, 23. II., 28. II., 2. III., and 15. III. 1990; - unit No. 1, on the same substratum, 13. II. 1991. The fruit-bodies were smaller but thicker than the foregoing species, dirty white, the flesh was firmer, slightly bitter with an unpleasant musty-like smell.

Clitocybe sp. - unit No. 3, on soil among cucumber seedlings, 13. II. 1991, in Herb. J. K. A small species growing in tufts not yet identified.

Hohenbuehelia rickenii (Kühn.) Orton - unit No. 3, on waste rest of wood mixed with soil, especially under the heating tubes, not so often among the rows on remnants of bark and bast used for strewing paths; - in the units No. 6 and 8, on the same substratum very abundant, 9. III., 15. III., and 6. IV. 1989; - in the unit No. 7, on the same substratum, 15. III. 1990; - in the unit No. 2, on the same substratum but in a plantation of red pepper, solitary, 18. III. 1991. In the years 1988 and 1989 very abundant species growing in smaller or greater tufts or groups, rarely solitary. The fruit-bodies were irregulary infundibuliform, with gills decurrent on a more or less short stem. The stem was mostly excentric but sometimes nearly placed almost at center, with white rhizoids on the base. The colour of fruit-bodies was very different from light cream (exceptionally almost white), ochre, avellaneous to brown, sometimes grey, grey brown to rich grey with a whitish pruination at the centre of cap when young. The thicknes of the gelatinous layer underneath the epicutis was not easy to judge because the fruit-bodies were often very wet by watering, but it was more than 100 µm wide. The spores were (7,4 -) 7,9-9,2 (-9,5) x 4,1-5,2 (-5,5) µm great, which corresponds to what Kühner et Romagnesi call *Geopetalum rickenii* Kühner (1953) and what is also accepted by Kreisel (1987). But Ricken's spore measurements in *Pleurotus geogenius* sensu Ricken were only 5-6 x 4 µm (probably erroneously made in immature spores), Kühner and Romagnesi noted spores 6,7-7,2 x 3,7-4,5 µm, and Kreisel (1987) 5-7 x 4-5 µm. This problem and derangement was just discussed by Singer and Kuthan (1980), and a new species with spores very close to Ricken's measurements was described under to name *Hohenbuehelia recedens* Sing. et Kuthan.

Lepista sordida (Schum.: Fr.) Sing. - unit No. 6, on soil, 21. III. 1989; - unit No. 7, on the same substratum, 15. III. 1990. At Paskov only rarely occurring species.

Melanoleuca brevipes (Bull.: Fr.) Pat. - unit No. 10, on soil on the border (outside the cultures), 15. III. 1990, only 2 fruit-bodies.

Melanoleuca verrucipes (Fr. in Quél.) Sing. - unit No. 7, in an unit prepared for planting but not yet heated, on remnants of bark and bast mixed with soil, 2. III. 1990. A rare species in Czechoslovakia but found more times in the recent years in the nature (NE Moravia, NE Slovakia). It was mostly collected in old places for reloading wood in forest or sawmill stores with a higher layer of remnants and sawdust of coniferous wood.

Melanoleuca sp. - unit No. 9, on soil mixed with remnants of wood,, 22. III. 1990, leg. M. Konečná, in Herb. J. K. - not yet identified species ressembling *Melanoleuca graminicola* (Velen.) Kühn. et R. Maire, but with spores 8 - 10 µm long.

Mycena flavoalba (Fr.) Quél. - unit No. 7, in an unit prepared for planting, but, for the time being, heated only partly, on remnants of bark and bast mixed with the soil, 22. II. 1990, det. L. Kotilová-Kubičková.

Mycena leptocephala (Pers.: Fr.) Gill - unit No. 7, on the border of the unit, on soil with remnants of wood among weeds, 22. II. 1990, det. L. Kotilová-Kubičková. Fruit-bodies with distinct nitrous smell.

Entolomataceae

Clitopilus passeckerianus (Pil.) Sing. - unit No. 6, on soil of a row, 9. II. and 21. II. 1989. White shell-like fruit-bodies with only a short lateral stem or without stem, 2 - 4 cm in diam., gills at first white, later pinkish; smell of the flesh farinaceous. - This species was introduced into the cucumber plantation probably with the just applied substratum from champignon culture mixed into soil in the central soil preparation plant. Some years ago I collected the same species in an enterprise for champignons cultivation; much smaller, and partly by the absence of light, in stipe elongated fruit-bodies grew up from chinks in woody containers for cultivation.

Entoloma undatum (Gill.) Mos. ss. Bres., Favre non Lange - unit No. 8, on soil on a row with cucumbers, 16. II. 1989; - unit No. 10, on the same substratum, 8. III. 1990, in both cases only 1 fruit-body was found. Small fruit-bodies with a grey brown cap, depressed at center without farinaceous smell.

Entoloma sp. - unit No. 2, in soil among red-pepper plants, 5. III. 1991, in Herb. J. K. - A species not yet identified with habitus e.g. of *E. politum*, with slightly depressed cap on a longer stem, fresh with olive to mustard yellow colour, yellow ochre when dry.

Pluteaceae

Pluteus depauperatus Romagn. - unit No. 7, on soil with remnants of straw and wood, 23. II., 28. II., and 8. III. 1990, det. J. K. (ut *P. depauperatus*), rev. C. Vellinga ut *P. plautus* (Weinm.) Gill. - Young fruit-bodies with a white fine granular cap surface only slightly greyish on the top, in maturity greyish to light grey brown, wrinkled (non venate) on the top, and fine fibrillous-tomentous with brown grey adpresses fibrils forming partly very fine scales; the margin was striate, stem white silky with dark hairs on the extreme base only. According to Vellinga et Schreurs (1985) and Vellinga (1990) *P. depauperatus* is identical with *P. plautus* (Weinm.) Gill. In a wide conception they included up to now separated species *P. semibulbosus* (Lasch) Gill., *P. granulatus* Bres., *P. punctipes* P. D. Orton and the just mentioned *P. depauperatus* Romagn. There is no doubt that the microscopic characters are very close and, from this point of view, may allow such a conception, but the habitus and ecology of the last mentioned species are different. As my observations on fungi are based more likely on fresh fruit-bodies in the nature than on dry specimens, I prefer to be a "splitter" at this point of view, and, as will be shown, in some other cases.

Pluteus petasatus (Fr.) Gill - unit No. 5, on remnants of bark and bast mixed with soil, abundant in 1988 but not herbarized; - unit No. 6, on the same substratum, 21. II. 1989. - This species often grows on sawdust in sawmills or stores for wood.

Volvariella plumulosa (Lasch: Quél) Sing. - unit No. 7, on remnants of bark and bast mixed with soil, 2. III. 1990, 6 fruit-bodies. The cap was pure white, fine silky tomentose, the stem smooth with a grey brown volva divided in two (exceptionally in three) lobes. Vellinga (1990), probably on the base of herbarium specimens, gives this taxon to the synonymy of *Volvariella hypopithys* (Fr.) Mos. with a white or yellowish volva, a pubescent stem, and the occurrence mostly in deciduous (or mixed) forests in warmer regions. According to my observations (Kuthan 1972). *V. plumulosa* prefere environments affected by human activities and it may be regarded as synantropic.

Volvariella speciosa (Fr.) Gill. - unit No. 6, on rotten straw and soil, 11. III. 1988; - units No. 6 and 8, on the same substratum, 15. II. and 21. II. 1989; - units No. 9 and 10, on the same substratum, 15. II. and 15. III. 1990, in the time between these last dates very abundant. All the fruit-bodies collected under this name were typical with their pure white caps, humid but not slimy when young, with a rather long, pure white stem. They occurred separately or at different time than fruit-bodies of the next mentioned var. *gloiocephala*.

Volvariella speciosa (Fr.) Gill. var. *gloiocephala* (DC.: Fr.) Sing. - unit No. 9, on a row with cucumber plants on soil and rotten straw, 15. III. 1989; - unit No. 9, on the same substratum, 15. II. 1990 and here very abundant in the following 20 days. This variety did not occur in the units No. 6 and No. 8 in 1989 together with var. *speciosa*. Var. *gloiocephala* from there had the cap mostly grey and slimy when young, the fruit-bodies were more robust as well. Fruit-bodies with brown olive to pure brown cap were collected only in the unit No. 5 on soil among tomato plants, 28. II. 1990, specimens are also in BRNM. Vellinga (1990) mentioned both taxons under the name *Volvariella gloiocephala* (DC.: Fr.) Boekh. et Enderle.

Volvariella volvacea (Bull.: Fr.) Sing. - this species occurred only rarely in the unit No. 8, on straw in a row, 15. III. 1989; later also in the unit No. 9, on the same substratum, but there in rich groups, 26. IV. and 18. V. 1989. This species is also cultivated on rice straw in east and southeast Asia for food. It is very interesting that fruit-bodies of this species contain a very high level of ascorbic acid as well as some cytostatic substancies.

Volvariella taylori (Berk. et Br.) Sing. - unit No. 10, on soil with remnants of rotten straw and cow-dung, 28. III. 1990, only 1 fruit-body; - unit No. 3, on the same substratum, 5. III. 1991, 2 fruit-bodies, leg. J. Lederer. - A small species with a dark grey centre of the grey virgulate cap, with a grey brown volva, divided into more lobes. Vellinga (1990) regards this species only as a variety - var. *taylori* (Berk.) Boekhoud of *Volvariella pusilla* (Pers.: Fr.) Sing., which I cannot accept not only because of the excessive simplifying of the problem.

Agaricaceae

Agaricus bisporus (Lange) Imbach - this species was evidently introduced into the units with the applied substratum from the champignon cultivation which is mixed with soil. The fruit-bodies were observed dispersed in the units, e.g. in the unit No. 8 in 1989; in the units

No. 7 and No. 10 in 1990, all in cucumber plantations; in 1991 in the units No. 1 (with cucumbers), No. 2 (with red pepper), and No. 4 (with tomatoes). Two collections from the units No. 2, on soil among red pepper plants, 5. III. an 18. III. 1991 were herbarized.

Lepiota sp. - a small Lepiota or *Cystolepiota*, collected in soil among cucumber plants in 1989, it was sent to J. Herink, a *Lepiota* - specialist. By now without any comment.

Leucoagaricus bresadolae (Schulz.) Bon [= *Leucocoprinus bresadolae* (Schulz.) S. Wasser] - unit No. 5, on soil with remnants of straw and wastes of wood, 18. III. 1988; - unit No. 6, on the same substratum, 15. II., 28. II. (2 specimens), 22. III., and 20. IV. 1989; - in the unit No. 7, on the same substratum, 15. III. 1990. Fruit-bodies of this species occurred solitary and/or in smaller or greater tufts, the cap diam. ranged from 3 to 18 cm. I collected this species more times outside the greenhouses in Ostrava (North Moravia), in Slovakia, Roumania, and Bulgaria. The mentioned species is placed by Babos (1979), Moser (1983), Kreisel (1987) and Reid (1989, 1990) into the genus *Leucocoprinus* Pat., but by Singer (1952, 1986), Bon (1977), Candusso et Lanzoni (1990) and Krieglsteiner (1991) into the genus *Leucoagaricus* (Locq.) Sing. Reid (1990) described a new species from greenhouses: *Leucocoprinus calidarium* Reid. This species occurs only in greenhouses, rather small fruit-bodies grow in tufts, and the flesh on cut does not change, only the surface of the stem may redden when bruised, unlike *L. bresadolae*, the flesh of which becoming yellow at first, then saffron yellow, and finally red to red brown. There are only very small differences in the spore-size. According Reid *L. bresadolae* is more robust and grows solitary outside greenhouses. All my collections inside or outside greenhouses were clearly *Leucoagaricus bresadolae*.

Leucoagaricus leucothites (Witt.) S. Wasser - [= *Agaricus pudicus* Bull. 1791 p. p., = *L. pudica* (Bull.) Quél. sensu Moser, = *Agaricus leucothites* Vitt., = *Agaricus naucinus* Fr. 1836, = *Lepiota naucina* (Fr.) Kummer sensu Lange non Cooke] - unit No. 6 and No. 8, on soil in a cucumber plantation; 21. II. 1989 (2 specimens); - unit No. 9, on the same substratum, 8. II., 15. II., and 8. III. 1990, - unit No. 3 on the same substratum, 13. II. 1991. - This species is the most abundant one of the group identified as *Lepiota naucina* or *L. pudica* before. Besides greenhouses it is common in the nature and often in environments affected by human activity. After drying specimens are pure white and becoming light red brown after a longer time.

Leucoagaricus meleagris (Sow.) Sing. [= *Agaricus meleagris* Sowerby 1799, = *Lepiota meleagris* (Sow.: Fr.) Sacc., = *Leucocoprinus meleagris* (Sow.: Fr.) Locquin] - unit No. 10, on soil mixed with remnants of wood under the heating tubes, 15. III. 1989 (some smaller fruit-bodies - f. *minor*?); - unit No. 10, in the same place and substratum, 21. III. 1989, a tuft of normally developed fruit-bodies; - unit No. 10, in the same place and substratum a year later, 15. III. 1990. - Very interesting and rare species growing mostly on rotten remnants of wood and sawdust, especially in warmer climatic condition. I myself collected the species more times, about 20 years ago together with J. Veselský on a burning coal mining dump in Ostrava (North Moravia), later twice in Southern Slovakia on remnants of bark and wood from a cellulose plant at Gemerská Horka, and on sawdust in a stock of sawmill at Betliar. According to my observations *L. meleagris* grows in tufts, the gills are light lemon yellow, the scales on the cap are dark brown to black brown (almost black at centre), black brown on the stem. Flesh on cut becoming orange, after time brown to red brown, sometimes with violet tinge. Dry specimens are dirty vinaceous with exception of the fusiform base which is black. I cannot accept the opinion of Krieglsteiner (1991), although based on detailed analysis of the group of *Leucoagaricus badhamii* - *Leucoagaricus bresadolae* - *Leucoagaricus meleagris*. I accept the doubts concerning the validity of the Sowerby's name but I cannot assent to an interpretation of *L. meleagris* as a vegetation form of *L. bresadolae* only. An excellent picture of *L. meleagris* by A. Dermek can be found on the table 45a in the monography by Candusso et Lanzoni (1990).

Leucoagaricus subcretaceus Bon in Bon et Van Haluwyn [= *Leucoagaricus cretaceus* (Bull. sensu Locquin) in Moser 1983 = *Lepiota naucina* ss. Cooke non ss. Lange] - unit No. 5, on soil on the border of rows, 6. IV. 1988; - unit No. 6, on the same substratum, 27. II. and 21. III. 1989; - unit No. 8, on soil, 4. III. and 22. III. 1989; - unit No. 9, on soil, 6. III. and 30. III. 1989; - unit No. 10, on the same substratum, 10. III. 1989. - This is an another separate species from the group called earlier *Lepiota naucina* or *L. pudica*. I do not accept *Leucoagaricus pudicus* (Bull.: Quél) Bon because this combination was constituted by M. Bon on the base of only a part of depicted fruit-bodies which are in Herb. de la France IV on p. 645 under the name *Agaricus pudicus* Bull. 1791. The reason of my decision lies in the fact that some other, partly different interpretations of *A. pudicus* (e.g. Locquin, Moser) exist, and that the Bon's description has no essential differences from *Leucoagaricus leucothites* (Vitt.) S. Wasser which I consider as the oldest avaible name for the species with the flesh and surface of fruit-bodies not changing on cut or bruise. The fruit-bodies collected in the Paskov greenhouses were rather large (cap diam. up to 15 cm), with the surface of cap white to white cream, with fine white adpressed flocculose scales. The surface of fruit-bodies on bruised places and the flesh on cut are becoming red brown, dried specimens are also instantly red brown. Spores 7-9 (- 9,5) x (4,5 -) 5-6 µm large, therefore very slightly smaller than those of *L. leucothites* from the same place. In the same case no differences in basidia measurements between these two mentioned species were observed. Cheilocystidia: in *L. subcretaceus* these elements are a little slender with a large portion of capitate cheilocystidia (in addition to clavate and ventricose forms), which is not observed in *L. leucothites*. Both species *L. leucothites* and *L. subcretaceus* have white gills in young fruit-bodies, becoming pink in maturity. During my visits both were (as "champignons") picked by the workers in the greenhouses and consumed without any problems.

Leucocoprinus birnbaumii (Corda) Sing. - unit No. 5, on soil of rows with cucumbers, 15. II. 1988; - unit No. 3, on the same substratum; 13. IV. 1988; - units No. 6 and No. 8, 21. II., 27. II., 6. III., 6. IV. (2 specimens), and 13. V. 1989; - unit No. 7, on the same substratum, 15. II. 1990; - unit No. 3, on soil of the rows just prepared for planting seedlings, 13. II. 1991. A rich synonymy is mentioned in Candusso et Lanzoni (1990). This yellow and charming species occurring often at our homes on soil of the flower-pots grew in the greenhouses at Paskov (especially in 1988 and 1989) in such extensive and exuberant formations causing nearly a shock to me. Though the biomass of this species was only about a third in comparison with *Peziza vesiculosa* the light yellow colour produced the same effect as a luminiscent yellow marker in a manuscript. This fungus formed not only giant solitary fruit-bodies (with cap diam. up to 15 cm, stem to 18 cm long and to 2,5 cm broad in the ventricose part) or smaller and greater tufts but also areas of light yellow surface mycelium on soil with numerous small primordia. The scales on the cap were also very different in shape and colour. Pure yellow flaring scales, as well as adpressed yellow brown scales, could be seen on young fruit-bodies, in mature the scales were mostly brown, in some cases brown black especially on the top and on the upper part of the cap. Certainly, not all the fruit-bodies grew up from the visible primordia on the places with surface mycelium, a certain part depauperated or dried up. After the watering technology had been changed the growth of this species was reduced or almost stopped.

Leucocoprinus brebissonii (Godey in Gill.) Locq. - unit No. 6, on soil of a row with cucumbers, 6. III. 1989. Only once collected species very similar to *L. lilacinogranulosus* (Henn.) Locq., but the scales on the cap are just in youth black (not violet), and in maturity with black disk surrounded by fine black scales. A similar species *Leucocoprinus heinemannii* Migliozzi (1987) has the scales distributed on its cap without any disk, and the microscopic features are also different.

Leucocoprinus cepistipes (also *cepaestipes*) (Sow.: Fr.) Pat. - in the units No. 6 and No. 8, on soil of a row with cucumbers, 15. II., 21. II., 27. II., 6. III. (2 specimens), and 15. III. 1989 (2 specimens). In other units and/or other years the species did not occur at Paskov. I collected this species before on sawdust in Bulgaria (Kuthan et Kotlaba 1981) and Roumania and also in South Slovakia. The scales on the cap are white or light rusty not forming a disk on the cap in maturity.

Leucocoprinus cretatus Locquin ex Lanzoni 1986 - unit No. 5, on wet straw in the rows and on soil; 15. II. 1988; - units No. 6 and No. 8, abundant, 15. II., 21. II., 13. III., 30. III., 6. IV. (2 specimens), 13. IV., and 20. IV. 1989; - unit No. 10, on the same substratum, 15. III. and 31. III. 1990. A pure white species the cap of which is covered with white detersile flocci of the velum (as well as its stem in the lower part). It is necessary to collect and store the fruit-bodies in separated boxes or covers because the particles of the velum may contaminate other collections. The cap diam. of the collected fruit-bodies ranged from 3 to 15 cm.

Leucocoprinus denudatus (Rabenh.) Sing. - units No. 6 and No. 8 on soil of rows with cucumbers, always in small groups solitary or in tufts with 3 - 5 fruit-bodies, 9. II., 15. II., and 15. III. 1989; - unit No. 9, on the same substratum, 13. II. and 15. III. 1991. The fruit-bodies of this species were the smallest ones from the noted species of *Leucocoprinus*, with the cap over 2 cm in diam., white yellow, membranaceous with a yellow disk.

Leucocoprinus lilacinogranulosus (Henn.) Locq. - units No. 6 and No. 8, on soil of rows or outside rows, 9. II., 15. II., 17. II., 10. III., and 15. III. 1989. The cap of young fruit-bodies (when closed) is in the upper part covered with very fine violet scales. In maturity these violet to brown violet scales are located only around the violet brown disk at the center of cap, lower part and margin are white, membranaceous, and fine striate. Some very old fruit-bodies are often similar to *L. brebissonii*, but the scales of our species are never pure black. - Some years ago a case of poisoning by crude fruit-bodies occurred in Ostrava. Young girls-workers in a horticulture with some greenhouses in Ostrava - chewed or bit (evidently by silliness) crude fruit-bodies of this fungus which occurred in a plantation. According to my deceased friend J. Veselský, med. doctor, this species caused sickness and vomiting in more cases, but without any later consequences.

Leucocoprinus sp. - unit No. 8, on soil of a cucumber row; 10. III. 1990, two fruit-bodies of a *Leucocoprinus* sp., near to *L. cepistipes* but with a distinc rusty disk on the top of the cap, not yet identified. In Herb. J. K.

Macrolepiota bohemica (Wich.) Krieglst. et Pázmany [= *Macrolepiota rhacodes* (Vitt.) Sing. var. *hortensis* Pil.] - unit No. 5, in a plantation of flowers (*Freesia*) on soil, 15. III. 1990. In this unit especially carnations were cultivated, but in 4 sections (10%) *Freesia* sp., therefore this unit was heated in a lower temperature (16 - 18°C). Just some years ago I received this species from a greenhouse at Palkovice (North Moravia) where it was abundant in a cultivation of *Asparagus plumosus*, it is also abundant in *Robinia* forests on sandy soil in the Danube Lowland (Southern Slovakia). On both localities it was picked and eaten by the local population without any health difficulties. The fruit-bodies from the hot and dry climat of the Danube Lowland were often a little different from those growing in greenhouses or on fertilized soil in gardens. They differed by colour and by features of scales on the cap, mainly at center where, in many cases, dark brown black, irregular areas were present partly splitted into strips or broad flat scales to the margin. I do emphasize this fact because a very similar species - *Macrolepiota venenata* (Jacob ex) Bon in Bon, Vallée et Jacob (1979) - was described but, in contradiction with my experience with *M.*

bohemica, this last mentioned species might be poisonous and provoke more or less serious poisonings accompanied with diarrhoea and vomiting. I have never collected *M. venenata* in my life but considering habitus and ecology of this species and *M. bohemica* I cannot be sure now which species I have actually had in my hands. They are some small differencies, e.g. presence of clamp-connections on hyphae in *M. bohemica* (but they are very uneasy to find) while they are fully absent in *M. venenata*, and the occurrence on pastures with cow-dung (locality of the typus of *M. venenata*), which is not typical locality for *M. hortensis.* Kreisel (1987) also mentioned *M. venenata* from greenhouses or from ruderal localities with nitrophilous plants as *Urtica, Chenopodium* etc., which is also normal ecology for *M. bohemica.* Microscopic features are nearly the same in both species. The close related species *M. rhacodes* (or *M. rachodes* according Kreisel 1987) also caused, in some sporadic cases, light poisonings with diarrhoea and vomiting, especially when food is insufficiently heated (e.g. wiener steak). Therefore I am nearly sure the differences between *M. bohemica* and *M. venenata* are probably speculative only.

Coprinaceae

During the years 1988 - 1990 I collected 75 specimens of *Coprinus* under different conditions of plantation technology. The quantity of specimens collected during each of about 45 visits in the greenhouses at Paskov allowed me making only short descriptions, notes or drawings of *Coprinus* species, but I was able to identify, although with doubts, 7 species only. Therefore, on Mr. Enderle's (GFR) advice, I sent most material to Mr. Hans Bender, Mönchengladbach, GFR, for determination and/or revision. Thanks to his kindness it was possible to identify 16 different species in my material, 1 species could not be identified, it might (according to H. Bender) probably be a new taxon. He also confirmed my determinations although not in all cases. It was impossible to identify 3 specimens of *Coprinus* sp., forming sterile vitreous, colourless or light pink fruit-bodies. They did not produced normal spores although autolysing in maturity. Only very few spore-like hyaline elements were observed.

Coprinus callinus M. Lange et A. H. Smith - unit No. 10, on soil with bits of insufficiently distributed cow-dung, 8. III. and 28. III. 1990, det. H. Bender.

Coprinus cinereus (Schaeff.: Fr.) S. F. Gray - unit No. 10, on soil in cucumber plantation, 16. III. 1988, det. J. K.; - unit No. 6 and No. 8, on the same substratum, 15. II. 1989, det. J. K., 31. III. 1989, det. J. K., rev. H. Bender; - unit No. 9, on the same substratum, 28. III. 1990, det. H. Bender.

Coprinus cothurnatus Godey ap. Gill. - units No. 6 and No. 8, on soil and on rotten straw of the "Multsch" base in cucumber plantation, 27. II., 10. III., and 22. III. 1989, det. J. K.; - in the same units, 9. II., 15. II., 15. III., and 13. IV. 1989, det. H. Bender; - unit No. 7, on soil with cow dung rich in straw, 6. III., 15. III., and 31. III. 1990, det. H. Bender.

Coprinus flocculosus (DC.) Fr. - unit No. 3, on soil among cucumber plants, 16. II., and 10. III. 1988, det. H. Bender; - units No. 6 and No. 8, on the same substratum, 24. I., 3. II., and 27. II. 1989, det. J. K.; - in the same units, on the same substratum, 6. III. (2 specimens), 15. III., 22. III., and 31. III. 1989, det. H. Bender; - unit No. 10, on soil, 6. IV. 1989, det. H. Bender; - units No. 9 and No. 10, on soil with cow-dung, 9. II., 8. III., 10. III., 15. III., and 28. III. 1990, det. H. Bender. An abundant but under the greenhouse conditions a very versiform species, especially in form, colour, and distribution of velum rests on the cap. Therefore the identification was not easy in every cases, especially for me.

Coprinus friesii Quél. - unit No. 5, on straw in the "Multsch" base of the rows with cucumbers, 16. II. and 10. III. 1988, det. H. Bender; - unit No. 6, on the same substratum, 6. III. 1989, det. H. Bender; - unit No. 9, on straw with cow-dung (manure), 28. II. 1990, det. J. K. with help of comparative material of the former by H. Bender determined specimens.

Coprinus heterocomus Malençon - unit No. 10, on soil, 15. III., and 28. III. 1990, det. H. Bender.

Coprinus lagopus (Fr.) Fr. - unit No. 10, on soil of the row with cucumbers, 20. IV. 1989, det. J. K.; - unit No. 10, on soil with cow-dung, 15. III. and 22. III. 1990, det. H. Bender.

Coprinus macrocephalus (Berk.) Berk. - unit No. 6 and No. 8, on soil of a row, 22. III. and 31. III. 1989, det. H. Bender.

Coprinus marculentus Britz. (= *C. hexagonosporus* Joss.) - unit No. 5, on soil of a row with cucumbers, 9. II. 1988, det. J. K.; - in the same place and substratum, 16. III. 1988, det. H. Bender; - units No. 6 and No. 8, on soil with rotten straw; 18. I., 15. II., and 6. IV. 1989, det. J. K.; - on the same place and substratum, 30. I., 9. II. 1989, det. H. Bender; - unit No. 10, on soil with manure, 9. II., 16. II., and 28. III. 1990, det. H. Bender. I have collected this species with a certain nostalgy because under the name *Coprinus hexagonosporus* Joss. I published my first mycological contribution (Kuthan 1966) in a paper 26 years ago. I collected this species on a insufficiently fermented substratum of champignon culture in exploited rooms of a coal mine at Ostrava.

Coprinus megaspermus Orton - unit No. 9, on soil among fruit-bodies of *Peziza vesiculosa*, 8. III., and 22. III. 1990, det. H. Bender; the first specimen in BRNM, the second one in Herb. H. Bender.

Coprinus patouillardii Quél. - unit No. 8, on soil with manure, 9. II. and 28. II. 1990, det. H. Bender.

Coprinus phaeosporus Karst. - unit No. 10, on soil, 31. III. 1989, det. H. Bender.

Coprinus radiatus (Bolt.) Fr. - unit No. 10, on soil with manure, 22. III. and 28. III. 1990, det. H. Bender.

Coprinus sclerocystidiatus M. Lange et A. H. Smith - unit No. 8, on soil of a row with cucumbers, 26. IV. 1989, det H. Bender; - unit No. 9, on the same substratum, 28. III. 1990, det H. Bender.

Coprinus urticaecola (Berk. et Br.) Buller - unit No. 5, on straw of a "Multsch" base, 4. III. 1988, det. J. K.; - unit No. 3, on the same substratum, 4. III. 1988, det. H. Bender; - unit No. 6 and No. 8, on the same substratum very abundantly, 15. II. and 15. III. 1989, det H. Bender; - unit No. 9, on the same substratum, 22. III. 1990, det. H. Bender. In 1989 a greater part of straw sticking out of the rows was covered with small fruit-bodies or primordia (like small whitish grains) of this *Coprinus* species. For taking better photographs as well as for other studies it was very usefull to cultivate these fruit-bodies at home in a wet box.

Coprinus aff. *pseudoradiatus* Kühn. et Joss. - unit No. 8, on soil; 10. III. 1989; det H. Bender with a caution of not quite sure identification. Specimen in Herb. J. K.

Coprinus sp. - unit No. 6, on soil of a row with cucumbers, 31. III. 1989, not yet identified, in Herb. H. Bender.

Panaeolus subbalteatus (Berk. et Br.) Sacc. - unit No. 5, on soil of rows with cucumbers, 16. II. and 4. III. 1988, det. J. Herink; units No. 6 and No. 8, on the same substratum, 15. II., 6. III., 15. III., 31. III., and 9. IV. 1989, det. J. K.; - units No. 9 and No. 10, 23. II., 28. II., 2. III., 8. III., 15. III., and 23. III. 1990, det. J. K.; - unit No. 3, on soil, 5. III. and 18. III. 1991, det. J. K. This very abundant species mainly in 1988 - 1990 caused some difficulties in the determination, because the relatively persistent fruit-bodies were substantially changing during the growth. The darker red brown hydrophanous strip on the marginal part of the cap disappeared mainly during maturity and the nearly flat cap was coloured light brown, dark brown, white grey to silver grey or nearly white even in the same species. I cannot say whether it was caused by different conditions when the units were heated and watered; there is no doubt that we probably cannot find such a scale of cap colours in this species in the nature because the fruit-bodies have not so much chance to persist there.

Psathyrella albidula (Romagn.) Mos. - unit No. 3, on rotten straw on the base of rows, 4. III. 1988. Only once collected in the greenhouses at Paskov. A small light ochre to creamy white species.

Psathyrella atomata (Fr.) Quél. - unit No. 6 and No. 8, on soil mixed with remnants of bark and bast, 15. II. and 6. III. 1989, - units No. 10, on the same substratum, 2. III. 1990. It is a species similar to the above mentioned one but with a cap brown when moist, light grey brown when drying, also spores larger than those in *P. albidula*.

Psathyrella marcescibilis (Britz.) Sing. - unit No. 9, on soil of a row with cucumbers,

28. II. 1990. A smaller light brown and very fragile species growing in tufts, with rests of a white velum on the margin of cap.

Psathyrella prona (Fr.) Gill. f. *prona* - units No. 6 and No. 8, on soil of a row with cucumbers, 10. III. and 15. IV. 1989; - unit No. 7, on the same substratum, 28. II. and 2. III. 1990. A small species with grey brown colour and a conspicuously striate cap.

Psathyrella prona (Fr.) Gill. f. *cana* Kits van Waveren - unit No. 10, on soil of a row, 28. II. 1990; - unit No. 3, on the same substratum, 5. III. 1991, leg. J. Lederer, both collections det. J. K. In contradiction with f. *prona* this form has a light grey to grey cap sometimes with pink tinge, covered with fine glimmering grains. The margin of a little more semiglobose cap is translucent striate.

Bolbitiaceae

In the family *Bolbitiaceae*, like in the genus *Coprinus*, I asked for help with revision and determination (especially in the genus *Conocybe*) Dr. Roy Watling from Royal Botanic Gardens, Edinburgh. Only thanks to him it was possible to identify a number of rare and interesting species of this family.

Agrocybe gibberosa (Fr.) Fayod - unit No. 10, on soil before planting seedlings, 13. IV. 1989, det. R. Watling. This species is not often mentioned in the common mycological literature and its position is close to *A. praecox*. The spores of *A. gibberosa* are smaller than those of the last mentioned species, the colour of the cap is darker brown and the gills have a vinaceous tinge. The partial veil does not form a coherent ring on the stem but is much thiner, forming irregular fragments and later a ring zone only.

Agrocybe molesta (Lasch) Sing. [=*Agrocybe dura (*Bolt.: Fr.) Sing.] - unit No. 9, on soil in cucumber plantation, 6. IV. 1989, det. J. K., rev. R. Watling. This species often occurs in gardens, hotbeds, and on humous soil. In the greenhouses at Paskov it was found only once.

Agrocybe praecox (Pers.: Fr.) Fayod - in the units No. 6 and No. 8, on soil in cucumbers rows, 20. IV. and 26. IV. 1989, det. J. K., rev. R. Watling; - unit No. 7, on the same substratum, 9. II. 1990, det. J. K.

Agrocybe pediades (Fr.) Fayod - units No. 8 and No. 10, on soil of the rows with cucumbers, 10. II. and 27. II. 1989, det. R. Watling; - unit No. 9, on the same substratum, 9. II. 1990 and 28. II. 1990, both det. R. Watling.

Agrocybe temulenta (Fr.) Sing. - unit No. 8, on soil of a row, 27. II. 1989, det. R. Watling; - unit No. 9, on the same substratum, 8. II. and 15. II. 1990, det. R. Watling. This insufficiently known species from the vicinity of *A. semiorbicularis* differs from the last mentioned species by a darker and more plano-convex cap, by presence of velum forming tomentous rests on the margin of cap and similar, not coherent ring zone on the stem when young. Gills in maturity may have a vinaceous tinge. Basidia 2-, 3-, and 4-spored, therefore the size of spores is very different in dependence on the type of basidia the spores have grown from.

Bolbitius coprophilus (Peck) Hongo - units No. 6 and No. 8, on soil and rotten straw in rows, 21. I., 15. II., 22. II., 15. III., and 22. III. 1989, det. J. K., rev. R. Watling; - units No. 9 and No. 10, on the same substratum, 15. II., 23. II., 28. II., and 15. III. 1990, det. J. K., rev. R. Watling. According to M. Svrček (in litt., 31. III. 1989) this is the first record from Czechoslovakia. Specimen No. 576620 in PRM noted by R. Watling as *Bolbitius* aff. *coprophilus* during his revision of *Bolbitiaceae* in this herbarium was not collected in Czechoslovakia and belongs to the collection of Fungi exs. suecici No. 2725 by Lundell and Nannfeld. Watling (1982) noted that only one collection is known from Great Britain, and that this species is rather common in greenhouses in the Netherlands. It is also mentioned from GFR - West by Krieglsteiner (1983), and by Enderle, Kajan et Krieglsteiner (1985); a collection noted by R. Fellner (in litt.) from the vicinity of Prague (ČSFR) is not proved by a specimen. This very nice and charming fungus was not found anymore in 1991 for the change in the plantation technology. The thin fleshy cap is narrowly parabolic in youth, broadly parabolic to campanulate later, and plane in maturity, located on a very slender stem. The cap colour is at first light ochre to creamy with a pink tinge on the top, the cap being white with an eosin red centre in maturity, sometimes a larger part of the cap (to a half of the cap diam.) is also in this colour and stem is also pink to eosin red. In fruit-bodies growing in groups the surface of caps is often coloured by mature spores of the nearby fruit-bodies. A fully pink red coloured fruit-body, as it can be seen on the photograph by H. Bender in Krieglsteiner (1983), have never been observed at Paskov.

Bolbitius lacteus Lange - unit No. 10, on soil of a cucumber row, 6. IV. 1989 (3 fruit-bodies only), det. J. K., rev. R. Watling. A sole collection of this rare, pure white species from the greenhouses at Paskov. The cap of this species is relatively small, spores are smaller (shorter) than in *B. coprophilus*.

Bolbitius variicolor Atk. - units No. 6 and No. 8, on soil, 3. II., 9. II., and 10. III. 1989, det. J. K., rev. R. Watling; - unit No. 7, on rotten straw of rows ("Multsch"), 15. II. and 22. II. 1990, det. J. K., rev. R. Watling. This species occurred less frequently than *B. vitellinus* and *B. coprophilus*. It was mentioned from Hungary (Babos 1980), Switzerland and Italy (Moser 1983), Austria (Hausknecht et Rücker 1989), GFR (Krieglsteiner 1983; Enderle, Kajan et Krieglsteiner 1985), Great Britain (Watling 1982). In the Herbarium PRM, according to M. Svrček (in litt.), two specimens belonging to this species are present: namely PRM 6389 (ad excrementum equinum, 7. VIII. 1942, leg. et det. J. Herink ut *Bolbitius vitellinus* f. *olivascens* Herink in herb., rev. R. Watling ut *B. variicolor*) and PRM 614829(Jindřichův Hradec, on wastes of flax processing, 19. V. 1963, leg. et det. J.

Kubička, ut *B. vitellinus* f. *griseo-olivacea* Kubička in herb., rev. R. Watling ut *B.* aff. *variicolor* Atk.). Entz and Sedláček (1990), too, reported an occurrence of the species in North Bohemia on straw in a cultivation unit of *Pleurotus ostreatus*. Recently Krieglsteiner (1991) has regarded this species as a variety of *B. vitellinus* only. I do not accept this opinion at the present time.

Bolbitius vitellinus (Pers.: Fr.) Fr. - the most common species of *Bolbitius* in greenhouses at Paskov. - units No. 6 and No. 8, on rotten straw of rows, 30. I., 3. II., and 15. III. 1989, det. J. K. (specimens from 3. II. 1989 rev. by R. Watling); - units No. 9 and No. 10, on the same substratum, 20. II., 28. II., and 8. III. 1990, det. J. K., all in BRNM. Of all of the *Bolbitius* sp. this was the first to occur and the first to disappear.

Conocybe aurea (J. Schaeff.) Hongo - unit No. 10, on soil of a row with cucumbers, 22. III. 1989, det. R. Watling; unit No. 9, on the same substratum, 15. II. and 28. II. 1990, det. R. Watling; - unit No. 3, on soil; 5. III. 1991; det. J. K. *Conocybe aurea* is more mustard yellow coloured on the cap and is more slender than the near relative species *C. macrocephala*. The size of basidiospores (according to R. Watling with slightly rugulous surface under scannig microscope) and a shape of caulocystidia are also different in these two species.

Conocybe farinacea Watling - unit No. 10, on soil of a row with cucumbers, 15. II. 1990, det. R. Watling. The surface of stem in this species is covered with ellipsoid, mucronate filamentous cells and lecythiform elements. Only once noted species.

Conocybe fuscimarginata (Murrill) Sing. - unit No. 8, on soil in cucumber plantation, 6. IV. 1989, det. R. Watling. This species belongs to the group of *Conocybe siliginea* together with *C. rickenii*, both were also collected at Paskov. *C. fuscimarginata* differs mainly by the presence of 4-spored basidia, by a smaller size of spores, and by a pink tinge of ochre to cinnamon brown cap.

Conocybe huijsmanii Watling - unit No. 8, on soil among cucumber seedlings, 15. III. and 6. IV. 1989, det. R. Wattling; - unit No. 10, on the same substratum; 14. IV. 1989, det. R. Watling. *C. huijsmanii* is a conspicuous species with a pure white, convex and mammiform cap.

Conocybe intrusa (Peck) Sing. - units No. 6 and No. 8, on soil in cucumber plantations, 31. III. and 6. IV. 1989, det. J. K., rev. R. Watling; - unit No. 7, on the same substratum, 15. II. 1990, det. R. Watling; unit No. 2, on soil in a plantation of red pepper (*Capsicum*), 5. III. 1991, leg. J. Lederer, det. J. K. A very conspicuous species, fairly strongly resembling more a *Hebeloma* sp. than a *Conocybe*. Fruit-bodies collected on 15. II. 1990 were more slender than in all other collections.

Conocybe kuehneriana Sing. - units No. 9 and No. 10, on soil in a cucumber plantation, 2. II., 21. III., 28. III., and 6. IV. 1990, det. R. Watling; - unit No. 2, on soil in a plantation of red pepper, 13. II. 1991, det. J. K. The specimen No. 90/322 collected on 21. III. 1990 has, according to R. Watling, slightly smaller and lighter coloured spores as they usually are in this species, therefore he noted it as *Conocybe* aff. *kuehneriana*.

Conocybe lactea (Lange) Métrod - unit No. 8, mainly on the border of the unit (lower temperature!), 22. III. and 6. IV. 1989, det. J. K.; - unit No. 7, on the same substratum, 6. IV. 1990, det. R. Watling; - unit No. 4, on soil among tomato seedlings, 5. III. 1991, det. J. K. - I collected this species more times before in the nature, but the determination is not without problems. R. Watling (in litt.) mentioned about the specimens No. 89/62 (-unit No. 8, 22. III. 1989); No. 90/358 (-unit No. 7, 6. IV. 1990); No. 90/323 (-the same unit, 21. III. 1990); and No. 90/359, (-the same unit, 6. IV. 1990) the following: "All are the same taxon with broad basidiospores very much like *C. lactea*, and hairs with lecythiform cystidia on the stem. The almost versiform spores (except for 89/62) are characteristic of what I know as *C. lactea* and they may just represent a variant of that or even simply a glasshouse expression. There is a *Conocybe* originally described as *Bolbitius conocephalus* by Cooke and later *B. niveus* by Massee from palm house at Kew. It is a true *Conocybe* judging from the cheilocystidia and needs to be considered in any discussion on *C. lactea*. *Bolbitius tener* is different as it is small and has lecythiform caulocystidia, in fact I do not think sect. *Candidae* is sustainable. I think a very interesting study be carried out by describing all the individual populations of these pale capped species and making an accurate comparison."

Conocybe macrocephala (Kühner ex) Kühner et Watling - units No. 6 and No. 8, on soil in a cucumber plantation, frequent, 22. III. 1989, det. J. K.; - unit No. 9, on soil, 29. II. 1989, det. J. K., rev. R. Watling. This species is very similar to *C. aurea* but the fruit-bodies have mostly a much shorter stem and a more campanulate and larger (up to 4 cm in diam.) cap.

Conocybe percincta P. D. Orton [= *Pholiotina percincta* (Orton) Bon = *P. teneroides* (Lange) Sing. sensu Moser] - unit No. 7, on soil, 8. III. 1990, det. R. Watling. This record had according to R. Watling a greater percentage of 4-spored basidia than he had ever seen in this species.

Conocybe rickenii (J. Schaeff.) Kühner - unit No. 7, on bits of not well dispersed cow-dung in rows with cucumbers, 2. II. 1990, det. R. Watling. From the next mentioned species (with 2-spored basidia as well) *C. rickenii* differs by thick-walled spores, by the coprophilousity, an ochraceous cap, and by other features. A very similar to *C. rickenii* is *C. fuscimarginata* (also recorded in the greenhouses at Paskov), but it has 4-spored basidia.

Conocybe siliginea (Fr.: Fr.) Kühner - unit No. 10, on soil of a row with cucumbers, 15. III. 1989, det. R. Watling; - unit No. 7, on the same substratum, a small tuft of fruit-bodies, 21. III. 1990, det. R. Watling.

Strophariaceae

Hypholoma fasciculare (Huds.: Fr.) Kummer - unit No. 6 and No. 8, on remnants of wood, bark and bast between the rows, 21. II. 1989; - unit No. 10, on the same substratum, 15. III. 1990.

Pholiota gummosa (Lasch) Sing. - unit No. 9, on the soil with remnants of wood, on the border ot the unit, 10. III. 1989.

Pholiota lucifera (Lasch) Quél. - unit No. 9, on soil with remnants of wood, bark and bast on the border of the unit (lower temperature!), 23. II. 1990. As just mentioned before *Pholiota lenta* (Pers.: Fr.) Sing. has also been found outside the greenhouses, but this species has never been found inside the units although the substratum was the same: remnants of wood, bark and bast from the cellulose plant. The reason was probably the higher temperature and humidity inside the units.

Psilocybe merdaria (Fr.) Ricken - unit No. 1, on bits of insufficiently distributed cow-dung in a cucumber plantation, 18. III. 1991.

Psilocybe montana (Pers.: Fr.) Kummer - unit No. 6 and No. 8, on soil on the border of the unit in moss *Funaria hygrometrica*, 9. IV. 1989.

Psilocybe physaloides (Bull: Fr.) P. Karst. - unit No. 6 and No. 8, on soil of a row with cucumbers, 15. III. 1989; - unit No. 10, on the same substratum but the soil was richer in cow-dung, 28. III. 1990. This species occurred in smaller tufts, the cap (diam. up to 2 cm) was brown, relatively dry and striate on the margin. No velum rests were found on the cap, spores were rather thick-walled, nearly ellipsoid, 6-7 x 4-5 µm, gills red brown when old.

Stropharia coronilla (Bull.: Fr.) Quél. - unit No. 4, on soil among tomato seedlings, 5. III. 1991.

Stropharia rugosoannulata Farlow - units No. 9 and No. 10, on straw on the base of the rows, 8. II., 23. II., and 2. III. 1990; - unit No. 1, only in one section where more straw was applied for the rows, on the same substratum, 13. II. 1991. This edible fungus is often cultivated in Czechoslovakia and GFR, mainly in small private gardens on partly fermented straw. Two forms were observed here, one with a red brown to vinaceous cap (''Vinetou"), and the other with a creamy to straw yellow cap (''Giant''). All the fruit-bodies found occasionally in the greenhouses (with only some exceptions) were of the red brown type, with a cap diam. up to 20 cm and they were intensively collected by the greenhouse workers for meal.

Galerina sp. (*G. calidarium* nom. prov.) - unit No. 7, on remnants of coniferous wood in soil, 10. III. 1989, specimen sent to M. Svrček for determination; - unit No. 9, on the same substratum, 2. III. 1990; - units No. 1 and No. 3, on the same substratum, 13. II. and 5. III. 1991, all in Herb. J. K. This may probably be a new *Galerina* sp. according to M. Svrček (in litt.), a specimen was also sent to R. Watling, for him, too, this *Galerina* is unknown.

He noted in his letter: "the combination of small calyptrate spores, lack of pleurocystidia, and naucorioid stature with slightly deccurent gills is unique, I think. Kees Bas, Leiden, may be able to offer a suggestion." I used this last recommandation without any answer but I will do my best for a solution. An another specimen suggested as *Pholiotina* sp. (No. 89/74, - unit No. 6, 10. III. 1989, on soil) was declared by R. Watling as a *Galerina* sp. but probably not identical with the species noted before.

Gymnopilus penetrans (Fr.: Fr.) Murrill - unit No. 6, on remnants of wood, bark and bast on the border of the unit, 9. II. 1989.

Gasteromycetes

Crucibulum laeve (Huds.) Kambly - unit No. 8, on remnants of wood and bark on the border of the unit, 15. III. 1989.

Cyathus olla (Batsch) Pers. - units No. 6 and No. 8, on remnants of wood and bark in moss *Funaria hygrometrica*, 6. IV. and 13. V. 1989; - unit No. 10, on the same substratum, 28. II. 1990.

Sphaerobolus stellatus Tode: Pers. - unit No. 6, on a piece of coniferous wood in soil of a row, 6. IV. 1989; - unit No. 9, on rotten straw of rows in more places, 23. II. and 2. III. 1990.

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New or less known Discomycetes. XXII.
Nové nebo méně známé diskomycety. XXII.

Mirko Svrček

Seven new species of Discomycetes according to the material collected in Czechoslovakia are described: *Calycellina chalarae, Chlorosplenium hyperici-maculati, Cistella citrinescens, Hymenoscyphus caeruleo-annulatus, Hymenoscyphus sclerotigerus, Incrupilella carpini* and *Orbilia aranea.*

Je popsáno sedm nových druhů z Československa: *Calycellina chalarae, Chlorosplenium hyperici-maculati, Cistella citrinescens, Hymenoscyphus caeruleo-annulatus, Hymenoscyphus sclerotigerus, Incrupilella carpini* a *Orbilia aranea.*

Calycellina chalarae sp. nov.

Apothecia 0.5 - 1 µm diam., solitaria inter conidiophora hyphomyceti *Chalara cylindrosperma* ab initio in superficie folii, late sessilia, albida, pallida, tinctu fusco vel cinereo, disco subplano, sicco albido vel pallide luteolo, margine extusque subtiliter puberula, subnuda. Excipulum parte basali cellulis usque ad 14 µm latis, subglobosis vel angulato-globosis, luteolis, tenuiter vel parum incrassato-tunicatis, marginem versus elongatis, angulatis, minoribus (6 - 7 µm latis), cellulis superficialibus indumenti breviter lageniformibus vel conico-angustatis, 12 - 15 x 3 - 5 µm, hyalinis, tenuiter tunicatis. Asci 40 - 50 x 5 - 6 µm, oblongo-clavati, deorsum sensim crasse stipitati, basi interdum subfurcati, apice angustati, poro amyloideo, 8-spori. Paraphyses filiformes, 1.5 - 2.5 µm crassae, apice rectae, non dilatatae, obtusae, ascos non superantes, hyalinae. Ascosporae 8 - 10 x 1.5 - 2 µm, anguste fusiformes polis angustatis usque attenuatis, latere uno applanatae, rectae vel subcurvatae, eguttulatae, hyalinae.

Habitat ad paginam inferiorem folii emortui deiecti *Betulae pendulae.*

Bohemia centralis: Nemiž prope Vlašim (distr. Benešov ap. Pragam), in fruticeto *Juniperi communis* areae tutae „Na ostrově'', 27. IX. 1981 leg. M. Svrček (holotypus PRM).

The minute apothecia of this discomycete occur in small groups on fallen leaf amongst conidiophores of dematiaceous hyphomycete *Chalara cylindrosperma* (Corda) Hughes, and are distinctive from other foliicolous *Calycellina*-species by light-yellowish excipulum without the dark coloured basal ring. M. B. Ellis (1971), T. R. Nag Raj and B. Kendrick (1975) recorded *Chalara cylindrosperma* as a polyphagous fungus on dead wood, beech cupules, dead leaves and herbs. *Calycellina chalarae* was published by me as „nomen nudum'' in a paper on the fungus flora of the nature reserve „Na ostrově'' (Svrček 1982), where *Juniperus communis* is a dominant shrub. *Calycellina populina* (Fuckel) Höhn. on fallen leaves of deciduous trees (typically on *Populus)* with a dark brown or blackish basal ring, sometimes very prominent, and only rarely not well developed, has similar superficial cells (Dennis 1956). *Hyaloscypha puberula* ss. Cooke (non Lasch), mentioned by Dennis

(1956) has also a dark brown basal ring and resembles *Calycellina populina*, but is much hairier (on leaves of *Quercus*). The material collected by me is scarce but this foliicolous discomycete cannot be identified with similar species, and especially its relationship to *Chalara cylindrosperma* should be further observed.

Chlorosplenium hyperici-maculati sp. nov.

Apothecia 0.8 - 1.5 µm diam., solitaria vel 2 - 3 aggregata, firme subcanosa, patella-ria, mox explanata, subtus breviter stipitata (stipite 0.4 - 0.8 µm longo), basi attenuata, tota conspecte pulchreque viridia, disco saturate viridi facie velutino, extus concolor atque subtiliter fibrillosa. Excipulum obscure viride, textura porrecta, cellulis omnibus tenuiter tunicatis, angulatis, in seriebus ordinatis, usque ad 13 x 6 µm magnis, parte basali subisodiametricis, plus minusve angulatis, usque ad 8 µm diam., hyalinis, hyphis marginalibus cylindraceis, 50 - 60 µm longis, 2.5 - 3.5 µm crassis, apice obtusis, septatis, minute granuloso-incrassatis vel sublaevibus, hyalinis. Superficies excipuli hyphis longis, 1.5 - 3 µm crassis, nudis vel subtiliter granuloso-incrustatis, hyalinis, in strato pallide viridibus tecta. Asci 50 - 60 x 6 - 8 µm, oblongo-clavati vel clavate-cylindracei, basi breviter vel longius attenuati, apice obtusi, poro minuto (0.8 - 1 µm diam.) inamyloideo, sed post vi solutionis 10% KOH amyloideo vel subamyloideo, 8-spori, sporis partim distichis. Paraphyses 2.5 - 3 µm crassae, apice non dilatatae, obtusae, rectae, hyalinae, ascis aequilongae vel parum longiores. Ascosporae 8 - 10 x 2.5 - 3 µm, oblongae, inaequilaterales, polis obtusis, guttulis binis minutis polaribus instructae, sed etiam eguttulatae, hyalinae.

Habitat and caules emortuos deiectos *Hyperici maculati* Cr.

Slovacia: montes Belianské Tatry, Tatranská Kotlina, in convalle „Kotlina Siedmich prameňov" (=Holubyho dolina), in declivitate montis Bujači vrch (1950 m s. m.), loco „Lavinový žlab", 1900 m s. m., 5. X. 1958 leg. J. Kubička et M. Svrček (BT no. 965; holotypus PRM).

The beautiful colour of this discomycete is conspicuously deep green in all outer parts of apothecia, the disc has an almost velvety appearance. The only one herbicolous species of *Chlorosplenium* Fr., *Ch. aeruginellum* (Karst.) Karst. is very close; it is occurring on rotting stems of *Filipendula ulmaria* which are blue-green stained. It is a very rare species found also by me in Southern Bohemia. No green colour of *Hypericum* - stems has been observed. In spite of the intensive research with a view to the discomycetes on *Hypericum* spp. in our country, this *Chlorosplenium* was not more found.

Cistella citrinescens Velenovský in Svrček, sp. nov.

Apothecia 0.5 - 1 µm diam., dense gregaria, sessilia, patellaria, dein explanata, margine saepe flexuosa, viva niveo-alba, pellucida, sed vulnerata cito citrino-lutescentia denique rubrobrunnescentia, extus margineque subtiliter pruinoso-granulosa. E disco apothecia nova minuta copiose proliferunt. Excipulum textura angularis usque prismatica cellulis angulatis, hyalinis, margine extusque pilis numerosis 10 - 20 x 2.5 - 6 µm, cylindraceis vel oblongo-clavatis, 0-2-septatis, hyalinis, tenuiter tunicatis, cellula terminali minutissime dense granulato-incrustata tectum. Asci (25-) 30 - 35 x 4-5 µm, breviter clavati, apice obtusi, deorsum sensim crasse attenuati, 8-spori, poro amyloideo. Paraphyses 2 - 2,5 µm crassae, apice rectae, obtusae, non dilatatae, hyalinae ascos non superantes. Ascosporae 4 - 5 x 1.5 - 1.8 µm, fusoideae, uno latere applanatae, rectae, basi attenuatae, eguttulatae, hyalinae.

Habitat ad lignum putridum (? *Pinus* sp.) tabulae deiectae.

Bohemia centralis: Praha-Nové Město, in horto botanico Universitatis Carolinae, 11. XI. 1922 leg. J. Velenovský (holotypus PRM 149504).

This species, collected by J. Velenovský on pine board in Botanical Garden at Prague and described by him in his manuscript-notes only as *Pezizella citrinescens* sp. n., but not published, is preserved in the herbarium PRM. I completed the original description by some microscopical features according to the holotypus. This is a true *Cistella* remarkable by the change of colour when fresh.

Hymenoscyphus caeruleo-annulatus sp. nov.

Apothecia (sicca) 1 - 1.5 µm diam., sparse gregaria, cyathiformia, breviter crasseque stipitata (0.3 - 0.4 µm), stipite cylindraceo, pallide luteola, disco luteola vel pallide brunneolo, margine subflexuoso tinctu brunneo, acuto, extus nuda, laevia, interdum subalbida, stipite cylindraceo radium thecii breviori (plerumque 0.5 µm), deorsum brunneola, basi obscure brunnea usque nigrella, hyphis ferrugineo-flavis substrato coniuncta. Apothecia in aqua humectata tota subalba vel albida apparet. Superficies stipitis atque excipuli inferiori distincte griseocaeruleo-colorata est. Excipulum textura prismatica, parte basali cellulis angulatis, usque ad 25 x 18 µm magnis, marginem versus elongatis angustioribusque (22 x 5 µm), tenuiter tunicatis, hyalinis, hyphae marginales paraphysiformes, dense continuae, 70 - 150 µm longae, guttulis parvis impletae. Hyphae myceliales parte basali excipuli hyalinae, tenuiter tunicatae, septatae, 1.5 - 3 µm crasse, in solutione Melzeri fulgide vinaceo-rubescentes (dextrinoideae). Pars basalis stipitis e cellulis isodiametricis, 5 - 10 µm diam., subcrasse tunicatis, atque annulo obscure brunneo, 20 - 30 µm lato instructa, sursum cum hyphis caeruleo-violaceis, usque 100 - 200 µm attingentibus. Superficies stipitis atque excipuli partim cellulis vel hyphis brevibus, 0-1-septatis, vesiculosis, cylindraceis, saepe clavato-vel subclaviculato-terminatis, 5 - 8 µm crassis, griseo-caeruleis (in aqua, etiam in NH_4OH), partim hyphis longis, valde flexuosis, ramosis, 3 - 4 µm crassis, septatis, ferrugineoflavis tecta est. Asci 80 - 90 x 6.5 - 8 µm, clavato-cylindracei, deorsum sensim longe stipitati, apice obtusi, 8-spori, sporis monostichis. Paraphyses valde numerosae, 1.5 - 2.5 µm crassae, hyalinae, intus dense guttulis parvis impletae, apice rectae, non dilatatae, obtusae. Ascosporae 12 - 15 (-17) x 3.5 - 4.5 µm, oblongo-fusiformes, latere uno applanatae, polis angustatis sed obtusis, rectae, guttulis binis maioribus nonnulisque parvis implatae, hyalinae.

Slovacia: Herlany, silva parkensis, 25. IX. 1990, leg. H. Deckerová (herb. J. Herink No. 611/90, holotypus PRM).

This *Hymenoscyphus* is very remarkable by its blue or almost violet or greyish-violet cells and hyphae at the base of stipe and outer part of excipulum, as well as by the presence of ferrugineous superficial excipular hyphae. It is close to *Hymenoscyphus sazavae* (Vel.) Svr. (Svrček 1984), a species occurring on conifer-debris, too, but without a ring-like zone and bluish coloured hyphae.

Hymenoscyphus sclerotigerus sp. nov.

Apothecia 1 - 2 µm diam., breviter vel longius stipitata, tota fulgide vitellino-lutea, disco mox plano, anguste marginato, extus nuda, stipite concolori e sclerotio vivo *Typhulae* sp. ecrescentia, solitaria vel subfasciculata. Excipulum textura prismatica, cellulis angulatis, oblongis, usque ad 22 x 10 - 12 µm magnis, tenuiter tunicatis, hyalinis, parte basali excipuli longioribus angustioribusque, 2.5 - 5 µm crassis, non dextrinoideis, hyphis marginalibus anguste cylindraceis. Asci 50 - 60 x 6 - 7.-5 µm, oblongo-clavati, deorsum sensim attenuati, apice obtusi, poro amyloideo, 1.3 - 1.5 µm diam., 8-spori, sporis partim distichis vel monostichis. Paraphyses 2 - 3 µm crassae, simplices, apice obtusae, rectae, totae pigmento fulgide luteo-colorato impletae. Ascosporae 6.5 - 8.5 x 1.8 - 2 µm, oblongae, uno latere applanatae, polis obtusis attenuatis, eguttulatae, hyalinae.

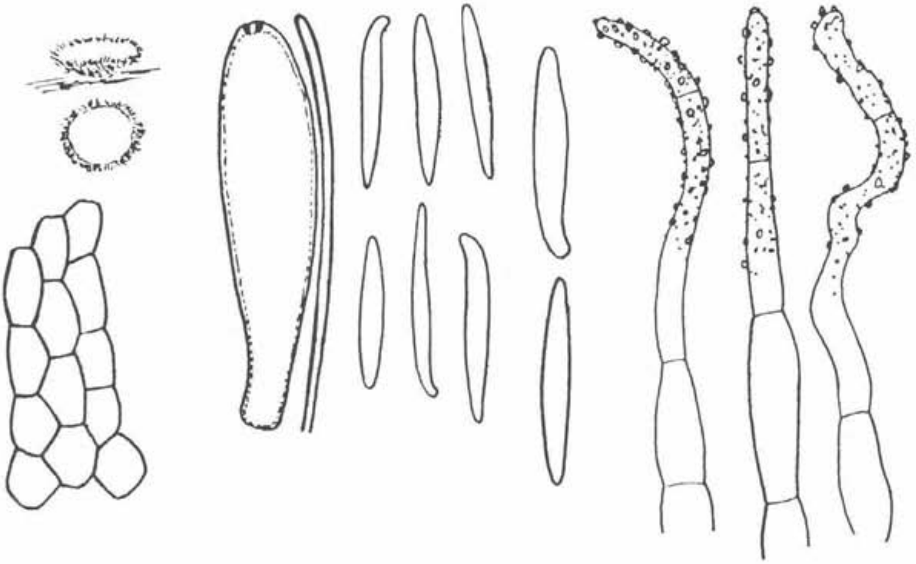
Habitat ad sclerotia viva *Typhulae* sp. in petiolis foliorum emortuorum anno praecedente *Petasitis* sp. (probabiliter *P. albus*).

Bohemia septentrionalis: montes Krkonoše, Malá Úpa, ad ripam rivi Malá Úpa apud ostium vallis rivuli „Jeleni potok", cca 800 m s. m., copiose, 14. - 16. IX. 1989, leg. M. Svrček (holotypus PRM).

The bright yellow apothecia arising from living brown sclerotia of *Typhula* sp. occurring in dead petioles of *Petasites* sp. (probably *P. albus*) are very peculiar and unusual character in the genus *Hymenoscyphus*. The shortly articulate, irregularly flexuous, brown or blackish coloured hyphae 2 - 3.5 µm thick are present at the spot where the stalk is growing from the sclerotium.

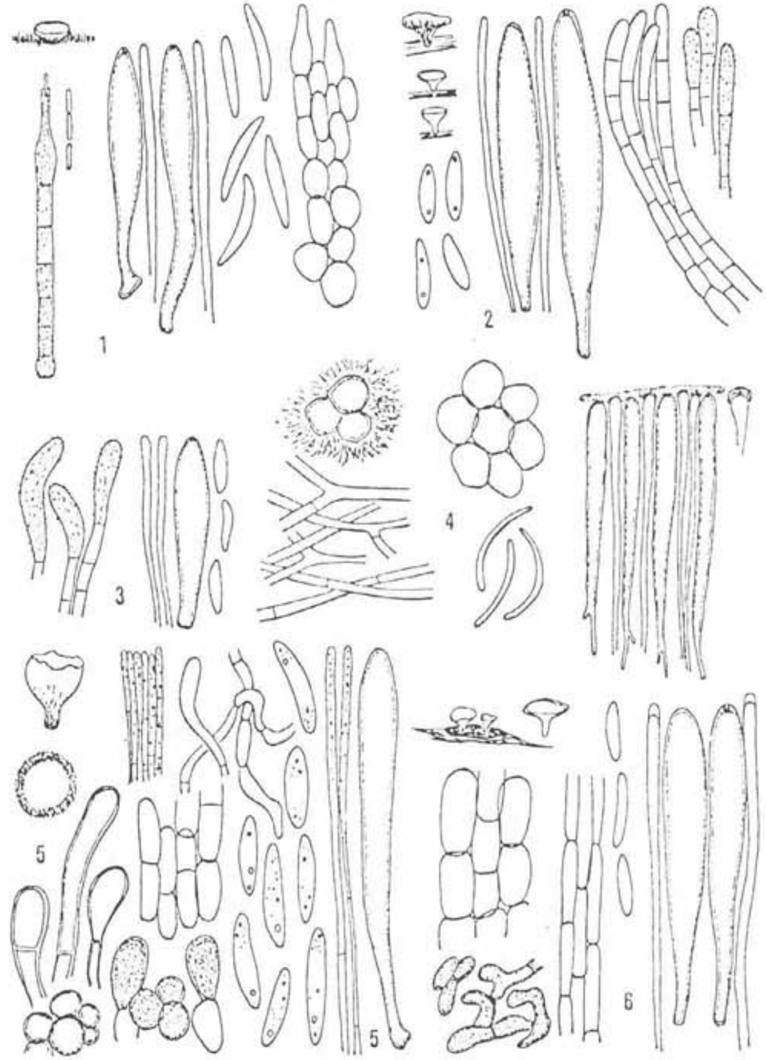
Incrupilella carpini sp. nov.

Apothecia 0.2 - 0.5 µm diam., singularia, rarior gregaria, indistincte marginata, subtus brevissime stipitiformiter angustato-sessilia, mollier ceracea, patellaria dein explanata, disco plano, orbicularia, extus dense breviter tomentoso-pilosula, margine dense erecto-pilosula, primo subalba deinde tinctu cremeo-luteo usque butyraceo-luteo vulnerata immutabilia. Excipulum textura prismatica e cellulis angulatis, parte basali magis rotundatis, tenuiter tunicatis, hyalinis. Pili 40 - 70 x 2 - 3 (apex), 3 - 5 (pars basalis) µm, cylindracei, septati, flexuosi, apice obtusi, tenuiter tunicati, toti vel maxima e parte grosse granulato-incrustati, hyalini. Asci 50 - 60 x 7 - 8 µm, 8-spori (sporis plus minusve distichis), crasse clavati, apice rotundati, basi breviter crasseque stipitati, poro amyloideo.



Incrupilella carpini Svr. (holotype). Apothecia, excipular cells, ascus, paraphysis, ascospores (right two ascospores under oil immersion), three hairs.

M. Svrček del.



1. *Calycellina chalarae* Svr. (holotype). Apothecium amongst conidiophores of *Chalara cylindrosperma* (Corda) Hughes, one conidiophore and conidia of this Chalara, asci, paraphyses, ascospores, marginal excipular cells. - 2. *Chlorosplenium hypericimaculati* Svr. (holotype). Apothecia, ascospores, asci, paraphyses, marginal excipular hyphae. - 3. *Cistella citrinescens* Vel. in Svr. (holotype). Hairs, paraphyses, ascus, ascospores. - 4. *Orbilia aranea* Svr. (holotype). Apothecia on subiculum, hyphae of the subiculum, excipular cells, ascospores, asci, paraphyses. - 5. *Hymenoscyphus caeruleo-annulatus* Svr. (holotype). Apothecium, blue-coloured ring-like zone at the base of apothecium, superficial blue-coloured hyphae and cells from the outer part of the excipulum and stipe, excipular cells, flexuous rust coloured hyphae from the ectal part of the excipulum, ascospores, paraphyses, ascus. - 6. *Hymenoscyphus sclerotigerus* Svr. (holotype). - Apothecia (partly on the *Typhula*-sclerotium), excipular cells, articulate hyphae from the base of apothecium, excipular long hyphae from the inferior part of excipulum, ascospores, paraphyses, asci.

M. Svrček del.

Paraphyses filiformes, apice non dilatatae, 1.5 μm crassae, rectae, cum ascis aequilongae, hyalinae. Ascosporae 14 - 19 x 2 - 3 (-3.5) μm, anguste fusoideae vel cylindraceo-fusoideae, rectae, apice uno plerumque rostro parvo obtuso curvatoque instructae, eguttulatae, hyalinae.

Habitat ad nervos foliorum deiectorum (ad paginam inferiorem) *Carpini betuli.*
Bohemia septentrionalis: České středohoří, Vchynice prope Lovosice, in declivitate septentr. collis „Ovčin" (431 m s. m.), 18. XI. 1960 leg. M. Svrček (holotypus PRM).

The encrusted hairs of this discomycete are of the same shape as that of the type-species of the genus *Incrupilella* Svr., *I. flexipila* Svrček (1986). The encrustation can be only badly observable in water because the granules easily fall off. When dried, the hairs are very conspicuously encrusted. The foliicolous *Setyscypha lachnobrachya* (Desm.) Svrček (1987:196) with similar ascospores, differs in its quite smooth and pointed hairs.

Orbilia aranea sp. nov.

Apothecia 0.3 - 2 μm diam., subiculo arachnoideo candido insidentia, plerumque gregaria usque confluentia, rare solitaria, late sessilia, tenuiter marginata, orbicularia, nuda, disco plano, vinoso-lutea vel ochracea, sicca pallide luteola vel pallida, molliter elastico-carnosa. Excipulum e cellulis parte basali elongato-angulatis, ad marginem versus late ellipsoideis usque rotundatis, ad 35 μm diam., vel 25 x 17 μm diam., marginalibus minoribus (solum 3 - 4 um diam.), hyalinis, tenuiter tunicatis. Hyphae subiculi e cellulis basalibus excipuli crescentes, 3 - 5 μm crassae, longae, rectae, ramosae, tenuiter tunicatae (sed firmae), nudae vel sparse granulosae, remote septatae, hyalinae, partim paulisper inflatae. Asci 30 - 45 x 3 - 4 μm, breviter vel longius stipitati (stipite usque ad 12 μm longo, simplici vel brevissime bifurcato), cylindracei, apice subtruncati, poro inamyloideo, 8-spori (sporis distichis), epithecio valido (2 - 5 μm crasso) hyalino vel luteolo tecti, paraphysibus firme cohaerentes. Paraphyses filiformes, apice plerumque clavato-dilatatae (1.5 - 2.5 μm). Hypothecium hyalinum e cellulis 1.5 - 3 μm diam., isodiametricis instructum. Ascosporae 8 - 13 x 0.8 - 1 μm (plerumque 10 - 12 μm longae), arcuatae, basi sensim attenuatae, eguttulatae, hyalinae.

Habitat ad corticem ramorum deiectorum (in cumulo iacentibus) *Populi tremulae.*
Bohemia meridionalis: Boudy prope Čimelice (distr. Pisek), in declivitate orient. collis „Hrad" (574 m s. m.), 1. VIII. 1969 leg. M. Svrček (608/89, holotypus PRM 684767).

This *Orbilia* is remarkable by the pure white, cobweb-like subiculum (hypothallus) forming a dense mat to a distance up to 2 μm from apothecium, and separable as a thin membrane when dried apothecia are moisted. Apothecia grown often on lenticels in bark of fallen branches. In the past, I collected and identified this *Orbilia* several times under the name *Orbilia curvatispora* var. *robiniae* Vel., doubtless identical with *O. aranea*, e. g. in woods near Karlštejn, Central Bohemia, on bark of accumalated branches of *Robinia pseudacacia*, 19. VI. 1949 (see also Velenovský 1934, Svrček 1954).

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On the genus Didonia Vel. (Helotiales)
O rodu Didonia Vel. (Helotiales)

Mirko Svrček

The authentic material of all species of the discomycetous genus *Didonia* Vel. (1934) was examined and results are discussed.

Je pojednáno o sedmi druzích rodu *Didonia* Vel. (1934) na základě revize typového materiálu.

The genus *Didonia* Velenovský (1934:296), considered by its author as member of the family *Hyaloscyphaceae*, was characterized as follows: "Apothecia minuta, sessilia, patellaria, glabra, laete colorata vel alba, basi fusca vel nigra, parenchymate ad marginem usque (sine prosench.), basi obscure fusco, tentacula longa, stricta, fusca, septata, lumine capillari (membranis incrassatis) gerenti. Asci clavati, paraphyses filiformes, simplices. Sporae ellipticae, tenues, unicellulares." The type species of this genus was not designated, but according to the Velenovský's handwritten manuscripts which I have for disposal cannot be doubt that *Didonia* was established for the species *Didonia picea* Vel., perfectly agreeing with the generic diagnosis. The most important generic features are the long, firm, brown-coloured, septate, thick-walled, bristle-like hyphae, named by Velenovský as „tentacula", and present at base of apothecia. In addition, four other species were described in 1934 (*Didonia juniperina, D. quercina, D. crataegi* and *D. carlinae*), and in 1947 two further species, *D. betulina* and *D. carpinacea* were added.

In Herbarium Mycologicum of National Museum in Prague (PRM) all type-specimens of these *Didonia* species are preserved which I revised in recent years.

The etymology of *Didonia* is rather unclear, Velenovský named it either in honour of French theologian and writer Henri Didon (born 1840) or according to a mythical goddess Dido.

Didonia picea Vel., Mon. Discom. Boh. p. 297, 1934 (sine fig.)

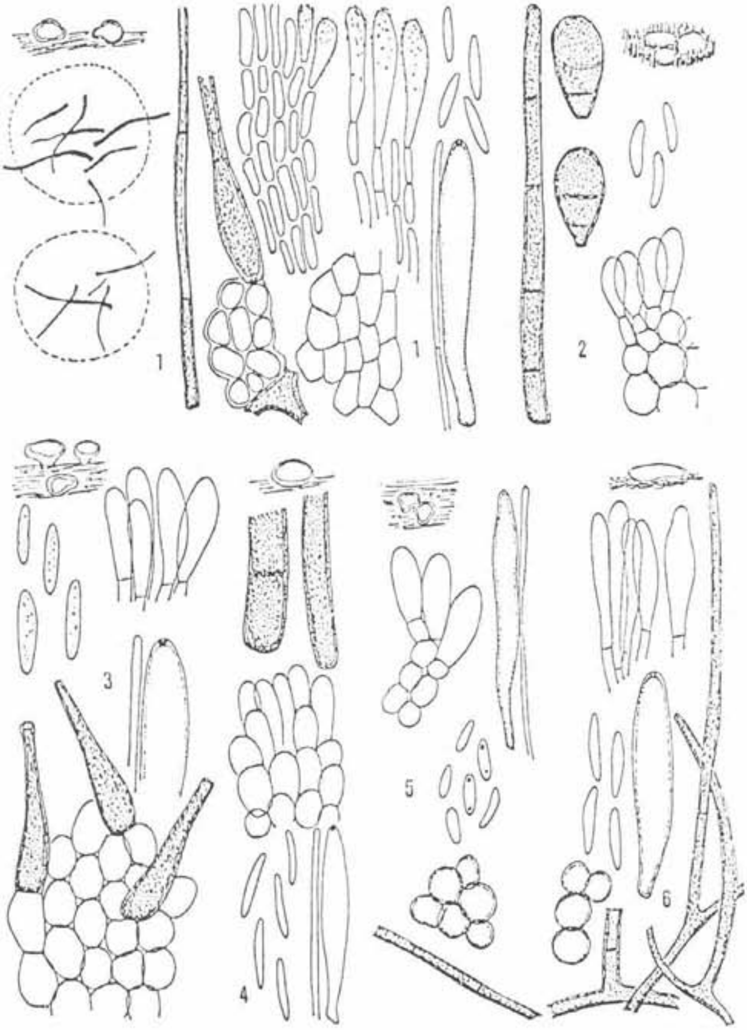
This species was selected by me as the type species of the genus. Of two specimens (both conspecific) in PRM is No. 151276 considered for the lectotypus: Bohemia centralis, Hrusice prope Mnichovice, „supra lateritiam", ad acus deiectos *Piceae abietis,* 7. V. 1929 leg. et det. J. Velenovský (ut *Iubilea picea* Vel., nom. nud. in herb.). The specimen consists of one spruce-needle with several apothecia now 200 - 300 µm diam., up to 320 µm across when moisted, dully yellowish-brown, broadly sessile, almost disciform, narrowly marginate, glabrous, scattered or contiguous, without conidiophores. Excipulum of textura prismatica in the basal part, composed of isodiametric, polygonal, thin-walled, hyaline cells up to 15 x 9 µm, passing in thick-walled glassy hyphae 1.5 - 2 µm wide, resembles textura oblita, passing into marginal excipular zone of cylindrical or slightly clavate, thin-walled, often sparsely granulate short hyphae up to 15 x 2 - 4 µm large. At base of the excipulum a group of isodiametric, thick-walled (-1.5 µm), brown-coloured cells only 2 - 5 µm across is present, from which long cylindrical hyphae ("tentacula" accoring to Velenovský) are growing, up to 160 x 3 - 4.5 µm, mostly slightly curvate, sparsely septate, dark brown, sometimes somewhat enlarged below, obtuse at the tip. It cannot be say with certainty that brown isodiametric small basal cells are a part of excipulum or not. The excipulum is not dextrinoid. Asci 30 - 35 x 4 - 5 µm, subcylindrical, thickly stipitate, the pore strongly amyloid (deep blued by Melzer's reagent). Paraphyses 1.5 µm thick, not enlarged at the tip, straight, hyaline, not longer than the asci. Ascospores 5 - 7 x 1.5 - 2 µm, fusiform, straight, obtuse at both ends, eguttulate, hyaline.

Also the second specimen PRM 151275: Bohemia centr., Mnichovice, in acubus piceis (*Picea abies*), 25. V. 1931 leg et det. Velenovský (ut *Iubilea picea* Vel., nom. nud. in herb.) consists of one spruce needle with several apothecia not different from the lectotype specimen. Altough in both cases no conidia at the tips of so-called „tentacula" has been observed, they can be considered with a high probability conidiophores. The taxonomic position of this discomycete is unclear and it is hardly a representative of *Hyaloscyphaceae*.

Didonia betulina Vel., Novit. mycol. novis. p. 140, 1947 (sine fig.)

Holotypus PRM 150706: Bohemia centr., Mnichovice (Božkov - „Bílá skála"), *Betula (pendula)*, VI. 1942, leg. et det. J. Velenovský.

Two fragments of some rotten wood (a conifer cannot be excluded) with about 20 helotioid apothecia 200 - 300 µm diam., somewhat fleshy, saucer-shaped, shortly attenuated below, pale yellowish, smooth, disc almost cocave, basal part dark coloured. Apothecia scattered, sessile on blackish surface (perhaps remnants of an old hyphomycete?). Excipulum textura prismatica, composed of more or less polygonal cells up to 10 µm diam., elongated towards the base (-15 µm), thin-walled, pale brown, forming a layer at base of the excipulum almost blackish-brown coloured. Excipulum by Melzer's reagent not dextrinoid, but deeply chestnut-brown coloured. At the margin and on the ectal part of excipulum numerous cells, 15-20 x 5-10 µm large, obtusely fusoid, pale brown, are present, and the flanks of the receptacle are covered with rather numerous, oblong-lageniform, up to 25 x 4 µm large, brownish, slightly thick-walled cells resembling conidiophores of *Chalara* sp.; they are attenuated above in a neck truncate at the tip but no conidia were observed. These *Chalara*-cells are most probably co called "corpuscula" mentioned in the original description of *D. betulina*, while "aculei" recorded also for it



1. *Didonia picea* Vel. (lectotype). Two apothecia, Schematic outline of two apothecia from below showing dark conidiophores of a dematioid hyphomycete, conidiophores of this hyphomycete growing on excipular (?) cells, marginal part of excipulum with encrusted cells, basal part of excipulum, ascospores, paraphyses, ascus. - 2. *Didonia quercina* Vel. (holytype). One conidiophore and two conidia of this hyphomycete, three apothecia amongst conidiophores of a dematiaceous hyphomycete, ascospores, marginal part of the excipulum. - 3. *Didonia betulina* Vel. (holytype). Apothecia, ascospores, marginal excipular cells, apical part of one paraphysis and ascus, excipular cells with three *Chalara*-conidiophores. - 4. *Didonia carlinae* Vel. (holytype). One apothecium, two fragments of some conidiophores, marginal excipular cells, ascospores, paraphysis, ascus. - 5. *Didonia crataegi* Vel. (holotype). Apothecia, marginal excipular cells, ascus, paraphysis, ascospores, basal excipular cells, subicular hypha. - 6. *Didonia juniperina* Vel. (holotype). One apothecium, marginal excipular cells, ascospores, ascus, excipular basal cells, thickwalled brown branched hyphae ("tentacula").

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could not to be found. Asci 45-60 6-8 µm, subcylindrical, obtuse above, thickly stipitate below, the large pore (1.5 µm) strongly amyloid (deeply blued by Melzer's reagent). Paraphyses unbranched, 2-2.5 µm thick, straight, not enlarged at the tip, not longer than the asci, hyaline. Ascospores 10 - 12 x 2.5 - 3 µm, oblong, almost cylindrical, obtuse, straight, minutely granulate inside, hyaline.

The excipular structure suggests the genus *Ciliolarina* Svr.

Didonia carpinacea Vel., Novit. mycol. novis. p. 140, 1947

Holotypus PRM 150707: Bohemia centr., Mnichovice, "Hanzlovka" ad lignum *Carpini betuli*, 29. X. 1942 leg. et det. Velenovský (these informations are absent in the original description).

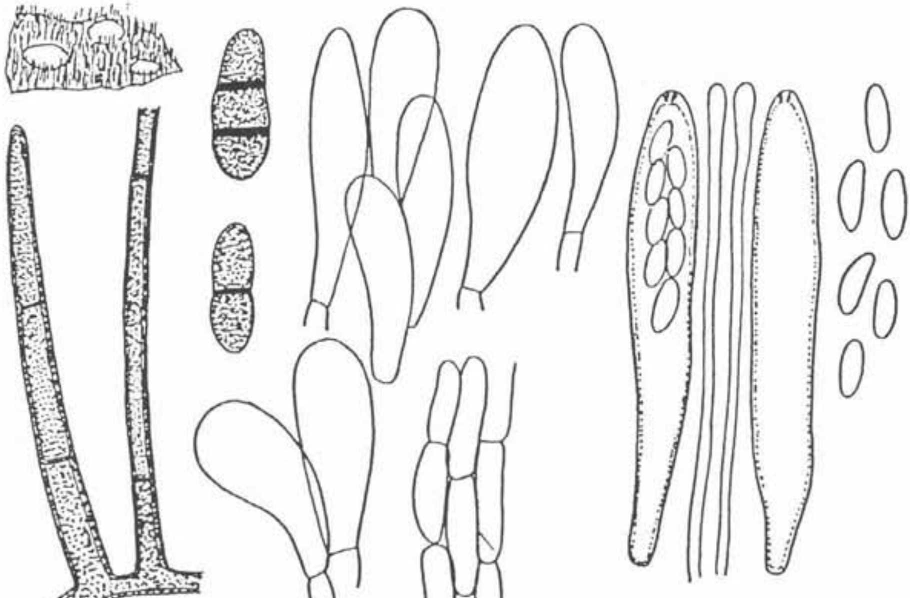
The holotype consists of one small piece of wood densely covered with black straight conidiophores and scattered *Hyaloscypha*-like apothecia. Apothecia when moisted 300 - 400 µm diam., yellowish broadly sessile, disc almost flat, margin and ectal part of the receptacle without distinct hairs. Excipulum textura prismatica, composed of polygonal cells up to 7 x 3 µm large, thin-walled, hyaline, the flanks of the receptacle covered with numerous unicellular, up to 18 x 3 - 6 µm large cells, shortly clavate or subcylindrical, sometimes largely fusoid-clavate, thin-walled, hyaline, smooth. Asci 40 - 45 x 4 - 5 µm, 8-spored (ascospores biseriate), oblong clavate or subcylindrical, shortly and thickly stipitate, above largely obtuse, the pore distinctly amyloid (blued by Melzer's reagent). Paraphyses not enlarged above, unbranched, straight, hyaline, 2 - 3 µm thick. Ascospores (in asci only) 3 - 4 x 1.5 - 1.8 µm, narrowly oblong ellipsoidal, unaequilateral, aguttulate, hyaline. Conidiophores sparsely growing at base of apothecia are up to 90 x 3.5 - 4 µm, unbranched, only below sometimes fasciculate, dark brown, thick-walled, septate, intermingled with 2 - 5-cellular, brown, cylindrical-ellipsoidal conidia 12 - 14 x 4 - 6 µm large.

The original description of this species is incomplete and partly incorrect, without the size of ascospores, which I found in asci only and thus immature. I could not find capilliform hairs ("pili capillares") and conidiophores, in original diagnosis called "aculei" which evidently produce conidia of another form as those seen by me. The excipular structure of this species suggest much the genus *Cystopezizella* Svr.

Didonia carlinae Vel., Mon. Discom. Boh. p. 297, 1934 (sine fig.)

Holotypus PRM 151278: Bohemia centr., Mnichovice, silva "Jidášky" in foliis *Carlinae acaulis*, 29. VII. 1931 leg. et det. J. Velenovský (ut *Iubilea carlinae* Vel., nom nud. in herb.).

On a dead leaf of *Carlina acaulis* only two mollisioid apothecia were found, now dark grey, when moisted in water pale grey, 250 µm diam., broadly sessile, plane, smooth,



Didonia carpinacea Vel. (holotype). Apothecia amongst conidiophores of some dematiaceous hyphomycete, conidiophores and two conidia of this hyphomycete, superficial excipular cells and polygonal cells of the excipulum, asci, paraphyses, ascospores.

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without a subiculum. Excipulum textura globulosa, dark chestnut brown, not dextrinoid, composed of globose cells up to 9 µm diam., their contiguous walls are up to 2.5 µm thick, slightly smaller towards the margin and almost colourless, the margin even, composed of shortly cylindrical, 3.5 - 6 (-8) µm wide, hyaline or pale brownish thin-walled hyphae. Subicular hyphae absent. Asci 28 - 38 x 4 - 4.5 µm, narrowly clavate, shortly stipitate, the pore distinctly amyloid (blued by Melzer's reagent). Paraphyses 2 µm thick, obtuse, without oil globules, not longer than the asci. Ascospores 6 - 8 x 1.3 - 1.5 µm, narrowly fusoid, attenuated at base, straight or slightly curved, eguttulate. At the base of excipulum only fragments of inferior parts of two conidiophores were found, they were septate, thick-walled, blackish-brown. So-called "tentacula" described in the protologue I was not able to found (with regard to the scanty type material I examined a half of one apothecium only). Already J. Velenovský in his manuscript has a note that this discomycete "is similar to a *Mollisia*". In fact, it is a true *Mollisia* sp., morphologically indistinguishable from *Mollisia revincta* (Karst.) Rehm, commonly occurring on stems of various herbs.

Didonia crataegi Vel., Mon. Disc. Boh. p. 297, 1934 (sine fig.)

Bohemia centr., Mnichovice, Hubáčkov, in caudicibus *Crataegi* sp., 4. XI. 1933, leg. et dat. J. Velenovský (holotypus PRM 150708).

Several small pieces of rotten wood with several tens of mollisioid apothecia 0.8 - 1 µm diam., now greyish or yellowish, often with a whitish, lacerate margin, broadly sessile on felt-like brown hypothallus. Excipulum textura globulosa, the marginal cells 5 - 8 µm diam., globose, hyaline, thin-walled, towards the base somewhat larger and thick-walled, golden-yellow, not dextrinoid, but in some parts of excipulum relatively large and almost polygonal (- 10 µm diam.), colourless, the margin composed of unicellular, oblong clavate, hyaline, thin-walled, smooth, often fusoid cells or hyphae 12 - 15 x 3 - 5 µm. Hyphae of the hypothallus long, 2 - 3.5 µm wide, thick-walled, septate, dark brown. Asci 50 x 5 - 6 µm, narrowly clavate, 8-spored (ascospores 1- or partly 2-seriate), the pore very slightly amyloid by Melzer's reagent. Hypothecium small-celled (cells 2 - 3.5 µm across), hyaline. Paraphyses 1.5 - 2 µm thick, obtuse, not longer than the asci, without oil drops. Ascospores 4 - 6.5 x 2 µm, shortly cylindrical or obtusely cuneiform, straight or slightly curvate, often with two minute globules in the poles.

This is a typical *Tapesia*-species, remarkable by its golden-yellow, and at base only somewhat brownish coloured excipulum. "Setae" described in the original diagnosis could refer to the subicular hyphae.

Didonia juniperina Vel., Mon. Discom. Boh. p. 296, fig. 60, 61, tab. 16, 1934.

Holotypus PRM 151279: Bohemia centr., Mnichovice, in acubus marcidis juniperinis, 3. V. 1928 leg. et det. J. Velenovský (ut *Iubilaea juniperina* Vel., nom nud. in herb.).

I found only one apothecium, 400 µm diam. when moisted, flat, thin, colourless, sessile on the surface of a fragment of (a coniferous-needle/? *Juniperus*). The apothecium is not marginate, broadly sessile with its whole inferior part, at base are present hyphae 150 - 200 x 3 - 3.5 µm, 4 - 4.5 µm below (and there sometimes branched), thick-walled, septate, dark brown, obtuse (2.5 µm) at the tip, quite similar to conidiophores but no conidia observed. Excipulum textura globulosa, composed of almost globose or polygonal cells 6 - 10 µm diam., hyaline, not dextrinoid (pale yellow in Melzer's reagent), slightly thick-walled, smaller and more elongated towards the margin, the marginal cells forming a row of cylindrical or elongated cylindrical, hyaline hyphae up to 30 x 2 - 3.5 µm, smooth or sparsely and minutely granulate. Asci 35 - 40 x 4 - 5 µm, 8-spored (partly biseriate), cylindrical-clavate, obtuse, the pore very minute (0.7 - 0.8 µm diam.), amyloid. No paraphyses found. Ascospores 7 - 8 x 1.5 - 2 µm, narrowly fusoid, straight, eguttulate, hyaline.

The observed features agree with the original description of *D. juniperi* only in part, still the illustrations (tab. 16, fig. 61) are in full accordance with them. The only one apothecium examined by me has no doubt the basal hyphae named by Velenovský "tentacula". In this case we cannot exclude possibility either that this apothecium grows by chance in the spot where some conidiophores erumpent in fascicles from the host epidermis or that exists a close relation between apothecium and conidiophores (anamorph - teleomorph of one fungus species). An idea regarding parasitism between this discomycete and hyphomycete may be also considered, still this relationship seems to be less probable. The interpretation of "tentacula" as a part of excipular structure is hardly acceptable. The type-specimen contains in addition one microscopic slide (unfortunatelly useless for a re-examination), and one spruce-needle (*Picea abies*), now without apothecia, both separated by the Swedish mycologist L. Holm (Uppsala) in 1973 during his revision of *D. juniperina*, as well as one needle (perhaps of *Juniperus communis*) in an original small packet indicated by Velenovský's handwriting.

The excipular structure and other features suggest some affinity with the genus *Calycellina* Höhnel.

Didonia quercina Vel., Mon. Discom. Boh. p. 297, tab. 16, fig. 62 - 64, 1934.

Holotypus PRM 151277: Bohemia centr., Mnichovice, Hubáčkov, in ramis et truncis quercinis 22. VIII. 1931, leg., et det. J. Velenovský (ut *Iubilaea quercina* Vel. nom. nud. in herb.)

Two fragments of decorticated rotten wood overgrown with black, upright conidiophores and numerous, gregarious and often contiguous or confluent mollisioid apothecia 0.5 - 1 µm diam., sessile, disc bluish or whitish. Excipulum textura globulosa, light brown, composed of globose, up to 14 µm diam. thin-walled not dextrinoid cells, the marginal cells shortly clavate, 4 - 6 µm wide, hyaline or brownish, thin-walled, smooth, arranged in rows. Asci 50 - 60 x 4 - 5 µm, narrowly clavate, 8-spored (ascospores mostly biseriate), the pore amyloid. Paraphyses 3 - 3.5 µm thick, obtuse, not enlarged at the tip, not longer than the asci, hyaline. Ascospores 6 - 10 x 2 - 2.5 µm, unbranched, septate, thick-walled, blackish-brown, producing 3-celled, pyriform or obovate, 17 - 22 x 9 - 10 µm large, brown, conidia at their apices.

There is no doubt that Velenovský's "tentacula'' desccribed by him in the protologue of *D. quercina* are conidiophores mentioned above, and "corpuscula pyriformia" are conidia produced by these conidiophores, as it is also evident from cited illustrations. Apothecia of this taxon present a typical *Mollisia*-species.

As a result of the examination of all species studied of the genus *Didonia* it is clear that the only one feature of these taxa is the presence of hyphae which are conidiophores of some dematioid hyphomycetes or superficial mycelial hyphae respectively, close to apothecia or growing on surface of the ectal excipulum, namely in its basal part. The origin of these hyphae is not always clear - are they conidiophores of an associated anamorph on only present an accidental occurrence of another fungus growing together with apothecia on the same substratum? Theoretically, a parasitic dependence cannot be excluded, too. The most conspicuous is this close relation especially in *Didonia picea* selected by me as a lectotype for *Didonia*, a species agreeing perfectly with the generic diagnosis. The *Chalara*-conidiophores growing directly from the excipular cells as well as the long hyphae, or perhaps - conidiophores in *Didonia juniperina* and *D. carpinea* at basal part of the excipulum present also some close relation between apothecia and another fungus. In *Didonia quercina*, a similar connexion exists as in *Dematioscypha dematiicola* (Berk. et Br.) Svrček (1977) occurring always amongst dematiaceous hyphomycete *Haplographium delicatum* Berk. et Br. (Hughes 1953, 1958, M. B. Ellis 1971) or in *Strossmayeria basitricha* (Sacc.) Dennis intimately associated with conidiophores of *Pseudospiropes simplex* (Kunze ex Pers.) M. B. Ellis (M. B. Ellis et J. P. Ellis 1985) (Syn.: *Helminthosporium simplex* Kunze, secundum Dennis 1978). From taxonomic point of view the genus *Didonia* is doubtless a heterogeneous genus embracing species without any affinity and belonging into different families of inoperculate Discomycetes (*Helotiales*). The term ''tentaculum'' used by Velenovský for so morphologically different hyphae observed and described by him in *Didonia*-species, can be hardly explained. According to W. T. Stearn (1966) tentaculum is a ''sensitive glandular hair, as in *Drosera*''. Really surprising is the fact that not a single one of seven *Didonia*-species has been found repeatedly exclusively *D. carlinae*, most probably identical with *Mollisia revincta*. The possibility that the presence of various strange hyphae present in various parts of excipulum has been overlooked is also worth considering. Perhaps some of the mentioned species left aside as ''indeterminata'', too, with regard to their unclear value. Except for *Didonia picea,* collected twice, all species were found only once in the years 1928 - 1942, consequently during the period when J. Velenovský was most intensively concerned with the study of Discomycetes, and many thousands of specimens passed through his hands.

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The genera Paxillus and Tapinella in Central Europe

Rody Paxillus a Tapinella ve střední Evropě

Josef Šutara

A brief survey of the genera *Paxillus* Fr. and *Tapinella* Gilb. is given with a key to the determination of Central European species of this group. Differences between the above mentioned genera are summarized into seven points. The species *Agaricus atrotomentosus* Batsch: Fr., often treated as a *Paxillus*, is here transferred to the genus *Tapinella*. The following new combinations are proposed: *Tapinella atrotomentosa* (Batsch: Fr.) comb. nov. and *Tapinella panuoides* (Fr.: Fr.) Gilb. f. *ionipes* (Quél.) comb. nov.

Je podán stručný přehled rodů *Paxillus* Fr. a *Tapinella* Gilb. s klíčem k určení středoevropských druhů této skupiny. Rozdíly mezi výše zmíněnými rody jsou shrnuty do sedmi bodů. Druh *Agaricus atrotomentosus* Batsch: Fr., často považovaný za zástupce rodu *Paxillus*, je zde přemístěn do rodu *Tapinella*. Jsou navrženy následující nové kombinace: *Tapinella atrotomentosa* (Batsch: Fr.) comb. nov. a *Tapinella panuoides* (Fr.: Fr.) Gilb. f. *ionipes* (Quél.) comb. nov.

For some years I have studied the anatomy of Central European species of the family *Paxillaceae* Lotsy. On the basis of this study I arrived at the conclusion that *Tapinella* Gilb. is a good, separate genus, distinguished from the most related genus, *Paxillus* Fr., by many significant diagnostic characters. In this taxonomic question I agree with the authors who accepted *Tapinella* (= *Tapinia* P. Karst.) at the generic level already sooner (e. g. Karsten 1879, Fayod 1889, Murrill 1917, Gilbert 1931, Redhead and Ginns 1985, Kreisel 1987, Breitenbach and Kränzlin 1991, etc.).

Into the genus *Tapinella* it has usually been included only the type species, *Tapinella panuoides* (Fr.: Fr.) Gilb. (= *Agaricus panuoides* Fr.: Fr.). In my opinion, however, into this genus it should be placed also the species *Agaricus atrotomentosus* Batsch: Fr. which is like *T. panuoides* in all important microscopic and anatomical details. The microscopic features show that *A. atrotomentosus* belongs to *Tapinella* rather than to *Paxillus*. With respect to this fact I propose the following new combination: *Tapinella atrotomentosa* (Batsch: Fr.) Šutara comb. nov. [basionymum: *Agaricus atrotomentosus* Batsch, Elench. Fung., p. 89, 1783: Fries, Syst. Mycol. 1, p. 272, 1821].

Differences between the genera Paxillus and Tapinella

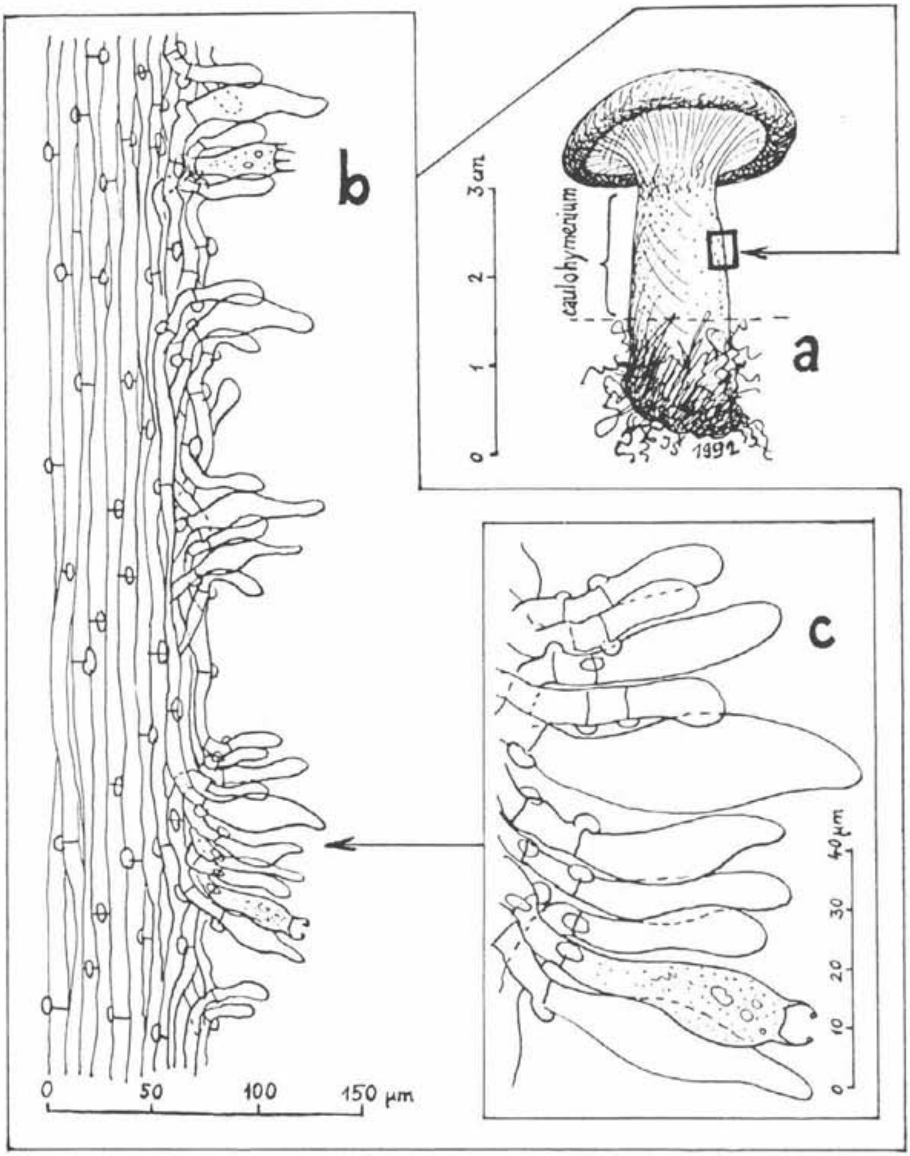
Paxillus:	*Tapinella:*
1. A predominant part of the stipe surface is fertile, composed of a caulohymenium with sporulating caulobasidia. (In other words: The stipe covering is analogous with the hymenium of the hymenophore).	1. The stipe surface is not fertile. The stipe is either absent or is covered with a trichodermium or tomentum. (The stipe covering is analogous with the pileus cuticle).
2. Lateral strata (or hymenopodia?) of the hymenophore gelatinize in a certain developmental stage.	2. Lateral strata of the hymenophore do not gelatinize.

3. Basidia clavate or clavate-capitate, 6.5-13 µm broad, resembling the ones of boletaceous genera.	3. Basidia slender, narrowly clavate or almost cylindric, only 4-6.5 µm broad, smaller and much narrower than those in *Paxillus*.
4. Spores longer than 6.5 µm, ellipsoid or ellipsoid-fusoid; some of them with a suprahilar applanation or depression in profile, reminiscent of a broad boletoid shape, only partly and weakly dextrinoid and cyanophilic.	4. Spores shorter than 6.5 µm, broadly ellipsoid, without a distinct suprahilar depression, rather strongly dextrinoid and cyanophilic, reminding of the ones of some *Coniophoraceae*.
5. Cystidia present both in the hymenophore and on the stipe.	5. Cystidia absent.
6. Medaillon clamp connections absent (see Lange and Hansen 1954).	6. Medaillon clamp connections present (see Lange and Hansen 1954).
7. Terricolous fungi, facultatively mycorrhizal.	7. Lignicolous fungi, causing brown rot (see Davidson and Patton 1961, Nilsson and Ginns 1979).

Genus **Paxillus** Fr., Fl. Scan.: 339, 1835.

Ruthea Opat., Arch. Naturgeschr. 2 (1): 3, 1836.
Rhymoxis (*"Rhymovis"*) Pers. ex Rabenh., Deutschl. Kryptogamenfl. 1: 453, 1844.
Tapinia (Fr.) Pat., Hym. Europ.: 130, 1887 (non *Tapina* Mart. 1829, nec *Tapinia* Steud. 1841, nec P. Karst. 1879).
Typus: *Agaricus involutus* Batsch: Fr. = *Paxillus involutus* (Batsch: Fr.) Fr.

Characters: Carpophores of lactarioid or clitocyboid habit, fleshy. Velum none. The pileus more or less circular, depressed at the centre and inrolled on the margin. The pileus cuticle a trichodermium, often collapsed and sometimes gelified. Lamellae crowded, decurrent, branching, anastomosing near the stipe. The lamellar trama is bilateral, with lateral strata (or hymenopodia?) which gelatinize in a certain developmental stage. Cystidia present both on the edge and on the surface of the lamellae. Most of the hymenophoral cystidia contain a yellow dispersed pigment. Basidia clavate or clavate-capitate, moderately broad (6.5-13 µm). Spores moderately large (6.5-13 µm long), yellowish or brownish under the light microscope, smooth, ellipsoid or ellipsoid-fusoid, some of them with a suprahilar applanation or shallow depression in profile, partly and weakly dextrinoid and cyanophilic. Spore print ochraceous or pale brown. The stipe central or somewhat eccentric, fleshy, solid. Except the basal part, the stipe is covered with a fertile caulohymenium. The caulohymenial layer is at first entire, later it gradually disrupts into small islands of caulobasidioles, caulocystidia and scattered functioning caulobasidia. No distinct lateral stratum was observed under the caulohymenium. The hyphal system monomitic; the hyphae filamentous or inflated, with walls thin or slightly thickened (to 0.6 µm). Trama of the pileus loosely and irregularly entangled. Trama of the stipe densely and regularly arranged in a longitudinal, parallel way. Clamp connections very abundant. Medaillon clamps were not observed (see Lange and Hansen 1954).



1. *Paxillus involutus.* - a) A young specimen (JŠ 3520). - b) Fragments of the disrupted caulohymenium on the stipe surface. - c) A detail of fig. b showing elements of the caulohymenium.

Paxillus involutus. - a) Mladý exemplář (JŠ 3520). - b) Fragmenty roztrhaného kaulohymenia na povrchu třeně. - c) Detail kresby b ukazující elementy kaulohymenia.

Terricolous species, forming ectomycorrhiza with frondose as well as coniferous trees (for detailed information on the mycorrhiza of *Paxillus involutus,* see Laiho 1970).

Note: *Paxillus* with its features (the presence of the caulohymenium and caulobasidia, the suprahilar depression on some spores, the not narrowed basidia, the gelified hymenophoral trama, the ability to form mycorrhiza, etc.) is more closely related to the family *Boletaceae* Chev. than is the genus *Tapinella.*

Central European species: (1) *Paxillus involutus* (Batsch: Fr.) Fr., (2) *Paxillus rubicundulus* Orton (= ? *P. filamentosus* Fr.), and (3) *Paxillus albidulus* Šutara.

Key to the identification of Central European species of Paxillus

1a) The pileus and stipe of young and maturing specimens are white or whitish, only on pressed or injured places they become brown or rusty coloured. The trichodermal hyphae on the pileus contain no distinct pigment. Also the flesh and the basal tomentum is white .... *Paxillus albidulus*

1b) The pileus and stipe are distinctly coloured (e. g. grey-ochreous, yellow-brown, rusty brown, brown, etc.) from the beginning. The trichodermal hyphae on the pileus contain a brown dispersed pigment. The flesh is at least slightly yellow, cremeous or rusty yellowish. The basal tomentum yellow-grey, olive-grey, grey or rusty brown 2

2a) The pileus cuticle become very soon squamulose. The lamellae of immature specimens are vivid yellow or golden yellow. Likewise the flesh is rather vivid yellow. Spores 6.5-8.5 x 4-5 (5.5) µm. On wet sites under *Alnus* .... *Paxillus rubicundulus*

2b) The pileus cuticle is not squamulose in normal conditions. The lamellae cremeous, ochreous as well as yellowish but not so vivid yellow as those of the previous species. Also the flesh is less yellow. Spores (8-) 8.5-12 x (4-) 5-6 (-6.5) µm. Under other trees than alders (*Alnus*), most frequently under *Betula* and *Picea* .... *Paxillus involutus*

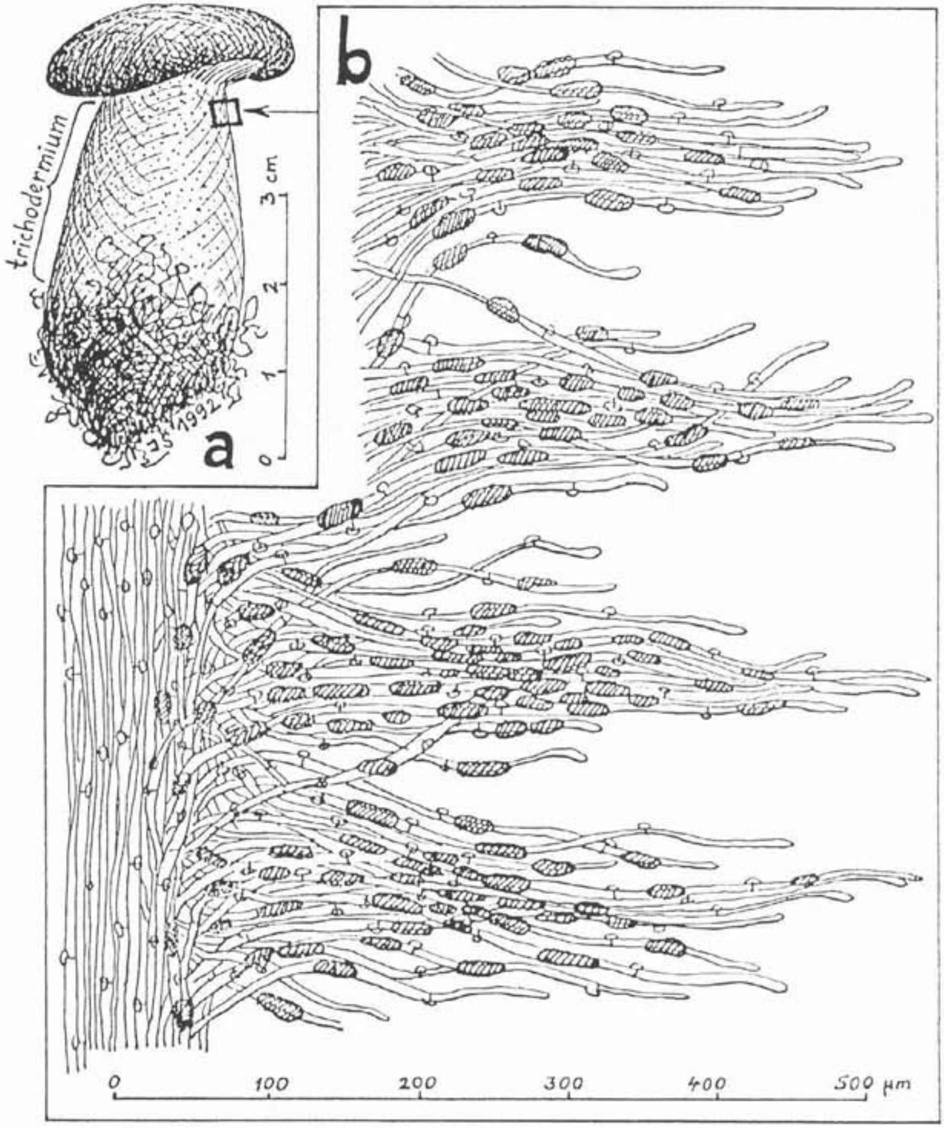
Genus **Tapinella** Gilb., Les Bolets: 67, 1931.

Tapinia P. Karst., Bidr. Känn. Finl. Nat. Folk 32: XXIII, 452, 1879 (non *Tapina* Mart. 1829, nec *Tapinia* Steud. 1841).

Paxillopsis Gilb., Les Bolets: 86, 1931 (nom. inval.).

Typus: *Agaricus panuoides* Fr.: Fr. = *Tapinella panuoides* (Fr.: Fr.) Gilb.

Characters: Carpophores of pleurotoid (or crepidotoid) habit, more or less fleshy. Velum none. The pileus conchate, flabellate, auriculate or almost circular, inrolled on the margin. The pileus cuticle a trichodermium, collapsed or erected, usually non-gelified. Lamellae decurrent, branching, anastomosing. The lamellar trama is bilateral, with lateral strata which do not gelatinize. Cystidia absent. Basidia narrowly clavate or nearly cylindric, merely 4-6.5 µm broad. Spores small, shortly ellipsoid, without a distinct suprahilar depression, smooth, yellowish or brownish under the light microscope, rather



2. *Tapinella atrotomentosa.* - a) A young specimen (JŠ 3511). - b) A trichodermium on the stipe surface, composed of erected hyphae which are conspicuously incrusted with the pigment atrotomentin in crystallized form.

Tapinella atrotomentosa. - a) Mladý exemplář (JŠ 3511). - b) Trichoderm na povrchu třeně, tvořený vzpřímenými hyfami, které jsou nápadně inkrustovány pigmentem atrotomentinem v krystalické podobě.

strongly dextrinoid and cyanophilic. Spore print ochreous or pale brown. The stipe eccentric, lateral or none, rarely almost central. If present, it is covered with a trichodermium or with a tomentose tangle of hyphae. No lateral stratum was observed under the stipe cuticle. The hyphal system monomitic; the hyphae filamentous or somewhat inflated, with walls thin or slightly thickened (to 0.6 µm). The pileus trama is loosely and irregularly entangled. The stipe trama is densely arranged in a longitudinal, parallel way. Clamp connections very abundant. Medaillon clamps were observed (see Lange and Hansen 1954).

Lignicolous species, living on coniferous wood, causing brown rot (see Davidson and Patton 1961, Nilsson and Ginns 1979, and others).

Note: *Tapinella*, with regard to its characters (the sterile stipe covering, the slender basidia, the absence of the suprahilar depression on spores, the brown rot, etc.), indicates a relationship to some groups of wood-decaying fungi. Some authors (e. g. Nilsson and Ginns 1979) suggested that *Tapinella panuoides* (the type species of *Tapinella*) is closely allied to the family *Coniophoraceae* Ulbr.

Central European species: (1) *Tapinella panuoides* (Fr.: Fr.) Gilb. and (2) *Tapinella atrotomentosa* (Batsch: Fr.) Šutara.

The first cited species occurs in several forms. One of them is *Tapinella panuoides* f. *ionipes* (Quél.) Šutara comb. nov. [basionymum: *Paxillus ionipes* Quél., C. R. Ass. Franc. Av. Sc. 16 (2): 588, ("1887") 1888].

Note on Tapinella atrotomentosa. Macroscopically *Tapinella atrotomentosa* perhaps seems to be somewhat similar to *Paxillus involutus* (the type of *Paxillus*), but microscopically these two species are very different. The microscopic and anatomical features of *T. atrotomentosa* (such as the absence of the caulohymenium and caulobasidia, the non-gelatinous hymenophoral trama, the narrow basidia, the absence of the suprahilar depression on spores, the absence of cystidia, the presence of medaillon clamps, etc.) demonstrate that this species cannot be placed with *P. involutus* together in the same genus. The ability to produce a brown rot, which is a physiological character, is undoubtedly also a significant feature supporting the transferrence of *T. atrotomentosa* from *Paxillus* to *Tapinella*.

Note on Plicaturella. The question of the generic name *Plicaturella* Murrill, which is sometimes cited as a synonym of *Tapinella*, was clarified by Redhead and Ginns (1985). These authors examined the type of *Cantharellus olivaceus* Schw. (the type of *Plicaturella*) and ascertained that it is most likely a specimen of *Gyrodon merulioides* (Schw.) Sing. = *Boletinellus merulioides* (Schw.) Murrill. On the basis of this fact, they came to the conclusion that *Plicaturella* is not synonymous with *Tapinella* or *Paxillus* but with *Gyrodon* Opat. or *Boletinellus* Murrill.

Key to the identification of Central European species of Tapinella

1a) The stipe well developed, stout, 3-9 cm long, 2-5 cm thick, eccentric or lateral, rarely almost central, covered with a dense, dark brown velvet. The pileus (8-) 10-20 (-25) cm, circular or eccentric, rusty brown, olive-brown or dark brown. The trichodermal hyphae on the stipe and pileus are richly covered with a conspicuous, dark brown incrustation - the pigment atrotomentin in crystallized form (see Kühner 1980). Carpophores grow singly or in tufts on stumps and at the base of coniferous trees .... *Tapinella atrotomentosa*

1b) The stipe absent or rudimentary, shortly lateral, not longer than 0.5 (-1) cm. The tomentum on the stipe mostly pale yellowish or greyish, occasionally lilac or ametyst violet (in the form *ionipes*), never dark brown. The pileus 2-7 (-10) cm, conchate, flabellate or auriculate, sordid ochreous, olive-yellow, golden ochreous or ochreous brown. A variety with brown-red squamules on the pileus was described as var. *rubrosquamulosus* (see Svrček and Kubička 1964). The superficial hyphae on the pileus and stipe are smooth or sparsely punctate with very minute, almost colourless granular particles. Carpophores grow gregariously or in overlapping tiers on decaying coniferous wood ..... *Tapinella panuoides*

Acknowledgements

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Pouzaroporia, gen. nov. - nový rod chorošů

Pouzaroporia, gen. nov. - a new genus of the polypores

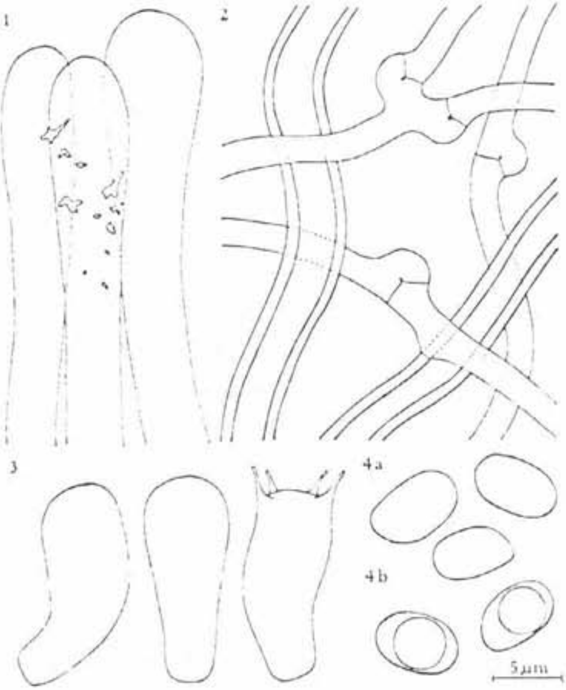
Petr Vampola

Pro vzácnou chorošovitou houbu *Poria subrufa* Ell. et Dearn. je vystaven nový monotypický rod *Pouzaroporia* Vampola. Jsou diskutována dříve publikovaná zařazení této houby do rodů *Ceriporiopsis* a *Fibroporia*. Tato zařazení nemohou být akceptována, neboť *Poria subrufa* se od druhů rodu *Ceriporiopsis* liší dimitickým hyfovým systémem a od druhů rodu *Fibroporia* bílou hnilobou dřeva.

A new genus *Pouzaroporia* Vampola is proposed for the rare pore fungus *Poria subrufa* Ell. et Dearn. Previously published classifications within the genera *Ceriporiopsis* and *Fibroporia* are discussed. These classifications cannot be accepted because *Poria subrufa* differs from the genus *Ceriporiopsis* in its dimitic hyphal system and from *Fibroporia* in the white decay of the wood.

Pórnatka nahnědlá - *Pouzaroporia subrufa* (Ell. et Dearn.) Vampola je velmi vzácná chorošovitá houba, která je pro většinu evropských mykologů neznámá. Pod jménem *Poria subrufa* ji popsali již před téměř sto lety (1897) Ellis a Dearness a pod tímto jménem byla až do nedávna uváděna v severoamerické mykologické literatuře. Rozpad příliš širokého rodu *Poria* byl v případě našeho druhu nedávno příčinou dvou nových zařazení. První, které však považuji za naprosto chybné, provedl Ginns (1984), když přeřadil *P. subrufa* do rodu *Ceriporiopsis* Domań., charakteristického monomitickým hyfovým systémem (Domański 1963). Ginns zřejmě nedostatečně studoval hyfový systém *P. subrufa* a stejně jako Lowe (1966) jej považoval za monomitický, tvořený pouze generativními hyfami. Toto chybné pojetí převzali později také Gilbertson a Ryvarden (1986). Ve stejném roce jako Ginns publikoval Pouzar (1984) první nález *P. subrufa* v Evropě a současně zařadil tento druh do rodu *Fibroporia* Parm. Jako první totiž zjistil, že *P. subrufa* není monomitická, nýbrž že její hyfový systém je dimitický, tvořený generativními a skeletovými hyfami. K tomuto závěru došel na základě studia nejenom evropského materiálu, ale i podrobným studiem typové položky ze Severní Ameriky. Pouzarovo zařazení *P. subrufa* do rodu *Fibroporia* však nelze rovněž akceptovat, neboť Parmasto vystavěl rod *Fibroporia* sice pro druhy dimitické, avšak působící červenou hnilobu dřeva. *Poria subrufa* však podle mého pozorování a také podle všech literárních údajů vyvolává bílou hnilobu dřeva a druhy s rozdílným typem hniloby podle mého názoru (i jiných mykologů) nemohou být kladeny do stejného rodu. Mimo tento zásadní rozdíl se *P. subrufa* liší od druhů rodu *Fibroporia* ještě červenáním poraněných čerstvých plodnic a naprostou absencí rhizomorf.

Vzhledem k uvedeným skutečnostem a také proto, že tento druh nelze uspokojivě zařadit do žádného z dosud popsaných rodů chorošů, popisuji pro něj nový (monotypický)



Pouzaroporia subrufa (Ell. et Dearn) Vampola. 1) konce hyf v ostří rourek, 2) dimitické hyfy tubulotramy, 3) bazidie, 4a) výtrusy v Melzerově činidle, 4b) výtrusy v KOH.

rod. Tento rod věnuji významnému československému mykologovi a mému starostlivému učiteli prom. biologovi Zdeňkovi Pouzarovi, CSc., k jeho životnímu jubileu.

Pouzaroporia Vampola, gen. nov.

Carposomata annua, poriiformia, effuso-sessilia, in recentibus mollia, in siccatis dura et fragilia, albida usque cremea, in recentibus vulneratis rubescentia, in senescentibus brunnescentia. Systema hypharum dimiticum: hyphae generativae tenuiter tunicatae, fibulatae, hyphae skeleticae tenuiter usque crasse tunicatae, non ramificatae, non amyloideae nec dextrinoideae; cystidia nulla; basidia late clavata usque cylindracea, tetrasterigmatica; sporae ellipsoideae vel ovoideae, laeves, hyalinae, non amyloideae nec dextrinoideae. Putrificatio ligni alba.

Typus generis: *Poria subrufa* Ell. et Dearn.

Species: *Pouzaroporia subrufa* (Ell. et Dearn.) Vampola, comb. nov.; basionymum: *Poria subrufa* Ellis et Dearness, Proc. Roy. Canad. Inst., ser. nov., Ottawa, 1:89, 1897.

Syn.: *Ceriporiopsis subrufa* (Ell. et Dearn.) Ginns, Mycotaxon, Ithaca, 21:326, 1984; *Fibroporia subrufa* (Ell. et Dearn.) Pouzar, Čes. Mykol., Praha, 38:204, 1984; ? *Poria atrorubens* Baxter, Pap. Mich. Acad. Sci., Arts Lett., Michigan, 34:42, 1950.

Plodnice jednoleté, po dřevě rozlité, tvořící až 1 cm tlusté nepravidelné povlaky v ploše až několika dm^2. Za čerstva jsou bělavé nebo krémové, poraněním nejprve červenají a po chvíli hnědnou (podobně jako *Physisporinus sanguinolentus*). Suché a starší plodnice jsou vždy tmavší a v různých odstínech hnědé nebo granátově hnědé barvy. Subiculum je velmi tenké, k substrátu pevně přirostlé, pouze u zasychajících plodnic se někdy na okraji od substrátu odtrhává. Rourky jsou až 1 cm dlouhé, tenkostěnné, na šikmém podkladu z boku otevřené, na ostří rovné nebo jemně brvité. Póry jsou hranatě okrouhlé, 2-4 na 1 µm. Konzistence čerstvých plodnic je měkká, suché plodnice však jsou tvrdé a křehké. Hyfový systém je dimitický, tvořený generativními a skeletovými hyfami: generativní hyfy jsou tenkostěnné, hyalinní, na přehrádkách s přezkami, 2-4 µm tlusté; skeletové hyfy jsou tenkostěnné i tlustostěnné, nevětvené nebo jen výjimečně se větvící, neamyloidní a nedextrinoidní, 3-7 µm tlusté. Konce hyf v ostří rourek jsou někdy mírně kyjovitě rozšířené, na povrchu místy řídce inkrustované a uvnitř vyplněné hmotou s hojnými drobnými světlolomnými zrny; působením KOH se tato hmota uvolňuje a na vrcholu hyf zůstává přilepena v podobě jakýchsi nepravidelných čepiček, takže konce hyf pak působí dojmem inkrustovaných cystid. Bazidie jsou tetrasporické, hyalinní, široce kyjovité, některé až téměř válcovité, s bazální přezkou, 11-16 x 4,5-6,5 µm veliké. Výtrusy jsou elipsoidní až oválné, hyalinní, hladké, v KOH většinou s jednou velikou kulovitou kapkou, 4,8-7,5 x 3-4,5 µm veliké.

Gilbertson a Ryvarden (1986) uvádějí, že výtrusy *P. subrufa* jsou tvarem velmi podobné výtrusům *Ceriporiopsis aneirina*, což však nepovažuji za správné. Výtrusy *C. aneirina* totiž v žádném případě nejsou oválné a podle mých pozorování mohou být označeny jako prohnutě kapkovité (Vampola 1989).

Lowe (1966) klade do synonymiky *P. subrufa* také *Poria atrorubens* Baxter (1950), což je druh popsaný rovněž ze Severní Ameriky, a to z Arkansasu. Tuto houbu jsem neměl možnost studovat, avšak podle původního popisu Baxtera jsou její výtrusy široce válcovité o rozměrech 1,5-2 x 4 µm. I když Lowe nepochybně studoval Baxterův typus, vysvětlení značně rozdílných hodnot velikosti výtrusů ve své monografii rodu *Poria* neuvádí. Z těchto důvodů raději řadím *Poria atrorubens* do synonymiky *P. subrufa* s otazníkem.

Co se týče rozšíření, je *Pouzaroporia subrufa* dosud známá pouze ze Severní Ameriky a Evropy. Ze Severní Ameriky je udávána z Kanady z Ontaria a z USA ze států Iowa, Missouri, Arkansas, Indiana, New York, Pennsylvania a New Jersey (Gilbertson et Ryvarden 1986). V Evropě je tento druh nepochybně vzácnější a dosud byl nalezen pouze v Jugoslávii (David et Tortić 1986, Tortić 1988) a v Československu (Pouzar 1984). Podrobnosti o prvních dvou lokalitách v Československu, kde je tento druh opakovaně sbírán již od roku 1960, publikoval Kotlaba (1984). Třetí lokalitu v Československu a současně první na Slovensku objevil v roce 1990 ing. Jan Kuthan v údolí říčky Chotinky nedaleko Stakčína na východním Slovensku.

Pouzaroporia subrufa je druhem saprofytickým, rostoucím většinou na silně ztrouchnivělých ležících kmenech listnáčů, v Severní Americe výjimečně i jehličnanů (*Pinus*). Patří mezi houby lignivorní, neboť působí bílou hnilobu dřeva.

Studované položky *Pouzaroporia subrufa* z ČSFR:

Moravia: Area tuta "Cahnov" prope Lanžhot, 150 m s. m., *Ulmus carpinifolia*, ad truncum iacentem, 31. VIII. 1989, leg. et det. Z. Pouzar (MJ 1630). - Area tuta "Ranšpurk" prope Lanžhot, 150 m s. m., *Ulmus carpinifolia*, ad truncum iacentem, 31. VIII. 1989, leg. J. Vlasák, det. Z. Pouzar (MJ 1631); ibid., *Fraxinus angustifolia* ssp. *danubialis*, ad truncum iacentem, 7. VII. 1990, leg. et det. P. Vampola (MJ 424/90).

Slovacia: Montes Bukovské vrchy, in valle rivi Chotinka ad pedem mont. Maňov prope Stakčín, distr. Humenné, 350 m s. m., ad truncum *Quercus* sp., 28. VI. 1990, leg. J. Kuthan, det. P. Vampola (BRA 90/375).

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Adresa autora: Petr Vampola, Žižkova 87, 586 01 Jihlava, ČSFR.

A new European species of the genus Thanatephorus subgen. Ypsilonidium (Corticiaceae)

Nový evropský druh rodu Thanatephorus subgen. Ypsilonidium (Corticiaceae)

Karel Čížek and *Zdeněk Pouzar*

A new species of the saprophytic resupinate Basidiomycete *Thanatephorus ovalisporus* Čížek et Pouzar collected in Central Slovakia on rather rotten prostrate spruce (*Picea abies*) trunks, branches and cones is described, differing from the closely allied species *Thanatephorus sterigmaticus* (Bourd.) Talbot by presence of hyphal strands, broader basidia and especially by ovoide-ellipsoid spores.

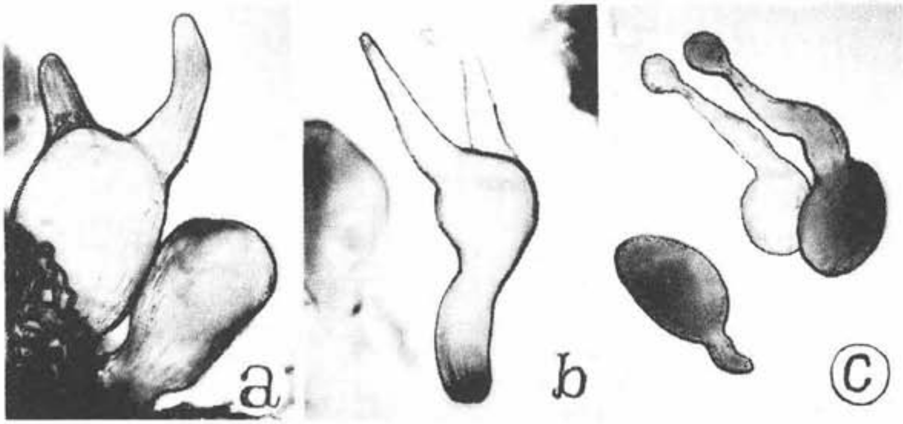
Je popsán nový saprofytický resupinátní zástupce stopkovýtrusých hub *Thanatephorus ovalisporus* Čížek et Pouzar sbíraný na středním Slovensku na silně shnilých ležících kmenech, větvích a šiškách smrku (*Picea abies*), který se liší od blízce příbuzného druhu *Thanatephorus sterigmaticus* (Bourd.) Talbot přítomnosti hyfových svazků, širšími basidiemi a hlavně vejčitě elipsoidními výtrusy.

1. *Thanatephorus ovalisporus* Čížek et Pouzar. Fragment of a carpophore (12x), collected 29. VIII. 1989 by Z. Pouzar in Vrchslatina on a branch of *Picea abies*. Photo: K. Čížek

In 1989 a new species of *Corticiaceae* was collected in a mountain wet spruce forest in elevation cca 950 m above sea level. It occurred here on various places on prostrate rotten trunks and branches and once also on an old cone of spruce (*Picea abies*). The material is sufficiently rich to consider the variability of this species. As no identical species has been found in literature, we are describing it as a new one.

Thanatephorus ovalisporus Čížek et Pouzar spec. nov.

Carposomata resupinata cca 100 - 200 μm crassa, leviter a substrato separabilia, hypochnoidea, dilute reticulata usque pellicularia, cum fasciculis hypharum numerosis. Color carposomatis sordide albidus, postea pallide isabellinus.



2. *Thanatephorus ovalisporus* Čížek et Pouzar, a. developing basidium with a short base (cca 1200x), b. mature basidium with strongly protracted base and a standard length of sterigmata (cca 900x), c. basidiospores germinating by repetition. Observed in Cotton bleu, the contours of structures pointed up by a retouch. Photo: K. Čížek

Hyphae subiculi dilutae, cylindricae, absque nodis, basales paralellae cum substrato, rectae, leviter crassetunicatae cum septis sparsis, 6 - 7.5 - 8.5 µm (raro usque 10 µm) latae. Hyphae subhymeniales breviter septatae, comparative tenuiter tunicatae 4 - 6 µm latae, in angulos rectos ramificatae et fasciculos candelabriformos formantes. Basidia 17-23 x 11-13 µm, in septis basalibus absque nodis, late ovoideae seu breviter capitato-clavatae cum basi brevi seu elongato, cum duobus seu raro tribus sterigmatibus (12) - 15 - 17 - (25) µm longis et 2.5 - 4.2 - 6 µm latis cylindricis rectis seu leviter incurvatis, in parte basali saepe incrassatis.

Basidiosporae (8) - 9.6 - 14 - (17) x 6 - 6.8 - 9 - (10.5) µm, ovoideae usque late elipsoideae, nonnumquam pyriformes, pro parte majore ad basim attenuatae, laeves, tenuiter tunicatae, cum apiculo distincto, sporas secundarias copiose producentes. Cystidiis absentibus. Parietes hypharum, basidiorum et sporarum sunt hyalinae, haud incrustatae, haud amyloideae, haud dextrinoideae sed cyanophilae (in solutione ''Cotton bleu'').

Holotypus: Bohemoslovacia, Slovacia, montes Slovenské rudohorie, sylva boreo a Vrchslatina ap. Lom nad Rimavicou prope Detva; ad ramum *Piceae abietis*, cca 950 m s. m., 29. VII. 1989 leg. Z. Pouzar, PRM 842853.

Paratypi: ibidem, eodem temporeque ad ramos, ramulos et conos *Piceae abietis* PRM 870413, 870414.

Description

Carpophore 100 - 120 µm thick, easily separable from substrate, sparsely reticulate to freely pellicular, dirty whitish to pale isabelline.

Hyphae sparse, in part forming hyphal strands, basale ones parallel with substrate, slightly thick-walled, clampless with sparse septa 6 - 7.5 - 8.5 µm, rarely up to 10 µm broad. Basidia broadly ovoid to capitate-clavate 17-23 x 11-13 µm with mostly two (rarely three) sterigmata (12) - 15 - 17 - (25) µm long and 2.5 - 4.2 - 6 µm broad, mostly straight.

Basidiospores (8) - 9.6 - 14 - (17) x 6 - 6.8 - 9 - (10.5) µm ovoid to broadly ellipsoid, rarely pear-shaped, smooth, thin-walled producing copiously secondary spores. Walls of hyphae, basidia and basidiospores are hyaline, not incrusted, non amyloid, indextrinoid but distinctly cyanophilous (in Cotton bleu).

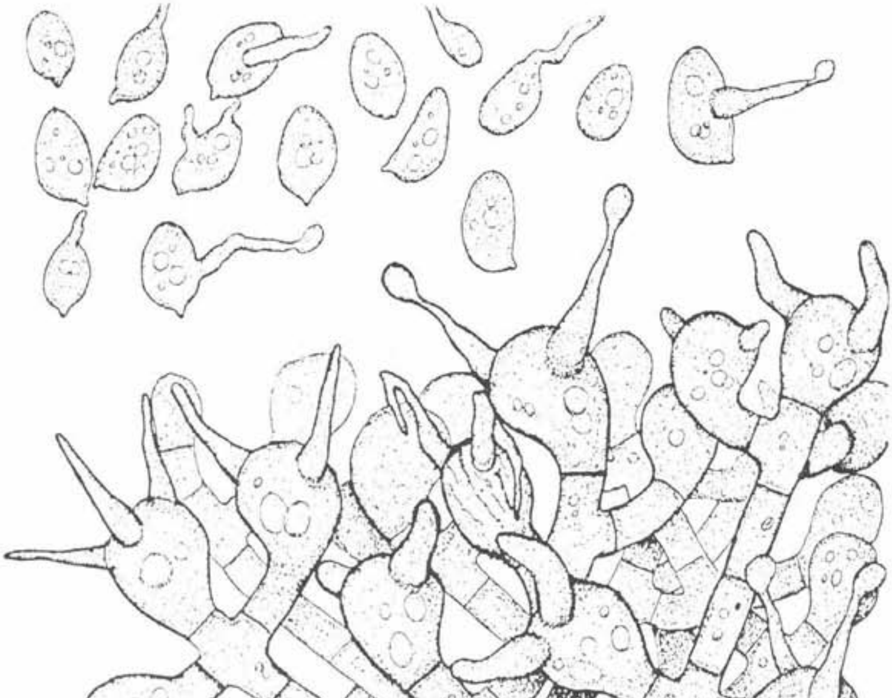
Discussion

The newly described species *Thanatephorus ovalisporus* could be distinguished from other bisporic representatives of the genera *Thanatephorus* Donk (incl. *Ypsilonidium* Donk) and *Ceratobasidium* D. P. Rogers by several characteristic features (see Bourdot et Galzin 1928, Christiansen 1959, Jülich et Stalpers 1980, Eriksson et al. 1989 and Reid 1969).

Thanatephorus ovalisporus could be separated from the closely allied *Thanatephorus sterigmaticus* (Bourd.) Talbot by numerous hyphal cordons, broader basidia and especially by the ovoid-ellipsoid spores. *T. sterigmaticus* is provided by spores which are longer, 15-18 x 5-7 µm and hyphae are not arranged in cordons. *Thanatephorus langlei-regis* D. Reid collected only once on leaves of *Plantago* sp., has besides more slender basidia narrower hyphae, the walls of which are brownish coloured (especially in the lower part of fruitbody). Another species with bisporic basidia is *Ceratobasidium bicorne* Erikss. et Ryv., collected also once on a moss of the genus *Polytrichum* and which differs in more slender hyphae and more prolonged spores, which are ellipsoid to cylindric.

In classifying our new species to the broadly circumscribed and not yet quite exactly defined genus *Thanatephorus* Donk em. Talbot we are stressing the whole anatomical construction, the absence of clamp-connections, the ovoid-ellipsoid basidiospores, the basidia only little broader than the subhymenial hyphae and the formation of secondary spores (conidia) developing from sterigma-like conidiophores on the mature basidio-spores (the so called "germination by repetition"); another possibility is to classify our new species to an independent genus *Ypsilonidium* Donk, an alternative which we could not recommend at the present state of knowledge.

We need more information about the eventual existence of anamorphs, the chemical reactions of hyphal and cell-walls, the behavior of species in culture, the cytology, the anatomy of hyphal septa, the relation of parasitism and saprophytism to clarify the relation between genera in this group and especially the relation between *Aphyllophorales* and *Tulasnellales*.



3. *Thanatephorus ovalisporus* Čížek et Pouzar, a. anatomic structure of carpophore and the main shapes of basidiospores, b. development stages of basidium, sterigmata and basal hyphae.

Del. K. Čížek

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Aktivitäten von ^{137} Cs und ^{134} Cs in einigen Hutpilzen zweier unterschiedlichen Standorte Mittelböhmens in den Jahren 1986 - 1990

Aktivity ^{137} Cs a ^{134}Cs v některých kloboukatých houbách dvou rozdílných lokalit středních Čech v letech 1986 - 1990

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Fünf Jahre lang nach dem Reaktorunfall im Kern-Kraftwerk in Tschernobyl (26. 4. 1986) wurden spezifische Aktivitäten von ^{137}Cs und ^{134}Cs in grösseren Proben verschiedener getrockneter Hutpilze bestimmt. Die Fruchtkörper wurden jeden Herbst auf zwei unterschiedlichen Waldstandorten 70 km südöstlich von Prag gesammelt. Parallel wurden Erdsubstrate verfolgt.

Die Ergebnisse, summarisiert in vier Tabellen, zeigten, dass der Grad der Kontamination durch Radionuklide artspezifisch ist, dass er im Pilzhut höher ist als im Pilzstiel, dass er währrend der verfolgten fünf Jahre vom dritten Jahr eine sinkende Tendenz aufweist und dass er in zwei nahe gelegenen Standorten verschieden war. Bei den Bodenproben beider Standorte hatte die spezifische Aktivität des Spaltproduktes ^{137}Caesium der Oberflächenschicht im Laufe der Jahre eine sinkende Tendenz, während sie in der tieferen Schicht allmählich anstieg.

Po dobu pěti let po havárii v Černobylské jaderné elektrárně (26. 4. 1986) byly měřeny měrné aktivity ^{137}Cs a ^{134}Cs v hmotnostně větších vzorcích sušených plodnic různých kloboukatých hub, sbíraných každý podzim na dvou rozdílných lesních lokalitách 70 km jihovýchodně od Prahy. Souběžně byly sledovány půdní substráty.

Výsledky, sumarizované ve čtyřech tabulkách, ukázaly, že stupeň kontaminace radionuklidy je druhově závislý, že je v klobouku plodnice vyšší nežli ve třeni, že má během pěti sledovaných let od třetího roku klesající tendenci, a že byl ve dvou blízkých lokalitách rozdílný. U vzorků půdy z obou sledovaných lokalit měla měrná aktivita štěpného produktu ^{137}Cs povrchové vrstvy v průběhu let klesající tendenci, zatímco v hlubší vrstvě postupně narůstala.

Material und Methoden

Beide Waldstandorte, auf denen fünf Jahre lang Hutpilze gesammelt wurden, befinden sich im südöstlichen Teil des mittelböhmischen Landkreises und sind von einander 9 km entfernt.

Standort I: Vlastišov bei Zvěstov, vorwiegend Nadelwald (Fichte, vereinzelt Kiefer, Lerche), ausnahmsweise Laubbäume (Eiche, Birke). Hang nach Südosten gekehrt. 420 m ü. M.

Stanfort II: Louňovice pod Blaníkem, vorwiegend Laubwald (junge Eichen, dazwischen kleine Fichtensämlinge und Baumstümpfe). Mässiger Hang nach Norden gerichtet. 396 m ü. M. Insgesamt ärmer an Pilzarten und Pilzmenge.

Das Sammeln der Pilze und Bodensubstrate wurde alljährlich im September bis Oktober durchgeführt (11. IX. 1986, I. X. 1987, 7. X. 1988, 12. IX. 1989 und 10. X. 1990).

Von Pilzen, die auf beiden Standorten in grösseren Mengen wuchsen, wurden Fruchtkörper einzelner Arten gesammelt (Frischmasse durchschnittlich 0,5 - 1,0 kg und mehr). Diese wurden auf Plättchen geschnitten, zum konstanten Gewicht getrocknet und in breithalsigen Polyäthylenflaschen bei Zimmertemperatur aufbewahrt. Insgesamt wurden 14 Arten von Hutpilzen der Klasse Basidiomycetes untersucht und zwar 9 Arten von Mykorrhizapilzen und 4 Arten von Holzpilzen. Arten und Menge der Fruchtkörper waren in Folge unterschiedlicher klimatischen Bedingungen in den einzelnen Jahren ungleich und es war daher nicht möglich die einzelnen Pilzarten in jedem Jahr zu sammeln. Die grösste Menge an Fruchtkörpern (über 7 kg) wurde im Jahre 1986 gewonnen. Am reichsten an Arten war das Jahr 1989, am ärmsten das Jahr 1988. Die Arten *Lactarius rufus* (1986, 1987), *Tylopilus felleus* (1987) und *Armillaria mellea* (1988) wurden in genügender Menge gefunden, so dass es möglich war getrennt auch Hutpilze und Hutstiele zu analysieren. Vom Standort I wurden 12 Arten, nämlich *Armillaria mellea* (1988), *Boletus badius* (1987, 1988), *Collybia maculata* (1989), *Hygrophoropsis aurantiaca* (1990), *Hypholoma fasciculare* (1989), *Lactarius rufus* (1986, 1987, 1989, 1990), *L. turpis*

(1989), *Paxillus involutus* (1989, 1990), *Strobilomyces floccopus* (1987), *Tricholomopsis rutilans* (1989), *Tylopilus felleus* (1986, 1987, 1989) und *Xerocomus chrysenteron* (1986) untersucht. Vom Standort II wurden 7 Arten, nämlich *Collybia maculata* (1989), *Hypholoma fasciculare* (1989), *H. sublateritium* (1987, 1988), *Lactarius rufus* (1986, 1987), *Paxillus involutus* (1989, 1990), *Russula cyanoxantha* (1990) und *Tylopilus felleus* (1989) verfolgt. Für Vergleichszwecke wurden von beiden Standorten alljährlich Bodenproben entnommen und untersucht und zwar die Oberflächenschicht (bis 2 cm) und die tiefere Schicht (unter 2 cm).

Das Trockengewicht der Fruchtkörper einzelner Proben betrug 5,2 - 16,7 %, der Substrate 37,2 - 92,4 %. Die für Messungen geforderte Trockenmasse war minimal 50 g, optimal 100 g und mehr. Einige Proben wurden für das Messen der Radiocaesium-Aktivität bei Temperatur des kochenden Wasserbades mit Stickstoffsäure mineralisiert, bei Zugabe von Chlorwasserstoffsäure und 100 mg Cs als Isotop-Träger. Nach der Mineralisierung wurde der Rest der Mineralsäuren gleichfalls bei Temperatur des kochenden Wasserbades abgedampft, das Mineralisat wurde quantitativ in das ursprüngliche Messgefäss überführt und mit destilliertem Wasser auf das ursprüngliche Volumen der trockenen Probe ergäntz. Nach dem Messen des Mineralisates wurde eine bekannte Menge der Aktivität von ^{137}Cs und ^{134}Cs hinzugefügt und die Messung wiederholt. Ausser der Bestimmung der spezifischen aktivität der mineralisierten Probe mit Hilfe der Standard-Zugabe wurde so auch die Korrektion auf Selbstabsorbtion für die gegebene Matrize und Geometrie vorgenommen.

Für die Bestimmung der Radioaktivität wurde das Spektrometer der Gamma-Strahlung genutzt, das aus dem System CICERO-8k (Silena, Milano) und HPGe-Detektor (Canberra) - FWHM 1.72 ke V, Effektivität 20 %, bestand. Die spezifische Aktivität von ^{137}Cs und ^{134}Cs der untersuchten Proben wurde gammaspektrometrisch unter Anwendung von Etalonlösungen der angeführten Radionuklide bestimmt. Zertifizierte Etalonlösungen von ^{137}Cs und ^{134}Cs der ER-Reihe (Institut für Forschung, Produktion und Nutzung von Radioisotopen, Prag). Bei der Datenverarbeitung wurden für Kalibrationsstandarde empfohlene Halbwertzeiten verwendet (Lorenz, 1983): für das Radionuklid ^{137}Cs 30,18 Jahre und für ^{134}Cs 2,066 Jahre. Die spezifischen Aktivitäten von ^{137} Cs und ^{134}Cs sind zum Datum des Reaktorunfalls 26. 4. 1986 umgerechnet. Sowohl die Proben, wie auch die Standarde wurden in Polyäthylenflaschen gemessen. Die Flaschen wurden zu solchen Volumen gefüllt, für die Kalibrationsmessungen durchgeführt worden waren.

Ergebnisse und Diskussion

Spezifische Aktivitäten von ^{137}Cs und ^{134}Cs in Pilzen, die in den Jahren 1986-1990 auf den Standorten I und II gesammelt worden waren, sind in den Tabellen I, II und III zusammengefasst, spezifische Aktivitäten von ^{137}Cs in Bodensubstraten in Tabelle IV. Das isotope Verhältnis ^{137}Cs/^{134}Cs der untersuchten Pilze und Substrate bewegte sich um den Wert 2, was der isotopen Zusammensetzung des Radiocaesiums der Tschernobyl-Kontamination entspricht (Vobecký und Těthal, 1991). Nach Feststellungen der Autoren (Vobecký und Těthal, 1991) überschritt die Kontamination von Tschernobyl in essbaren Röhrlingen im Jahre 1985 nicht das Niveau von 0,5 kBq ^{137}Cs/kg Trockengewicht. Auf Grund von uns gewonnener spezifischen Aktivitäten lassen sich trotz der durch Naturbedingungen beeinflussten Unvollständigkeiten aus den Tabellen folgende Erkenntnisse herauslesen:

1. Der Grad der Kontamination durch Radionuklide ^{137}Cs und ^{134}Cs ist artspezifisch. Von den 14 untersuchten Pilzarten hatten die höchsten spezifischen Aktivitäten von ^{137}Cs (über 30 kBq pro kg Trockengewicht) *Lactarius rufus*, *Boletus badius, Paxillus involutus* und *Tylopilus felleus*. Im Gegenteil sehr niedrige ^{137}Cs Werte (unter 1,5 kBq pro kg Trockengewicht) wiesen die Pilzarten *Russula cyanoxantha*

und *Armillaria mellea* auf (Tab. I). Diese Ergebnisse sind im Einklang mit den Arbeiten von Z. Řanda et al. (1988) und J. Klán et al. (1988). Diese Autoren verglichen kleine Proben vieler Pilzarten, die vor dem Jahre 1986 und dann im Herbst 1986 und im Jahre 1987 auf zahlreichen Standorten gesammelt worden waren. Zu den stärksten Akkumulatoren reihen sie ebenfalls alle vier, von uns angeführten Pilzarten. Als schwächste Akkumulatoren führen sie acht Pilzgattungen an, zu denen auch *Russula* und Holzpilze zählen. Auch schon H. Grüter (1971), der vor mehr als 20 Jahren die Kontamination von ^{137}Cs nach Kernwaffentesten in der Atmorphäre untersuchte, fand höhere Werte der spezifischen Aktivität von ^{137}Cs bei den Pilzarten *Paxillus involutus* und *Boletus badius*. Nach dem Unglück in Tschernobyl, besonders in Gebieten mit hohem radioaktiven Fallout, zu denen auch der südöstliche Teil des mittelböhmischen Landkreises einschliesslich beider von uns untersuchten Standorte zählt, aber auch andere Gebiete Europas, wie z. B. die Bundesrepublik Deutschland (Rückert, 1987; Molzahn et al. 1989; Elstner et al. 1989), Österreich (Teherani, 1987), Schweden (Mascanzoni, 1987), wurden in Pilzen markant höhere spezifische Aktivitäten von ^{137}Cs und ^{134}Cs gefunden. Bei der Pilzart *Laccaria amethystina* ^{137}Cs sogar bis 150,7 kBq/kg Trockengewicht (Řanda et al., 1988).

2. In Fruchtkörperhüten wurden bedeutend höhere spezifische Aktivitäten von ^{137}Cs und ^{134}Cs festgestellt als in Fruchtkörperstielen und das ungefähr doppelt so hohe, worauf Werte in Tab. II der geprüften Pilzarten *Lactarius rufus, Tylopilus felleus* und *Armillaria mellea* hinweisen. W. Bötticher (1974) führt an, dass die Anzeicherung der Radionuklide in den Lamellen geringfügig höher ist als im sich nach K. Rohleder (1967) in den Pilzhüten ein grösserer Gehalt an ^{137}Cs befindet, und ein kleinerer Gehalt an Strontium 90 als in den Stielen. Unsere Ergebnisse harmonieren weiter neuerdings mit Rückert und Diehl (1987), die auch in Fruchtkörperhüten höhere Werte von Radiocaesium ermittelten.

3. Spezifische Aktivitäten von ^{137}Cs und ^{134}Cs mancher Proben, insbesondere der Pilzart *Lactarius rufus*, zeigten im Jahre 1987 einen Anstieg gegenüber dem Jahre 1986. In den weiteren Jahren 1988, 1989 und 1990 hatten sie dann meist eine sinkende Tendenz (mit Ausnahme von *Tylopilus felleus*), wie aus Tab. I. ersichtlich ist. Einen Anstieg der Radioaktivität bei essbaren Pilzarten *Boletus badius, Kuehneromyces mutabilis* und *Xerocomus chrysenteron* im Jahre 1987 stellte auch G. Rückert (1988) fest, der gleichzeitig bei anderen Proben gleicher als auch anderer Pilzarten Senkungen verzeichnete. Z. Řanda et al. (1989) untersuchten getrocknete Speisepilze auch im Jahre 1988, nehmen an, dass die Radioaktivität das

Maximum erreichte und der Gehalt an Radiocaesium in den weiteren Jahren zu sinken beginnt, was unsere Ergebnisse nicht ausschliessen.

4. Aus Vergleichen der spezifischen Aktivitäten von ^{137}Cs und ^{134}Cs derselben Pilzarten von beiden untersuchten Standorten geht hervor, dass ein wesentlich höherer Grad der Kontamination in Pilzen des Standortes I (vorwiegend Nadelwald) ermittelt wurde, wie aus Tab. III hervorgeht. Alle fünf untersuchte Pilzarten des Standortes II (Laubwald) hatten in allen Jahren wesentlich niedrigere spezifische Aktivitäten von Radiocaesium. Einen bestimmten Einfluss könnte die Lage der Standorte und deren hydrometeorologische Situation im Jahre 1986 gehabt haben. Eine grosse Rolle spielt hier zweifellos die Bodenzusammensetzung. Darauf weist auch W. Bötticher (1974) hin, der nach H. Grüter (1964, 1967) anführt, dass die höchsten Gehalte an Radiocaesium im Nadelwald (Kiefernadelböden) und wesentlich niedrigere im Laubwald festgestellt wurden.

5. Die Kontamination der Bodensubstrate, in denen die Pilze auf beiden Standorten wuchsen, zeigt abschliessend Tab. IV. Im Nadel- wie auch im Laubwald wurden sowohl die Oberflächenschicht bis 2 cm Tiefe, wie auch die tiefere Bodenschicht unter 2 cm untersucht, wobei die Bodenproben alljährlich von fast gleicher Stelle entnommen wurden. In der Oberflächenschicht beider Standorte hatten die speizifischen Aktivitäten ^{137}Cs im Laufe der Jahre eine sinkende Tendenz im Nadelwaldbestand von 3,2 kBq (1987) auf 1,25 kBq (1990), im Laubwald von 1,0 kBq (1987) auf 0,35 kBq (1990), während sie in der tieferen Schicht einen langsamen Anstieg zeigten im Nadelwald von 2,25 kBq (1987) auf 5,70 kBq (1990), im Laubwald von 0,10 kBq (1987) auf 0,80 kBq (1990).

Insgesamt lässt sich aus den Messungen der Pilz- und Boden- proben schliessen, dass der radioaktive Fallout auf dem Standort II (vorwiegend Eichenbestand), obwohl er vom Standort I (vorwiegend Fichtenbestand) nur 9 km entfernt ist, im Jahre 1986 wesentlich geringer war.

Die Senkung der Radiocaesium-Kontamination der Hutpilze wird wesentlich von Prozessen beeinflusst, die mit seiner Migration in gegebener Umwelt zusammenhängen, was in konkreten Fällen durch die biogeochemische Situation gegeben ist und von hydrometeorologischen Bedingungen im untersuchten Zeitabschnitt beeinflusst wird. Das Radiocaesium dringt allmählich in tiefere Bodenschichten und gelangt somit in ein Milieu, das dem Myzel weniger zugänglich ist. In geringerem Masse beteiligt sich am Sinken der Pilzkontamination der radioaktive Zerfall des ^{137}Cs (Halbwertzeit 30 Jahre).

Tab. 1

Spezifische Aktivitäten von ^{137}Cs und ^{134}Cs (kBq pro kg Trockengewicht) in Pilzfruchtkörpern der Jahre 1986 - 1990 von zwei Standorten

Pilzart	1986	1987	1988	1989	1990
Standort I					
Lactarius rufus	15,96 8,21	33,57 17,68		22,27 11,99	9,16 4,53
Tylopilus felleus	8,35 4,07	28,79 13,73		32,86 17,34	
Xerocomus chrysenteron	8,99 5,02				
Boletus badius		42,28 22,94	19,65 10,22		
Strobilomyces floccopus		11,64 5,56			
Armillaria mellea				1,10 0,49	
Collybia maculata				5,47 2,97	
Hypholoma fasciculare				6,19 2,98	
Lactarius turpis				22,80 11,66	
Paxillus involutus				32,30 17,72	9,49 4,88
Tricholomopsis rutilans				15,20 8,15	
Hygrophoropsis aurantiaca					6,21 2,85
Standort II					
Lactarius rufus	0,55 0,28	13,76 7,01			
Hypholoma sublateritium		0,90 0,47	1,02 0,56		
Collybia maculata				1,84 0,76	
Hypholoma fasciculare				3,13 1,19	
Paxillus involutus				1,47 0,61	6,18 3,22
Tylopilus felleus				6,34 3,10	
Russula cyanoxantha					0,12 n.d.

Tab. II

Spezifische Aktivitäten von ^{137}Cs und ^{134}Cs (kBq pro kg Trockengewicht) in verschiedenen Fruchtkörperteilen

Pilzart	Sammeljahr	Fruchtkörperteil	^{137}Cs	^{134}Cs
Lactarius	1986	Pilzhüte	21,87	11,20
rufus	..	Pilzstiele	10,05	5,23
Lactarius	1987	Pilzhüte	44,34	23,59
rufus	..	Pilzstiele	23,17	12,46
Tylopilus	1987	Pilzhüte	49,05	20,10
felleus	..	Pilzstiele	24,00	11,30
Armillaria	1988	Pilzhüte	1,37	0,67
mellea	..	Pilzstiele	0,73	0,34

Tab. III

Spezifische Aktivitäten von ^{137}Cs und ^{134}Cs (kBq pro kg Trockengewicht) in Fruchtkörpern derselben Arten von zwei Standorten

Pilzart	Sammeljahr	Standort I		Standort II	
		^{137}Cs	^{134}Cs	^{137}Cs	^{134}Cs
Lactarius rufus	1986	15,96	8,21	0,55	0,28
Lactarius rufus	1987	33,57	17,68	13,76	7,10
Collybia maculata	1989	5,47	2,97	1,84	0,76
Hypholoma fasciculare	1989	6,19	2,98	3,13	1,19
Tylopilus felleus	1989	32,86	17,34	6,34	3,10
Paxillus involutus	1989	32,30	17,72	1,47	0,61
Paxillus involutus	1990	9,49	4,88	6,18	3,22

Tab. IV

Spezifische Aktivitäten von ^{137}Cs (kBq pro kg Trockengewicht) in Bodensubstraten der Jahre 1986 - 1990 von zwei Standorten

Standort	Schicht	1986	1987	1988	1989	1990
I Nadelwald (vorwiegend Fichte) Hang zum Südosten	Oberfläche bis 2 cm	6,1	3,2	3,0	3,35	1,25
	unter 2 "	-	2,25	-	2,80	5,70
II Laubwald (junge Eichen) Hang zum Norden	Oberfläche bis 2 cm	3,1	1,00	0,85	-	0,35
	unter 2 "	-	0,10	0,25	0,50	0,80

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Enzyme activity of mycelial cultures of saprotrophic macromycetes (Basidiomycotina). III A taxonomic application

Enzymatická aktivita myceliových kultur saprotrofních makromycetů (Basidiomycotina). III Využití v taxonomii

Jaroslav Klán, Dana Baudišová and *Zdeněk Skála*

Mycelial cultures of 92 species belonging to 40 genera of saprotrophic basidiomycetous fungi (orders *Agaricales, Aphyllophorales, Gastrosporiales, Lycoperdales* and *Nidulariales*) were tested with respect to the production of extracellular hydrolytic enzymes and oxidoreductases (laccase, peroxidase, tyrosinase, diaminooxidase, proteases, amylases, urease, p-cresol oxidases and hydrolyse of tyrosine) using simple plate and spot tests. The results obtained were evaluated by means of factor analysis methods. Distribution of enzyme activities in individual species was discussed.

Myceliové kultury 92 druhů saprotrofních basidiomycetů (z řádů *Agaricales, Aphyllophorales, Gastrosporiales, Lycoperdales* a *Nidulariales*) byly otestovány jednoduchými plotnovými a kapkovými testy na produkci extracelulárních hydrolytických enzymů a oxidoreduktáz (lakkázy, peroxidázy, tyrosinázy, diaminooxidázy, proteáz, amyláz, ureázy, p-kresol oxidáz a hydrolýzy tyrosinu). Výsledky jsou zpracovány pomocí metod faktorové analýzy. Diskuse je zaměřena na distribuci enzymatických aktivit u jednotlivých druhů.

Introduction

The present work is an extension of the previous studies (Klán and Baudišová 1990a, 1990b) in which the enzyme activity of mycelial cultures of saprotrophic macromycetes was investigated. In the first two parts the methods of plate diffusion and spot tests were elaborated including the study of literature data and evaluation of possible uses of individual detection agents. In the present work ten enzyme activities (oxidoreductases and hydrolases) were tested in mycelial cultures of 92 species (43 genera) of *Basidiomycotina* belonging to five orders (*Agaricales, Aphyllophorales, Gastrosporiales, Lycoperdales, Nidulariales*). In forty species the enzyme activities have not yet been investigated. The present study thus represents the most extensive study screening with respect to the heterogenity of species and enzymes studied. The results could serve for more detailed chemotaxonomic studies of individual taxons or for selection of species for a further biochemical study.

In an extensive study of oxidoreductases in mycelial cultures of wood-decaying fungi Käärik (1965) tested a collection of *Basidiomycetes*. Das et al. (1979) tested the production of certain hydrolases (e.g. amylases or proteinases) in 25 polyporous species and 19 enzyme activities (esterases, aminopeptidases, oxidases) were studied by Fiasson and Bernillon (1983) in mycelial cultures of 36 polyporous species. A larger collection of *Basidiomycetes* was used in their studies of proteolytic enzymes e.g. by Buchalo et al. (1971) - 36 species or by Mišurcová et al. (1987) - 91 species.

Material and Methods

All cultures were from the Culture Collection of Fungi of the Institute of Toxicology, Faculty of Medicine, Charles University in Prague (Klán and Štipek 1987). Before testing the fungi were precultivated on Petri dishes with malt extract agar (Imuna) containing malt extract 35 g, bactopeptone 5 g, agar 13 g in 1 l of double distilled water, pH 6 - 6.5.

Enzyme tests were described in detail previously (Klán and Baudišová 1990a - hydrolases, Klán and Baudišová 1990b - oxidoreductases).

Studied enzymes:

Oxidoreductases: 1. Spot tests: laccase (syringaldazine as substrate), peroxidases (p-phenylenediamine tartrate and 3% hydrogen peroxide), diaminooxidase (ethyloxethyl-p-phenylenediamine, photographic developer Agfa T 32), "phenoloxidase" = p-cresol oxidases (p-cresol):

Plate diffusion methods: tyrosinase (L-tyrosine).

Hydrolases: 1. Plate diffusion methods: amylase (starch and Lugol solution), proteases (casein or gelatine), hydrolyse of tyrosine (L-tyrosine), urease (urea and phenol red.).

In most species 2-3 strains were tested. However, as the results did not quantitatively differ, only a single species is presented here (as OTU). Differences in the quantity of individual enzymes produced by several strains of a single species cannot be excluded. However they could not be detected accurately, due to the semiquantitative nature of the tests. Some statistic methods of the program block Statgraphics, version 2.6, were used for the treatment of the results. Factor analysis with rotation method Varimax, convergence criterion 10^{-3}, was used as a decreased dimension method, properties were not standardized. "Sun ray plots" method was only used as a trial procedure for a simple expression of similarities of enzyme activities in selected species.

Results and Discussion

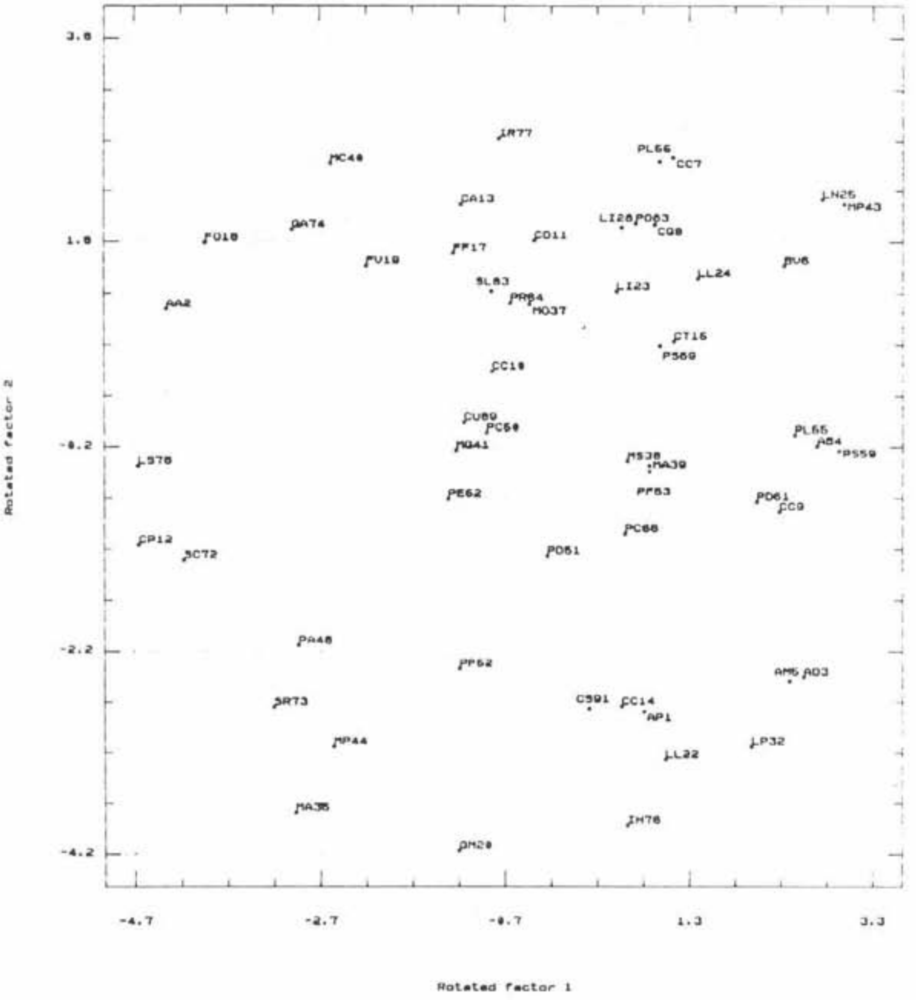
The results concernig enzyme acitivities in 92 species of *Basidiomycotina* are summarized in Table 1. The species are arranged alphabetically according to the system *Agaricales, Aphyllophorales, Gasteromycetes*. For a simple evaluation of the occurrence of enzymatic activities in individual fungal species the method of factor analysis was used. Due to the number of the fungal species studied and to binary coded properties a number of objects of graphs of the first two factor after rotation overlap (see Fig. 1). In the Fig. 2 the studied properties (enzymes) are projected again into the plane of the first two factors after rotation. The distance of the points in the plane indicates their mutual similarity. Plots of the first two factor scores (for species) and weights (for properties) saturate 45.3% of the overall variability.

Sun ray plots (see Fig. 3) show a graphically demonstrated occurrence of enzyme activities. The method was only used for an optical comparison of a mutual similarity of species on the basis of their enzyme apparatus in selected examples (family *Tricholomataceae)*.

It follows from the results obtained in 92 species of *Basidiomycotina* that the studied enzyme activities occur rather frequently in mycelial cultures. If 10 enzymes were studied that would be completely independent, 1024 combinations (2^{10}) should be observed which should be sufficient for determination of 9^2 species. However, the activities are interconnected and, hence, in a number of cases objects in the Figure of the first two

FIG. 1

Plot of First Two Factor Scores



factors overlap after rotation (Fig. 1). A total of 56 combinations of enzyme activities occurred, of them 35 points represented a single species (e. g. all three *Pleu-rotus* species investigated). The presence of all studied enzyme activities and the absence of the hydrolytic degradation of tyrosine was the most frequent combination being observed in 7 species (*Bolbitius vitellinus* BV6. *Lepista nuda* LN26. *L. personata* LS27. *L. sordida* LS29. *Oudemansiella mucida* OM 45. *Pholiota spumosa* PS58. *Polyporus rhizophilus* PR81). Five species (e. g. *Calocybe gambosa* CG8, *Pholiota adiposa* PA47, *P. cerifera* PA49, *P. gummosa* PG54, *P. jahnii* PM57) did not produce peroxidase, urease and did not hydrolyse tyrosine. One tetrad, five trinities and 13 species pairs with an identical enzyme combination also occurred.

If we realize that the distance of the points on the plane reflects their mutual similarity it cannot be concluded that a certain enzyme apparatus would be characteristic for individual taxons or ecological groups (e.g. polyporous *Ischnoderma resinosum* has the same enzyme apparatus as does the steppe hypogeic gasteromycete *Gastrosporium simplex*). The only taxon which is relatively homogenous with respect to enzyme activity appears to be the genus *Lepista* (7 species). In the collection studied activities of proteolytic enzymes (ENZGEL, ENZCAS) are significantly positively associated. They also represent a relatively isolated group with respect to the enzyme activities investigated. Therefore, the proteolytic activity is a significant chemotaxonomic marker and should be determined in addition to oxidase tests that have so far been performed much more frequently. However, it is sufficient to use only one of the substrates (Klán and Baudišová 1990a). Terminal oxidases, i.g. laccase (syringaldazine as substrate), tyrosinase (L-tyrosine) and peroxidase (p-phenylendiaminetartrate and hydrogen peroxide) are independent on each other. P-cresol used sometimes for determination of non-specific tyrosinase (Käärik 1965, Marr 1979) but also oxidized by laccase is positively associated with laccase and tyrosinase (Fig. 2). The factor analysis indicates that oxidation and hydrolysis of tyrosine are mutually independent processes as the points of these activities (ENZTYR and HYTYR) are quite distant in Fig. 2. Catalase, glucose-2-oxidase and lipase (tributyrin) are not presented here as the results of tests were all positive. In addition, the results of milk clotting enzymes tests are also not presented here as in this case the results obtained in different strains of the same species were sometimes different.

The spectrum of the enzymes presented here (laccase, tyrosinase, peroxidase, amylase, proteases, urease, diaminooxidase, hydrolyse of tyrosine) occasionally supplemented by some other enzyme activities involved in decomposition of natural substrates (cellulases, pectinases, xylanases, ligninases) should be sufficient for characterization of a larger, heterogenous collection of mycelial cultures of fungi. A detailed study should include a

FIG 2

Plot of First Two Factor Weights

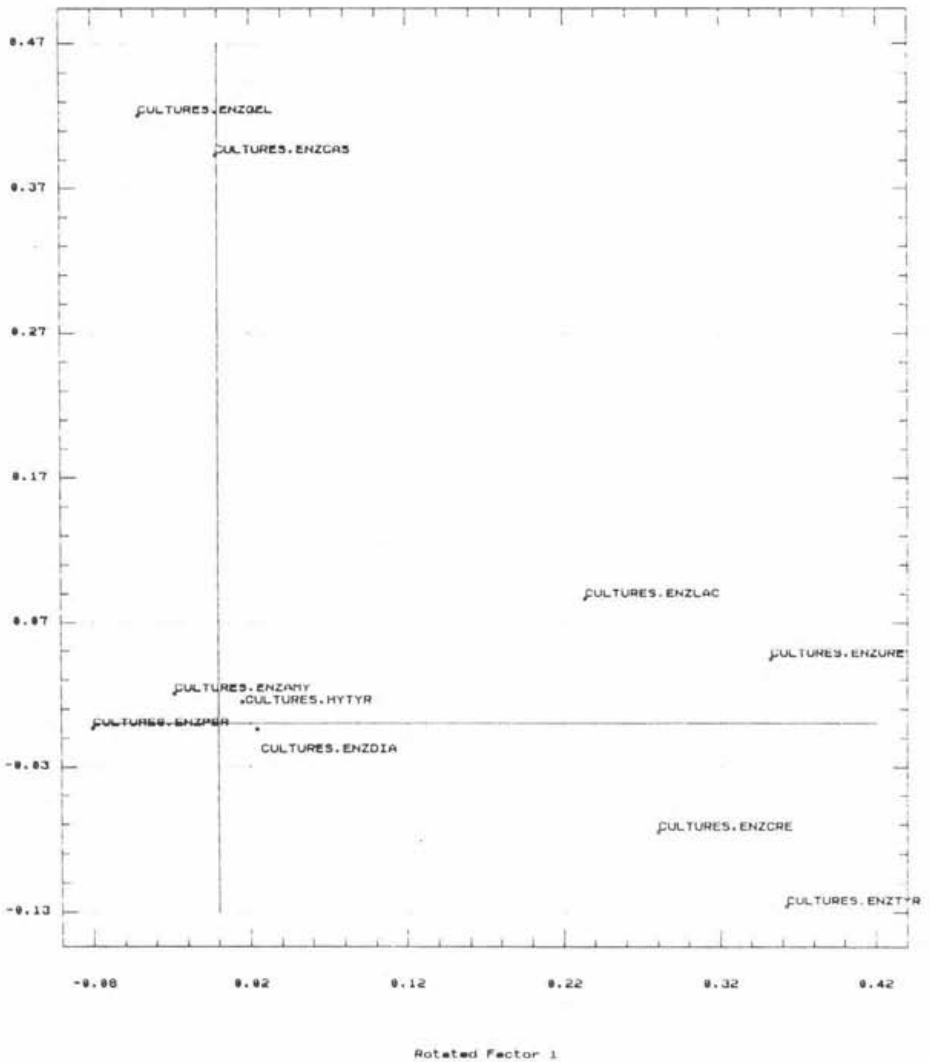
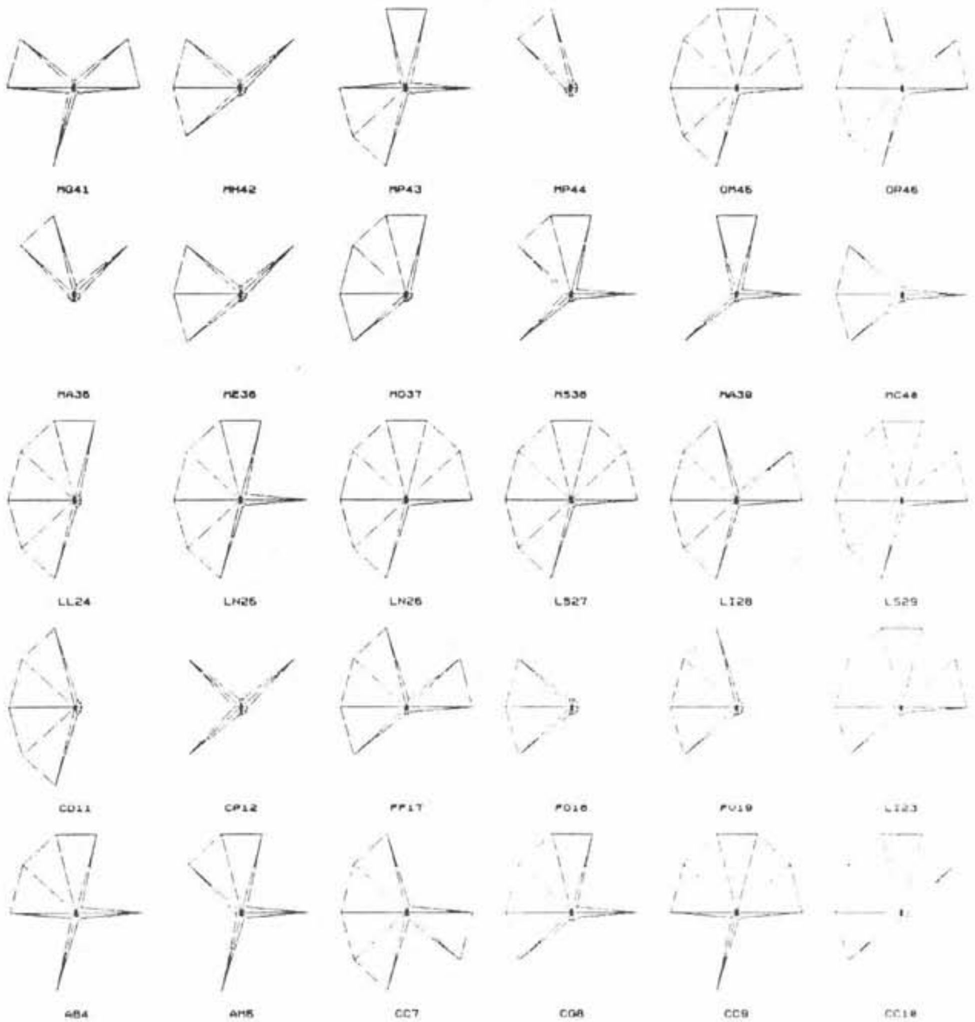
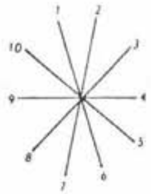


FIG. 3

STAR SYMBOL PLOTS

Family Tricholomataceae





Explanatory notes: 1.- p-cresol oxidases, 2.- tyrosinase, 3.- peroxidase, 4.-laccase, 5.- hydrolyse of tyrosine, 6.- diaminooxidase, 7.- urease, 8.- gelatinase, 9.-caseinase, 10.- amylase

TABLE 1: RESULTS OF ENZYMATIC ACTIVITIES

Agaricales	ISOLATED	SYMBOL	1	2	3	4	5	6	7	8	9	10
Agaricus porphyrizon Orton	(1981)	AP 1	1	0	1	1	0	0	0	0	1	0
Agrocybe arenaria (Peck.) Sing.	(1983)	AA 2	0	1	0	0	1	1	1	0	1	0
A. dura (Bolt.: Fr.) Sing.	(1983)	AD 3	1	0	1	1	1	0	0	1	1	1
Armillaria borealis Marx. et Korh.	(1982)	AB 4	1	0	1	1	1	1	0	1	1	0
A. mellea (Vahl. in Fl. Dan.: Fr.) Karst.	(1983)	AM 5	1	0	1	1	1	0	0	1	1	0
Bolbitius vitellinus (Pers.: Fr.) Fr.	(1978)	BV 6	1	1	1	1	1	1	1	1	1	0
Calocybe constricta (Fr.) Kühn.	(1984)	CC 7	1	0	0	1	1	1	1	1	1	1
C. gambosa (Fr.) Sing.	(1981)	CG 8	1	0	1	1	1	1	1	0	1	0
- " -	(1986)		1	0	1	1	1	1	1	0	1	0
Clitocybe clavipes (Pers.: Fr.) Kumm.	(1982)	CC10	0	1	1	1	1	1	1	0	1	0
C. phyllophila (Fr.) Kumm. s. l.	(1982)	CC 9	1	1	1	1	1	1	0	1	1	0
Collybia dryophila (Bull.: Fr.) Kumm.	(1982)	CD11	0	0	0	1	1	1	1	1	1	0
C. peronata (Bolt.: Fr.) Kumm.	(1981)	CP12	0	1	0	0	1	0	1	0	1	0
Coprinus atramentarius (Bull.: Fr.) Fr.	(1983)	CA13	1	1	0	0	1	1	1	1	1	0
C. comatus (Müll. in Fl. Dan.: Fr.) Pers.	(1981)	CC14	1	0	1	1	1	0	0	0	1	0
- " -	(1982)		1	0	1	1	1	0	0	0	1	0
C. micaceus (Bull.: Fr.) Fr.	(1977)	CM15	1	0	0	1	1	1	1	1	1	1
Cystoderma terrei (Berk. et Br.) Harm.	(1984)	CT16	0	1	1	1	1	1	1	1	1	1
Flammulina fennae Bas		FF17	1	1	0	1	1	1	1	0	1	0
F. ononidis Arnolds	(1979)	FO18	0	0	0	0	1	1	1	0	1	0
- " -	(1981)		0	0	0	0	1	1	1	0	1	0
F. velutipes (Curt.: Fr.) Karst.	(1979)	FV19	0	0	0	1	1	1	1	0	1	0
Galerina marginata (Batsch) Kühn.	(1983)	GM20	0	1	1	1	1	0	0	0	1	1
Gymnopilus hybridus (Fr.: Fr.) Sing.	(1984)	GH21	1	0	1	1	1	1	0	1	1	0

Lacrymaria lacrymabunda (Bull.: Fr.) Pat.	(1983)	PV67	0	1	1	1	1	0	0	0	1	0
Lentinus lepideus (Fr.: Fr.) Fr.	(1983)	LL22	0	0	1	1	1	0	0	1	1	0
Lepista inversa (Scop.: Fr.) Pat.	(1981)	LI28	1	1	0	1	1	1	1	1	1	0
- " -	(1985)		1	1	0	1	1	1	1	1	1	0
L. irina (Fr.) Bigelow	(1984)	LI23	1	1	1	1	1	1	1	0	1	0
L. luscina (Fr.) Sing.	(1981)	LL24	0	0	1	1	1	1	1	1	1	0
- " -	(1984)		0	0	1	1	1	1	1	1	1	0
L. nebularis Batsch: Harm.	(1981)	LN25	1	0	1	1	1	1	1	1	1	0
L. nuda (Bull.: Fr.)Cke	(1981)	LN26	1	1	1	1	1	1	1	1	1	0
-"-	(1983)		1	1	1	1	1	1	1	1	1	0
-"-	(1982)		1	1	1	1	1	1	1	1	1	0
L. personata (Fr.: Fr.) Cke	(1984)	LS27	1	1	1	1	1	1	1	1	1	0
L. sordida (Schum.: Fr) Sing.	(1970)	LS29	1	1	1	1	1	1	1	1	1	0
Leucocoprinus bresadolae (Schulz.) Wass.	(1985)	LB30	1	0	1	1	1	0	0	0	1	0
L. denudatus (Rabh.) Sing.	(1981)	LD31	1	0	1	1	1	0	0	1	1	0
Leucoagaricus leucothites (Vitt.) Wass.	(1983)	LP32	1	1	1	1	1	0	0	1	1	0
Macrolepiota excoriata (Schff.: Fr.) Wass.	(1981)	ME33	0	0	1	1	1	0	0	1	1	0
M. rhacodes (Vitt.) Sing.	(1984)	MR34	1	0	1	1	1	0	0	0	1	0
Marasmius alliaceus (Jacq.: Fr) Fr.	(1975)	MA35	0	1	0	1	1	0	0	0	1	0
M. epiphyllus (Pers.: Fr.) Fr.	(1982)	ME36	0	1	0	0	1	1	1	0	1	0
M. oreades (Bolt.: Fr.) Fr.	(1981)	MO37	0	0	1	1	1	1	1	0	1	0
-"-	(1984)		0	0	1	1	1	1	1	0	1	0
M. scorodonius (Fr.: Fr.) Fr.	(1981)	MS38	1	0	1	1	1	0	1	0	1	0
Mycena abramsii Murr.	(1982)	MA39	1	0	1	1	0	0	1	0	1	0
M. crocata (Schrad.: Fr.) Kumm.	(1975)	MC40	1	0	0	0	1	1	1	0	1	0
M. galericulata (Scop.: Fr.) Quél.	(1983)	MG41	1	1	0	0	1	1	0	1	1	0
M. haematopus (Pers.: Fr.) Kumm.	(1977)	MH42	0	1	0	0	1	1	1	0	1	0
M. pseudopicta (Lge) Kühn.	(1981)	MP43	1	0	1	1	0	1	1	1	1	0

M. pura (Pers.: Fr.) Kumm.	(1982)	MP44	0	0	0	1	1	0	0	0	1	0
Oudemansiella mucida (Schrad.: Fr.) Höhn.	(1982)	OM45	1	1	1	1	1	1	1	1	1	0
O. radicata (Relhan: Fr.) Sing.	(1982)	OR46	1	1	0	1	1	1	1	1	1	0
Pholiota adiposa (Fr.) Kumm.	(1983)	PA47	1	1	0	1	1	1	1	0	1	0
P. alnicola (Fr.) Sing.	(1983)	PA48	1	0	0	0	1	0	0	0	1	0
P. carbonaria (Fr.) Sing.	(1986)	PC50	1	0	0	1	1	1	0	0	1	0
P. cerifera (Karst.) Karst.	(1984)	PA49	1	0	1	1	1	1	1	0	1	0
P. destruens (Brond.) Quél. s. l.	(1965)	PD51	0	0	1	1	0	1	0	0	1	0
-"-	(1983)		0	0	1	1	0	1	0	0	1	0
P. flammans (Fr.) Kumm.	(1982)	PF52	1	0	0	1	1	0	0	0	1	0
P. flavida (Schff.: Fr.) Sing.	(1980)	PF53	1	0	1	1	1	1	0	0	1	0
-"-	(1983)		1	0	1	1	1	1	0	0	1	0
P. gummosa (Lasch) Sing.	(1975)	PG54	1	0	1	1	1	1	1	0	1	0
-"-	(1982)		1	0	1	1	1	1	1	0	1	0
P. jahnii Tjall. et Bas	(1979)	PM57	1	0	1	1	1	1	1	0	1	0
P. lenta (Pers.: Fr.) Sing.	(1983)	PL55	1	0	1	1	1	0	1	1	1	0
P. lucifera (Lasch) Quél.	(1978)	PL56	1	0	0	1	1	1	1	1	1	0
P. spumosa (Fr.) Sing.	(1983)	PS58	1	1	1	1	1	1	1	1	1	0
P. squarrosa (Müll.: Fr.) Kumm.	(1985)	PS59	1	0	1	1	0	1	0	1	1	0
-"-	(1986)		1	0	1	1	0	1	0	1	1	0
Pleurotus dryinus (Pers.: Fr.) Kumm.	(1982)	PD61	1	1	1	1	1	0	1	1	1	0
P. eryngii (DC.: Fr.) Quél.	(1975)	PE62	1	1	0	1	1	1	0	0	1	0
-"-	(1981)		1	1	0	1	1	1	0	0	1	0
P. ostreatus (Jacq.: Fr.) Kumm.	(1984)	PO63	1	1	0	1	1	1	1	1	1	1
Pluteus romellii (Britz.) Sacc.	(1984)	PR64	0	1	0	1	1	1	1	1	1	1
Psathyrella candolleana (Fr.: Fr.) Maire	(1981)	PC66	1	1	0	1	1	1	1	1	1	0
P. prona (Fr.) Gill.	(1981)	PA65	0	0	0	1	1	1	1	1	1	0
Psilocybe cyanescens Wakefield	(1984)	PC68	1	1	1	1	1	1	0	0	1	1

P. semilanceata (Fr.) Kumm.	(1969)	PS69	0	1	1	1	1	1	1	1	1	0
Rhodocybe popinalis (Fr.) Sing.	(1981)	RP70	0	1	1	1	1	0	0	0	1	0
Stropharia coronilla (Bull.: Fr.) Quél.	(1981)	SC72	0	1	0	0	0	1	0	0	1	0
S. rugosoannulata Farlow: Murr.	(1983)	SR73	1	1	0	0	1	0	0	0	1	1
Aphyllophorales												
Ganoderma lipsiense (Batsch) Atk.	(1981)	GA74	1	1	0	0	1	1	1	0	1	0
Heterobasidion annosum (Fr.) Bref.	(1981)	HA75	1	1	0	1	1	1	1	0	1	0
Inonotus hispidus (Bull.: Fr.) Karst.	(1983)	IH76	0	1	1	1	1	0	0	1	1	0
Ischnoderma resinosum (Schrad.: Fr.) Karst.	(1981)	IR77	1	0	0	0	1	1	1	1	1	0
Laetiporus sulphureus (Bull.: Fr.) Murr.	(1982)	LS78	0	0	0	0	1	0	1	0	0	0
Meripilus giganteus(Pers.: Fr.) Karst.	(1983)	MG79	0	1	1	1	1	1	1	0	1	0
Merulius tremellosus Schrad.: Fr.	(1981)	MT80	1	1	1	1	1	1	0	1	1	0
Polyporus rhizophilus Pat.	(1978)	PR81	1	1	1	1	1	1	1	1	1	0
-"-	(1980)		1	1	1	1	1	1	1	1	1	0
-"	(1981)		1	1	1	1	1	1	1	1	1	0
P. squamosus (Huds.): Fr.	(1981)	PS82	1	0	1	1	1	0	1	1	1	0
Serpula lacrymans (Wulf.: Fr.) Schroet.	(1984)	SL83	0	0	1	1	1	1	1	0	0	0
Trametes hirsuta (Wulf.: Fr.) Pil.	(1982)	TH84	1	1	0	0	1	1	1	0	1	0
T. versicolor (L.) Pil.	(1982)	TV85	1	1	0	0	1	1	1	0	1	0
Gasteromycetes												
Bovista nigrescens Pers.: Pers.	(1982)	BN86	0	0	0	1	1	0	0	0	1	0
B. plumbea Pers.: Pers.	(1982)	BP87	1	0	1	1	1	0	0	1	1	0
B. pusilla (Batsch): Pers.	(1981)	BP88	1	0	1	1	1	0	0	1	1	0
Calvatia utriformis (Bull.: Pers.) Jaap	(1984)	CU89	1	0	0	1	1	0	1	0	1	0
Cyathus olla(Batsch): Pers.	(1984)	CO90	1	1	1	1	1	0	0	1	1	0
C. striatus (Huds.) Willd.	(1981)	CS91	1	1	0	1	1	0	0	1	1	0
Gastrosporium simplex Matt.	(1981)	GS92	1	0	0	0	1	1	1	1	1	0
Lycoperdon foetidum Bonord.	(1982)	LF93	1	0	1	1	0	1	0	1	1	0
L. lividum Pers.	(1984)	LL94	1	0	0	1	1	1	0	0	1	0

broad spectrum of enzymes including their quantitative determination in more strains or, occasionally, characterization of isoenzymes including their electrophoretic pattern.

The ability of individual cultures to preserve a certain enzyme activity for a longer time period was determined by repeatedly testing primary tyrosinase, amylases, pro-teinases and urease during 7 years. It could be shown that the absolute age of the cultures (i. e. the time that has passed since their isolation) has only a negligible effects on production of the enzyme studied. Some differences, quantitative differences in particular, can be caused by age of the colony on the Petri dish (i. e. by the relative age of the culture) as a result of a different growth rate. When testing a large number of cultures with a different growth rate it is difficult to investigate the whole studied collection during the identical growth phase. Most pronounced deviations were observed with urease. In general however, the enzyme activity is a highly stable marker and can thus be used as a useful characteristic feature of a species and as an auxiliary marker for classifi-cation of mycelial cultures of *Basidiomycotina*.

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The growth of soil micromycetes in the media containing herbicides Basagran, Labuctril 25 and Oxytril CM

Ovlivnění růstu půdních mikroskopických hub přítomností herbicidů Basagran, Labuctril 25 a Oxytril CM

Alena Nováková-Řepová

The changes of fungal growth in laboratory experiments (estimation of mycelial biomass and colony diameter) were studied by cultivation of 10 species of soil fungi on media with different concentration of the herbicides Basagran, Labuctril 25 and Oxytril CM. The subject fungi responded to increased concentrations of herbicide in different ways. *Cladosporium herbarum* (colony diameter) and *Penicillium janthinellum* (mycelial biomass) were the only investigations to show a similar response to all the herbicides. *Penicillium janthinellum* (mycelial biomass) was the only example of a significant stimulation of fungal growth. Changes in colony pigmentation and sporulation were also recorded.

Při laboratorním pokusu byly sledovány změny růstu 10 druhů mikromycetů při kultivaci v tekutém (stanovení biomasy mycelia) a pevném živném médiu (měření průměru kolonií) s různou koncentrací herbicidů Basagran, Labuctril 25 a Oxytril CM. Sledované druhy mikromycetů reagovaly na vzrůstající koncentraci herbicidů různě, pouze *Cladosporitum herbarum* (průměr kolonie) a *Penicillium janthinellum* (biomasa mycelia) reagovaly stejně ke všem herbicidům. U *P. janthinellum* (biomasa mycelia) byla zaznamenána statisticky významná stimulace růstu mycelia. V práci jsou rovněž popsány změny v pigmentaci a sporulaci kolonií na pevném živném médiu.

Introduction

Soil fungi are an important part of the soil microflora; they not only decompose organic matter and contribute to the development of soil humus but also they decompose organic materials introduced by man such as organic fertilizers and pesticides.

The application of herbicides has become an integral part of modern agrotechnology (Grossbard 1976, Spurrier 1990) and the increasing amounts, and long-term persistence, of these substances causes changes in the composition of the soil microflora and soil chemical processes (Grossbard 1976).

The soil microflora can be suppressed by the presence of herbicides, completely inhibited or stimulated depending on the chemical composition of the herbicide or the physical and chemical conditions of the soil environment or the concentration of the herbicide used (Grossbard 1976, Malkomes 1988). The interaction of herbicides and certain groups of soil microflora is now important in contemporary soil microbiology.

The following is a report of a study of the growth of ten species of soil fungi cultivated in liquid and on solid media containing increasing concentration of the herbicides Basagran, Labuctril 25 and Oxytril CM. This study is subsequent to previous paper (Řepová 1984) studying the effect of herbicides application on micromycetes population of spruce forest soil.

Material and methods

The fungi

The following strains of microscopic fungi isolated from an apple orchard soil that had not received any herbicide, were used in the experiment: *Penicillium chrysogenum* Thom., *P. janthinellum* Biourge, *Aspergillus fumigatus* Fres., *Gliocladium roseum* Bainier, *Myrothecium roridum* Tode ex Steudel, *Cladosporium herbarum* (Pers.) Link ex Gray, *Paecilomyces lilacinus* (Thom) Samson, *Absidia cylindrospora* Hagem, *Zygorhynchus moelleri* Vuill. and *Trichoderma viride* Pers. ex Gray.

Herbicides

Three herbicides were used: Basagran (active component bentazone), Labuctril 25 (active component bromoxynil) and Oxytril CM (active component bromoxynil and ioxynil). These herbicides are commonly used in agriculture for destroying dicotyledonous weeds in cereal crops. In this experiment the herbicides were used in concentration of 48, 96, 144, 192 and 240 ppm.

Methods of estimating fungal growth

Measurements of colony diameter

Three replicate 90 µm Petri dishes containing 25 ml of Sabouraud's agar (Booth 1971) with 1 ml of each herbicide solution, were centrally inoculated. The plates were incubated at room temperature for seven days, and fungal growth was determined by measuring the colony diameter. Changes in the morphology, sporulation and pigmentation were also recorded.

Estimation of mycelial biomass

Fifty ml of liquid Sabouraud's medium were dispensed into 100 ml flasks. The control was 3 flasks containing only liquid medium and spore suspension. Into three flasks for each herbicide 1ml of spore suspension and 1 ml of each herbicide concentration were added aseptically. After seven days of incubation at room temperature the fungal mycelium was collected by filtration of the culture medium, washing with distilled water, drying at 105°C for five hours, and than weighing.

Statistical analysis of the results

A one-way analysis of the variance at 5% significance was employed for a statistical analysis of the results.

Results

Measurement of colony diameter

The fungi responded in differing ways: inhibition and stimulation, but in some cases no change of fungal growth were found with increasing herbicide concentrations. From Table 1 it is evident that only one species, *Cladosporium herbarum*, reacted similarly to all herbicides, i.e. a gradual decrease in colony growth. Stimulation of colony growth was recorded by *Penicillium chrysogenum* (144 and 192 ppm of Basagran and 240 ppm of Oxytril CM) and by *Aspergillus fumigatus* (48, 96, 192 and 240 ppm of Basagran, 48 and 96 ppm of Oxytril C and Labuctril 25). Almost no effect on colony growth was found with *Trichoderma viride* and *Zygorhynchus moelleri* and the herbicides Basagran and Labuctril 25 - see Table 1. The significant differences between fungal growth with and without herbicide were also recorded.

Some differences in growth habit, pigmentation and sporulation were also found. *Trichoderma viride* growing on medium containing 144 and 240 ppm of Labuctril 25 and 240 ppm of Oxytril CM produced a yellow pigment on the reverse of the colony which diffused into the surrounding agar. Yellow-orange pigmentation was found with *P. janthinellum* at 144 ppm of Labuctril 25 and an intense orange pigmentation at 240 ppm of the same herbicide. Conversely, less pigmentation was found with *Cladosporium herbarum* at 144, 192 and 240 ppm of Labuctril 25. Increasing sporulation was noted at 144 ppm of Labuctril 25 in both *P. janthinellum* and *Aspergillus fumigatus.*

Estimation of mycelial biomass

The majority of the fungi showed differing responses to different herbicides with the exception of *P. janthinellum* which responded with increasing growth with all three herbicides. Most differences in growth were statistically significant when compared to that of the control (see Table 2).

Discussion

Colony diameter showed differing responses by the fungi to increasing concentrations of the herbicides but generally increasing suppression was noted. Only *C. herbarum* responded in a consistent way to all three herbicides. The overall results are similar to those of Wilkinson et Lucas (1969) when they studied five herbicides. Guillemat et al. (1960) reported suppression of fungal growth. They indicated that half of the fungi had ceased to grow in a medium with 1.5 % simazine added. Pantos et al. (1962) could detect no significant effect on the growth of fungi on solid or in liquid media with simazine or atrazine added; none of the fungi showed any significant inhibition or stimulation. Steinbrenner et al. (1960) in Kaiser et al. (1970) reported two responses when studying mycelial growth on maltose agar with increasing simazine concentration. Firstly, a suppression of mycelial growth in all herbicide concentrations (e.g. *Zygorhynchus, Rhizopus, Alternaria, Trichoderma,* and *Stemphylium*) and secondly growth stimulation (e.g. *Fusarium*). Rudakov et Spiridonov (1979) divided fungi into three groups: 1. Fungi which were suppressed at all herbicide concentrations, 2. fungal growth only suppressed at higher concentrations of herbicides and 3. good fungal growth at middle herbicide concentrations and suppression at low concentrations. This classification appears to be deficient as it does not consider the case of growth stimulation by herbicides as reported by Grossbard (1976), who found that herbicides were particularly stimulatory when they were the source of carbon and nitrogen.

It is also necessary to consider that pH and the composition of the medium will affect the activity of a herbicide as demonstrated by Balická (1969) in Grossbard (1976) where lower pH values were found to be more toxic in most herbicides.

Valášková (1968) and Wilkinson et Lucas (1969) reported that herbicides can inhibit or stimulate spore production. Manturovskaya (1970) described the retardation of the beginning of spore production, whilst a good mycelial growth continued, in the presence of herbicides in the growth medium.

In this study two fungi showed changes in sporulation - *P. janthinellum* and *A. fumigatus*, in both cases spore production was stimulated. *T. viride* and *P. janthinellum* showed a significant pigmentation of the colony reverse whereas *C. herbarum* showed reduced pigmentation. Wilkinson et Lucas (1969) also reported a reduction in colony pigmentation.

The fungal biomass in liquid media were reduced in most cases with the exception of *P. janthinellum* which showed a significant increase with all herbicide concentrations.

Sikka et al. (1965) in Kaiser et al. (1970) recorded the stimulation of mycelial growth of common soil fungi in the presence of triazine herbicides in liquid nutrient medium even when not limited for nutrients. Bakalivanov (1972) described both increased and decreased growth of mycelium in liquid media with herbicides. This author recorded significant stimulation of the growth of *Aspergillus niger* and *A. tamarii* in a medium with prometryne, but inhibition of *A. tamarii* in a medium with dikotex. Abdel-Fattah et al. (1983) found suppression of *Alternaria alternata* growth at 78, 313 and 626 ppm of atrazine whilst *Trichoderma viride, Gliocladium roseum, Myrothecium verrucaria* and *Cunninghamella echinulata* were suppressed at the middle and upper concentrations and *Penicillium vermiculatum* was suppressed at highest concentrations only.

Grossbard (1976) states that microscopic fungi are more sensitive to a considerable number of herbicides than are bacteria. Similarly fungi appear to be more tolerant of herbicides in pure culture than in the soil environment. Rudakov et Spiridonov (1979) found, for example, that the same herbicide concentration which evoked only a slight fungal inhibition in laboratory conditions, suppressed the growth of a whole population of fungi in a soil environment. These authors suppose that herbicides do not act on the fungi directly but change the whole relationship of the mycocenose.

Microscopic fungi also participate in the processes of detoxication and degradation of herbicides (Hsu et Capmer 1979, Chahal et al. 1977, Tweedy et al. 1970), by using them as a source of carbon and nitrogen (Kaufman et al. 1963, Kaufman 1970). It would seem that soil microscopic fungi are an essential part of the soil microflora and participate in the breakdown of herbicides in the soil environment.

Table 1 — Growth rates of fungi on solid nutrient medium containing herbicides (Values were expressed as a percentage of the control). Asterisks indicate statistical conclusive results on the significant level $\alpha = 0.05(*)$, $\alpha = 0.01(**)$ and $\alpha = 0.001(***)$.

	Concentration of Basagran (ppm)						
Species	0	48	96	144	192	240	
Absidia cylindrospora	100	85.5	90.3	93.0	96.7	85.9	
Penicillium janthinellum	100	79.9	100.0	91.0	87.3	91.0	
Myrothecium roridum	100	98.3	101.7	93.0	91.2	96.4	
Zygorhynchus moelleri	100	94.4	100.0	100.0	100.0	100.0	
Trichoderma viride	100	100.0	100.0	100.0	100.0	100.0	
Cladosporium herbarum	100	91.4	85.1	91.0	86.6	82.1	
Penicillium chrysogenum	100	102.9	90.5	112.4	108.2	100.0	
Paecilomyces lilacinus	100	86.5	92.8	91.0	80.7	100.0	**
Gliocladium roseum	100	96.8	95.7	91.4	92.5	93.5	
Aspergillus fumigatus	100	102.0	106.6	100.0	107.1	102.0	

	Concentration of Oxytril CM (ppm)						
Species	0	48	96	144	192	240	
Absidia cylindrospora	100	80.5	74.4	73.0	71.4	57.0	***
Penicillium janthinellum	100	85.0	81.3	78.7	78.7	88.7	
Myrothecium roridum	100	91.2	80.7	75.4	64.9	68.4	***
Zygorhynchus moelleri	100	96.3	85.2	84.1	75.9	74.8	***
Trichoderma viride	100	100.0	98.9	86.7	84.4	98.5	***
Cladosporium herbarum	100	97.8	85.1	83.6	82.1	77.6	
Penicillium chrysogenum	100	83.5	98.8	100.0	95.9	107.8	
Paecilomyces lilacinus	100	74.9	70.4	79.4	73.0	70.4	***
Gliocladium roseum	100	77.9	86.0	73.1	74.2	73.1	*
Aspergillus fumigatus	100	104.1	104.1	91.8	91.8	92.8	**

	Concentration of Labuctril 25 (ppm)						
Species	0	48	96	144	192	240	
Absidia cylindrospora	100	86.7	77.8	65.0	69.2	62.8	***
Penicillium janthinellum	100	86.1	94.7	79.9	81.3	78.7	
Myrothecium roridum	100	100.0	89.4	94.7	82.4	89.4	*
Zygorhynchus moelleri	100	100.0	100.0	85.9	100.0	60.0	**
Trichoderma viride	100	100.0	100.0	100.0	100.0	71.4	**
Cladosporium herbarum	100	82.1	85.1	79.1	52.3	50.7	***
Penicillium chrysogenum	100	97.5	97.5	82.3	87.6	68.7	**
Paecilomyces lilacinus	100	86.5	88.3	80.7	61.9	68.6	***
Gliocladium roseum	100	80.6	88.2	73.1	74.7	81.6	
Aspergillus fumigatus	100	102.0	110.2	82.6	62.2	55.1	**

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Table 2 — Mycelial growth in liquid nutrient medium containing herbicides (Values were expressed as a percentage of the control). Asterisks indicate statistical conclusive results on the significant level $\alpha = 0.05$(*), $= 0.01$(**) and $\alpha = 0.001$(***).

	Concentration of Basagran (ppm)						
Species	0	48	96	144	192	240	
Absidia cylindrospora	100	95.8	89.6	87.5	77.1	81.2	
Penicillium janthinellum	100	544.4	533.3	422.2	377.7	411.1	***
Myrothecium roridum	100	87.5	90.6	65.6	62.5	68.7	*
Zygorhynchus moelleri	100	100.0	85.7	95.2	123.8	114.2	
Trichoderma viride	100	91.6	87.5	91.6	87.5	83.3	*
Cladosporium herbarum	100	107.7	57.7	80.7	84.6	88.5	***
Penicillium chrysogenum	100	75.5	53.3	48.9	35.5	33.3	***
Paecilomyces lilacinus	100	81.1	66.0	69.2	101.9	88.7	**
Gliocladium roseum	100	71.4	85.7	85.7	71.4	85.7	**
Aspergillus fumigatus	100	80.0	47.5	60.0	67.5	60.0	**

	Concentration of Oxytril CM (ppm)						
Species	0	48	96	144	192	240	
Absidia cylindrospora	100	66.6	54.2	68.7	60.4	20.8	*
Penicillium janthinellum	100	466.6	444.4	355.5	377.7	366.6	***
Myrothecium roridum	100	43.7	28.8	50.0	40.6	34.4	***
Zygorhynchus moelleri	100	104.8	100.0	100.0	80.9	80.9	
Trichoderma viride	100	87.5	66.6	83.3	79.2	70.8	*
Cladosporium herbarum	100	65.4	57.7	53.8	50.0	46.1	***
Penicillium chrysogenum	100	56.7	53.3	44.4	44.4	55.5	***
Paecilomyces lilacinus	100	45.3	32.1	45.3	18.7	22.6	***
Gliocladium roseum	100	114.3	85.7	78.6	78.6	85.7	
Aspergillus fumigatus	100	87.5	77.5	65.0	57.5	60.0	***

	Concentration of Labuctril 25 (ppm)						
Species	0	48	96	144	192	240	
Absidia cylindrospora	100	81.2	58.3	58.3	43.7	33.3	***
Penicillium janthinellum	100	433.3	388.8	366.6	300.0	266.6	*
Myrothecium roridum	100	75.0	50.0	43.7	28.1	18.7	***
Zygorhynchus moelleri	100	123.8	61.9	57.1	90.5	80.9	**
Trichoderma viride	100	91.6	79.2	79.2	70.8	75.0	**
Cladosporium herbarum	100	80.7	69.2	69.2	57.7	50.0	***
Penicillium chrysogenum	100	91.1	60.0	64.4	80.0	64.4	*
Paecilomyces lilacinus	100	58.5	39.6	45.3	37.3	39.6	***
Gliocladium roseum	100	71.4	78.6	71.4	71.4	71.4	
Aspergillus fumigatus	100	67.5	67.5	62.5	57.5	60.0	***

Conclusions

Responses of fungi to increased concentrations of herbicides in nutrient medium were found to differ not only between the species but also between herbicides. Only *Cladosporium herbarum* (colony diameter) and *Penicillium janthinellum* (mycelial biomass) showed a consistent response. A significant stimulation of fungal growth was recorded in one case: mycelial biomass of *Penicillium janthinellum*. In some cases changes of pigmentation, sporulation and growth habit in fungal colonies on medium with herbicide were found.

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The ecological role of mycorrhizal symbiosis and the origin of the land plants

Ekologická úloha mykorhizni symbiózy a původ suchozemských rostlin

Milan Gryndler

Phosphorus plays essential role in regulation and physiology of recent endomycorrhizas indicating possible evolutionary mechanism, involved in origin of symbiosis, based on improved phosphorus supply of first land plants. An evolutionary scenario of the origin of the endomycorrhizal symbiosis (*Glomales, Zygomycetes*) is constructed. Phosphorus was available in coastal anoxious sediments of Devonian and Silurian water reservoirs. Then the plants radiating to land lacked an effective mechanism for phosphorus accumulation in the oxidative environment. The cooperation between plants and fungal microorganisms would have resolved this problem. Partners then developed regulatory mechanisms balancing the nutritional relationship between them and formed the integrating structures (arbuscules), responsible for mass and signals interchange.

Fosfor hraje důležitou úlohu v regulačnich vazbách a ve fyziologii recentnich mykorhiz, čímž je naznačena i možnost existence evolučniho mechanismu, zúčastněného při vzniku symbiózy, jenž byl založen na zlepšené výživě prvnich suchozemských rostlin fosforem. Byl proto formulován evolučni scénář vzniku endomykorhizni symbiózy (*Glomales, Zygomycetes*). V bezkyslikatých pobřežnich sedimentech devonských a silurských vod byl dostatek pro rostliny dostupného fosforu. Proto rostliny, které pronikaly na souš, postrádaly efektivni mechanismus, kterým by mohly akumulovat fosfor v oxidativnim prostředi. Tento problém mohl být řešen kooperaci rostlin s houbovými mikroorganismy. Partneři pak rozvinuli regulačni mechanismus, který vyvažoval jejich výživu a vytvořili integrujici struktury (arbuskuly), zabezpečujici výměnu hmoty a signálů mezi nimi.

I. Introduction

Arbuscular mycorrhizal symbiosis is formed in root tissues of many plant taxa. Known arbuscular mycorrhizal fungi are members of the heterogenic order, *Glomales* (Morton and Benny 1990). The immense phylogenetical age of this mysterious group and its occurrence in fossilized prehistorical plant root tissues (compiled by Pirozynski and Dalpé 1989) offer the explanation of the land plants origin as a result of symbiosis between plant and fungus (Pirozynski and Malloch 1975, Pirozynski 1981).

The vascularization of plant organism was probably one of the major adaptive factors enabling their radiation onto dry land. The first vascular plants appeared in the fossil record in late Silurian (Obrhel 1962). Pirozynski and Malloch (1975) interpret the phylogenetical age of the first vascular land plants to be approx. 400 millions years. They assumed that these plants were probably living in symbiosis with fungi. We could speculate about whether symbiosis was the most important factor enabling the development of the land plants or the origin was "fungus independent" and only facilitated by symbiosis. Another essential question is: what possible mechanism favoured the symbiotic coexistence of both organisms during their transformation to dry land inhabitants. This will be the topic of this article.

II. Scenario

Morton (1990) presumes: "VA mycorrhizal symbiosis arose from contact between host and fungus that was not maladaptive to either. Clonal reproduction in both partners insured faithful replication and fixation of favorable gene combinations. . . . Genetic change in clonal genotypes are directed by selection pressures optimizing fitness of both partners, and this is expressed in mycorrhizal phenotypes." I should like to deal with this idea from the ecological point of view. The origin of the endomycorrhizal symbiosis of plants with glomalean fungi should be explainable as an ecological adaptation of both organisms to the changes of environmental parameters during expansion to dry land.

In the latest Silurian, an oxidative atmosphere was the most universal environment. Iron, manganese and some other elements were converted into their "modern" oxidized forms (Fe^{3+}). The atmosphere contained high, slowly increasing concentration of oxygen utilizable by living organisms (Cloud and Gibor 1970). Relatively advanced plants lived in coastal waters of Silurian seas. They produced, like recent plants, organic litter, forming a stout layer of anoxious sediment.

The plants, becoming vascularized, radiated to the land. Progression on land was retarded by lack of adaptations to environment, e. g. by unsufficient ability to absorb some nutrients in the form of oxidized minerals. A typical example of such nutrient is phosphorus. The sediments, formed in oxidative aquatic ecosystems, act as phosphorus trap due to the sedimentation of particulate, dead organic matter which is mineralized in the sediment and to the precipitation of metallic phosphates. In anaerobic organic detritus-containing sediments, phosphates are reduced, releasing soluble orthophosphate (Fenchel and Blackburn 1979, Pierrou 1976), available to plants. Then plants, growing in anoxious swamp layer, did not need to develop (or lost ?) adaptations enabling absorption of poorly soluble phosphate what was a serious barrier to expansion to terrestrical areas.

That problem could have been resolved by cooperation of plants with aerobic organisms of upper, aerobic layer of water reservoirs. Phosphate was present there in very low concentration and then these organisms had to have effective absorption mechanism. These organisms were probably coenocytic, microscopical autotrophs. On becoming to symbiotic they had lost the photosynthetic apparatus and adapted their energy metabolism to utilize compounds produced by plants.

The hypothetical cooperation of the first land plants taxa with possible symbiotic microorganisms would have resulted in the state, in which phosphate was absorbed in sufficient amount by the microorganism and transported and distributed in the plants with vascular system.

Both partners then developed adaptations, supporting the total biomass production and plant rhizomes receptivity (biochemical adaptations to infection) including the life-cycle control mechanism of fungal symbiont ancestor (necessary for succsessful regulation of development of fungal partner in symbiosis). Such state of coexistence represented serious success in expansion ability of both partners, when compared with their initial features. These changes resulted, being conserved, into the development of modern endomycorrhizal symbiosis of arbuscular type.

III. The coincidence of the postulated assumptions with the recent knowledge

The coenocytic symbionts are widespread in vascular plants (Newmann and Reddell 1987). It supports the idea of endomycorrhizal symbiosis of arbuscular type as a common and ancient phenomena. Because fungi forming other kinds of endomycorrhizas and ectomycorrhizas (e. g. ascomycetes and basidiomycetes) appeared later than coenocytic endosymbionts currently classified in *Zygomycetes* (deduced from Cavalier-Smith 1986 and Pirozynski 1981), they will not be considered further.

The formulation of above mentioned scenario was inspirated by two relevant facts: (i) phosphate availability strongly depends on the absence of oxygen in the environment (Pierrou 1976, Stumm 1973), and (ii) phosphorus metabolism plays a key regulatory role in modern arbuscular mycorrhizas (Elias and Safir 1987, Gianinazzi-Pearson et al. 1989). The presumption of effective phosphate absorption, mediated by the presence of symbiotic microorganisms is supported by interactions observed in recent arbuscular mycorrhizal symbiosis. Mycorrhizal fungi enhance absorption of less soluble forms of phosphorus (Murdoch, Jackobs and Gerdemann 1967) and improve exploitation of available phosphorus in soil (Gianinazzi-Pearson et al. 1981).

The fungus ancestor is postulated to have been adapted to aerobic environment. Recent arbuscular mycorrhizal fungi also are aerobes, sensitive to decreased oxygen concentrations in soil (Saif 1981, 1983). Spore germination is strongly depressed at low oxygen concentration, or at elevated levels of carbon dioxide which is a common product of anaerobic biochemical processes (LeTacon, Skinner and Mosse 1983). In normally aerated soil, the anaerobiosis occurs only in very limited area of root tip and elongation zone (Fischer, Flessa and Schaller 1989). The anaerobiosis is presumed to occur particularly in flooded, unaerated soils. Under such conditions, the population of infective propagules of arbuscular fungi is generally depressed (Haq et. al. 1987). Analogous results were obtained by Lodge (1989), with ectendomycorrhizal plants. These observations support presumption of non-mycorrhizal status of water inhabiting plants, including land plant ancestors.

The mycorrhizal infection process in the root is non-destructive, culminating in the final elimination of fungal structures (arbuscules) from host plant cells (Toth and Miller 1984). It suggest that the plant can recognize the fungal partner and that it is able to regulate the process of infection (Koide and Li 1990). The fungal partner is strictly dependent on the host. Attempts to cultivate arbuscular mycorrhizal fungi axenically were generally unsuccessful even though the fungi probably possess active components of energetical metabolism (Macdonald and Lewis 1978, Beilby and Kidby 1982).

IV. Possible cell cycle regulatory mechanism in glomalean fungi

According to the scenario, the expanding communities of land plants utilized phosphate afforded by the co-expanding symbiotic microorganisms, ancestors of arbuscular fungi. We could presume three parallel processes evolving under selection pressure of newly colonized ecosystem: (i) both partners in symbiosis developed the anatomical integration structures (responsible for phosphate flux into plant organism). That fact probably enabled also (ii) the development of mechanism for efficient exchange of carbon- and energy-rich compounds between plant and fungus. The third process is the most important for the understanding of relationships between both symbionts: (iii) the evolution of regulatory mechanisms in symbiosis.

In vitro, the mycelium of recent VA mycorrhizal fungi in the presymbiotic state (= germ tubes without contact with living root) does not show nuclear division and DNA synthesis (Burggraaf and Beringer 1989). The inhibited cell cycle is probable explanation, organism "is waiting" for a plant signal. We can interpret it to be the result of the regulatory mechanism function, preventing the saprotrophic growth of the fungus in the absence of plant. The ecological and evolutionary importance of this is evident. Microorganism, regularly supplied with carbon and energy via specialized organs in host tissue, cannot successfully compete with saprotrophic microorganisms in the soil: the regulatory mechanism defect causes the immediate elimination of defective individual. We presume that such an important regulatory mechanism would be highly conserved.

V. Rust fungi - an analogy in cell cycle regulatory mechanism?

It follows that the saprotrophic growth of the glomalean fungus could be observed only when competition for energy and carbon is eliminated for sufficient time (to cumulate cell cycle regulatory mechanism defective individuals). In the case of mycorrhizal fungi of arbuscular type no information was accumulated in this field (Very rarely is reported the axenic cultivation of arbuscular mycorrhizal fungus - Barrett 1947, Janardhanan, Gupta and Husain 1990 - but such results are not reproducible). But there are very interesting reports about axenic cultures of other obligate biotrophs, the rust fungi (*Uredinales*). In general, it is not possible to maintain the mycelium of rust fungi in serial culture. But when massive inoculum of urediospores of *Puccinia graminis* was incubated on a proper medium, the growth of several fungal colonies was observed after a long period of incubation (Maclean 1982). The mycelium in these colonies was subculturable, uninuclear (in contrast to the normal, dicaryotic condition) and probably genetically distinct from the parent fungus. We could presume the existence of some defect in the mechanism of cell cycle regulation.

The mechanisms of cell cycle regulation in eucaryotes consist of periodical activation of expression of different regulatory genes responsible for DNA synthesis and other processes connected with cell proliferation (Johnston 1990). The mechanisms of activation of regulatory genes in mycorrhizal fungi of arbuscular type is not yet known. These fungi, although being phylogenetically older and probably better adapted to biotrophy than the rust fungi, could demonstrate in axenic conditions some similarity to saprotrophic form of rust fungi. There is the opportunity to destroy presumed cell cycle regulatory genes using mutagenesis in the environment lacking pressure of competition for the energy and carbon with any other partner. It would allow us not only to maintain arbuscular fungi in axenic culture, but also present a more complex view of symbiosis, involving regulatory mechanism of mycorrhizal symbiosis of arbuscular type.

VI. Conclusion

In this article a speculative scenario of the evolution of arbuscular mycorrhizal symbiosis was constructed on the basis of facts derived from studies of recent arbuscular mycorrhiza. It aims to explain the influence of invironmental factors in the origin and stability of symbiosis. The cooperation between plants, lacking sufficiently effective phosphate absorption mechanism (radiating from phosphorus rich anoxic water ecosystems to land) and microorganisms inhabiting oxidative environment may have solved the problem of limited plant phosphorus supply in new oxidative conditions. The regulatory mechanism, balancing the relationship between the two partners probably plays an essential role in the phytogenetical stability there. It may also explain the unculturability of arbuscular fungi under axenic conditions.

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Štruktúra spoločenstva mikroskopických húb v lesných pôdach severného Slovenska. I. Podobnosť mykocenóz (Tichá dolina)

Microfungal community structure in forest soils of North Slovakia. I. Similarity of mycocenosis (The Valley Tichá)

Alexandra Šimonovičová

Štruktúru spoločenstva mikroskopických húb sme sledovali na štyroch lesných lokalitách v Tichej doline vo Vysokých Tatrách. Pôdy typu podzol a ranker sú chudobné na organické látky, fyzikálne a chemicky sú nepriaznivé. Pokles pH o 1 až 1,5 zaznamenaný približne od roku 1962 naznačuje zhoršenie pôdnych vlastností. Týmto zmenám zodpovedá i zhoršenie mykocenóz. Z celkového počtu 41 izolovaných druhov pôdnych mikroskopických húb sa najčastejšie vyskytovali zástupcovia čeľade *Moniliaceae*, reprezentované zástupcami rodu *Penicillium*. Druhy čeľade *Mucoraceae* boli naopak potlačené. Medzi susediacimi lokalitami sme zaznamenali väčšiu podobnosť mykocenóz ako medzi vzdialenými lokalitami.

Microfungal community structure in four forest localities in the Valley Tichá in the High Tatra Mountains was studied. Podzolic and ranker soils are poor in organic matter, physically and chemically unfavourable. The pH values are lower - by a 1.0 - 1.5 - than values in 1962, it means that the quality of the soils had degraded. These differences correspond with the quality of mycocenosis, which had worsen, too. 41 species of soil micromycetes were isolated. The occurrence of the representatives of the genus *Penicillium* (fam. *Moniliaceae*) was the highest. The occurrence of the representatives of the family *Mucoraceae* was suppressed. The similarity of the neighbouring mycocenosis was higher than of those, that are more distant from each another.

Úvod

Oblasť Vysokých Tatier je každoročne ovplyvňovaná pomerne rozsiahlou turistickou činnosťou a rovnako aj emisiami. Obidva tieto faktory negatívne vplývajú na faunu a fló-ru Tatranského národného parku. V centre pozornosti je starostlivosť, výskum i ochrana lesných ekosystémov (Stolina 1990), ktoré zaberajú 39 048 ha, pričom sú dominantou celej tejto oblasti a podstatnou zložkou vegetačného krytu (Bekeš et al. 1990).

Značnú pozornosť však treba venovať i pôdam, kde sa v konečnom dôsledku odrazia všetky negatívne faktory. Pre existenciu terestrického ekosystému sú rozhodujúce pôdne mikroorganizmy, ktoré sa svojou činnosťou podieľajú na cykle živín a toku energie a v konečnom dôsledku vplývajú na primárnu produktivitu a stabilitu spoločenstva. Tatranské pôdy lesných spoločenstiev sú z tohto hľadiska preštudované iba ojedinele (Bernát 1976, Šimonovičová 1989, 1990, 1991).

V príspevku venujeme pozornosť pôdnym mikroskopickým hubám a podobnosti mykocenóz na vybraných lokalitách v Tichej doline.

Materiál a metódy

Tichá dolina je najzápadnejšou dolinou Vysokých Tatier a svojou dĺžkou, 16 km, zároveň i jednou z najdlhších. V nej boli vybraté štyri lokality:

Lokalita 1 (1 050 m n. m.): *Vaccinio myrtilli-Piceetum* (Szafer et al. 1923) Šoltés 1976, variant s *Lycopodium annotinum*. Mierne hlboké (od 31 do 60 cm) a piesočnato-hlinité (s 20 až 30 % ílu) pôdy predstavujú podzol typický.

Lokalita 2 (1 180 m n. m.): *Vaccinio myrtilli-Piceetum* (Szafer et al. 1923) Šoltés 1976. Stredne hlboké (od 61 do 120 cm) a piesočnato-hlinité pôdy predstavujú podzol arenický.

Lokalita 3 (1 400 m n. m.): *Pino cembrae-Piceetum* Myczkowski, Lesiński 1974. Pôdny typ a jeho charakteristika je rovnaká ako na lokalite 2.

Lokalita 4 (1 430 m n. m.): *Adenostylo alliariae-Piceetum* (Sillinger 1933) Šoltés 1976. Mierne hlboká a piesočnato-hlinitá pôda predstavuje ranker podzolový.

Pôdne typy sú určené podľa pedologickej mapy TANAP-u (Kolektiv 1989) s upraveným názvoslovím (Hraško et al. 1987).

Materiál sa odobral v auguste 1985 z celkovej hĺbky od 0 do 43 cm. Celková hĺbka odberu na jednotlivých lokalitách kolíše podľa podložia, napr. veľké kamene alebo korene stromov, ktoré neumožnili v odbere pokračovať. Zo štyroch lokalít bolo spolu odobratých 10 vzoriek rôzneho charakteru (tab. č. 1). Vzorky sa kultivovali na sladinovom a Czapek-Doxovom agare 14 dní v tme a pri izbovej teplote. Čisté kultúry mikromycét získané preočkovaním na nové kultivačné prostredie sme identifikovali (Gilman 1957, Fassatiová 1979, Domsch et al. 1980).

Podľa druhového zloženia mikromycét sa vypočítala podobnosť mykocenóz S podľa Sörensena (Odum 1977).

$$S = \frac{2\,.\,C}{A + B}$$

pričom:
S = ukazovateľ podobnosti mykocenóz medzi dvoma vzorkami
A = množstvo druhov vo vzorke A
B = množstvo druhov vo vzorke B
C = množstvo druhov spoločných pre obidve vzorky

Jaccard (Lamée 1976) uvádza iný výpočet podobnosti mykocenóz, Sxy.

$$Sxy = \frac{Nxy}{(Nx + Ny) - Nxy}$$

pričom:
Sxy = ukazovateľ podobnosti mykocenóz medzi dvoma vzorkami
Nx = množstvo druhov vo vzorke x
Ny = množstvo druhov vo vzorke y
Nxy = množstvo druhov spoločných pre obidve vzorky

Hodnoty S, resp. Sxy sa pohybujú v rozmedzi od 0 do 1.0. Index rozdielnosti mykocenóz sa vypočítal nasledovne: 1-S, resp. 1-Sxy.

Výsledky a diskusia

Podzolové pôdy (lokalita 1-3) a pôdy typu ranker (lokalita 4) majú pod ihličnatým porastom značnú vrstvu surového humusu, ktorý je tvorený opadnutým ihličím v rôznom štádiu rozkladu (tab. č. 1). Hodnoty pôdnej reakcie sú tak vo vodnom výluhu ako i v mol KCl o 1,0 až 1,5 nižšie ako uvádza Šály (1962). Je to dôsledkom dlhodobého vplyvu kyslých zrážok, ktorých pH sa na území TANAP-u pohybuje od 3,8 do 4,5 a v extrémnych prípadoch až 2,5 (Chudíková 1990). Nízke zásoby organických látok (tab. č. 2) klasifikujú tieto pôdy ako chemicky a fyzikálne nepriaznivé.

Tab. 1 Charakter odobratého materiálu z Tichej doliny

Lokalita	Vzorka	Hĺbka v cm	Charakter odobratého materiálu
1	1	0-5	málo rozložené smrekové ihličie
	2	5-15	viac rozložené smrekové ihličie premiešané s mikroskopickými časticami minerálnych látok (sľuda)
2	3	0-4	slabo rozložené až nerozložené časti rastlinného opadu, najmä čučoriedky
	4	4-8	vrstva pôdy, čiastočne premiešaná s minerálnymi časticami
3	5	0-5	slabo rozložené ihličie pod limbou
	6	5-8	polorozložené limbové ihličie premiešané s machovou rašelinou
	7	8-12	machová rašelina
4	8	0-5	koreňová mačina pod *Calamagrostis villosa*
	9	5-15	humusový sivo-čierny horizont, silne prekorenený, asi 40%
	10	15-43	humusový sivo-čierny horizont, silne prekorenený, asi 40%

Mikroskopické huby sú stabilnou zložkou každého ekosystému, pričom niektoré druhy sa v ňom vyskytujú pravidelne a iné môžu byť i celkom náhodné.

Tab. 2 Všeobecná charakteristika vzoriek z Tichej doliny

Lokalita	Vzorka	pH_{H_2O}	pH_{KCl}	$\%C_{ox}$	$\%N_t$	C/N	% humusu
1	1	3.22	2.77	16.09	1.54	10.45	27.73
	2	3.62	2.83	15.59	0.95	16.41	26.89
2	3	4.00	3.70	20.40	1.89	10.79	35.17
	4	3.16	2.86	20.40	0.92	22.17	35.17
3	5	3.36	2.69	22.50	1.36	16.54	38.79
	6	3.25	2.79	27.50	1.86	14.78	47.41
	7	3.27	2.45	24.90	1.56	15.96	42.93
4	8	4.44	3.72	23.70	2.04	11.62	41.02
	9	3.35	2.81	19.50	0.53	17.92	16.38
	10	3.20	3.00	19.00	0.47	19.15	15.52

Zo štyroch lokalít v Tichej doline sa spolu izolovalo 41 druhov pôdnych mikroskopických húb, pričom je ich druhové spektrum v jednotlivých vzorkách rôzne (tab. č. 3). Najmenší počet druhov (11), čo sú zástupcovia čeľade *Mucoraceae* a *Monilliaceae* (tab. č. 4), reprezentuje lokalitu 1. Podľa počtu izolovaných druhov mikroskopických

Tab. 3 Druhy mikroskopických húb izolovaných z Tichej doliny

Druhy	Lokality			
	1	2	3	4
Zygomycetes				
Mucorales-Mucoraceae				
Mucor pusillus Lindt	+	+	-	-
M. racemosus Fres.	-	+	-	-
M. fragilis Bainier	+	-	-	-
M. hiemalis Wehmer	+	+	-	-
M. piriformis Fischer	-	-	-	+
Actinomucor elegans (Eidam) Benjamine et Hasseltine	-	-	+	-
Rhizopus nigricans Ehrenberg	-	-	-	+
Cunninghamella echinulata (Thaxt.) Thaxt.	-	-	+	-
Deuteromycetes				
Moniliales-Moniliaceae				
Acremonium strictum W. Gams	-	-	+	-
Botrytis cinerea Pers. ex Nocca et Balb.	-	-	+	-
Trichoderma koningii Oudem.	+	-	+	-
T. viride Pers. ex Gray	+	+	+	+
Penicillium thomii Maire	+	+	+	+
P. frequentans Westling	+	+	+	+
P. spinulosum Thom	-	+	+	+
P. roseopurpureum Dierckx	+	+	+	+
P. waksmanii Zaleski	-	+	-	+
P. chermesinum Biourge	-	+	+	+
P. janthianellum Biourge	-	+	-	-
P. decumbens Thom	-	-	-	+
P. fuscum (Sopp) Thom	-	-	+	+
P. albidum Sopp	-	+	+	-
P. citrinum Thom	-	+	-	-
P. brevicompactum Dierckx	-	+	-	-
P. notatum Westling	-	+	-	-
P. expansum Link (Thom)	-	-	+	-
P. lilacinum Thom	-	-	-	+
P. funiculosum Thom	-	+	+	+
P. rubrum Stoll	-	-	+	+
P. purpurogenum Stoll	-	-	+	-
P. lividum Westling	+	-	-	-
P. variabile Sopp	+	+	+	-
P. diversum Raper et Fennell	+	+	+	+
Aspergillus fumigatus Fres.	-	-	-	+
A. candidus Link	-	+	-	-
Moniliales - Dematiaceae				
Cladosporium cladosporioides (Fres.) de Vries	-	-	-	+
Cl. herbarum Link ex Fres.	-	-	+	-
Alternaria tenuissima (Fries) Wiltshire	-	-	+	-
A. alternata Fr. Keissler	-	+	-	-
Ascomycetes				
Talaromyces luteus (Sacc.) Stolk et Samson	-	-	-	+
Emericella nidulans (Eidam) Vuill.	-	-	-	+
Spolu: 41	11	20	21	19

húb (19-21), sú medzi lokalitami 2-4 veľmi malé rozdiely. Okrem už spomenutých čeľadí je tu zastúpená i čeľaď *Dematiaceae* a na lokalite 4 triedu *Ascomycetes* reprezentujú druhy *Talaromyces luteus* a *Emericella nidulans* (tab. č. 3).

Tab. 4 Percentuálne zastúpenie tried, radov a čeľadí pôdnych mikromycét z Tichej doliny

	1	2	3	4
Zygomycetes				
Mucorales	27.3	15.0	9.5	10.5
Mucoraceae	27.3	15.0	9.5	10.5
Deuteromycetes				
Moniliales	72.7	85.0	90.5	79.0
Moniliaceae	72.7	80.0	81.0	73.7
Dematiaceae	-	5.0	9.5	5.3
Ascomycetes	-	-	-	10.5

Z percentuálneho zastúpenia tried, radov a čeľadí pôdnych mikromycét (tab. č. 4) je zrejmé, že na sledovaných lokalitách sú značne potlačené druhy čeľade *Mucoraceae*. Ich obmedzený výskyt indikuje nedostatok ľahko prístupných organických látok v pôde, ktoré sú nevyhnutné pre rozvoj mukorovitých húb. Pod vplyvom zhoršených pôdnych vlastností (už spomínaný pokles pH) dochádza teda k zhoršeniu mykocenóz, čo dokumentuje tiež bohaté percentuálne zastúpenie druhov čeľade *Moniliaceae* (tab. č. 4) s pestrým zastúpením druhov rodu *Penicillium* (tab. č. 3) na všetkých štyroch lokalitách. Druhy rodu *Penicillium* nachádzame v pôdach ihličnatých a listnatých lesov Kanady (Widden 1979), v pásme alpínskych krovín a lúk do 4900 m n. m. v Himalájach (Janečková et al. 1977), v pôdach na úpätí sopiek v Mexiku (Rodrigues et al. 1990), ale i v tropických lesných pôdach Indie (Behera, Mukerji 1985). Široké druhové spektrum rodu *Penicillium* izolované z rôznych pôd na území ČSFR dokumentuje kompilačná práca Řepovej (1990). Kozmopolitné rozšírenie druhov tohto rodu je podmienené jeho vlastnosťami, ako je schopnosť vylučovať toxíny, napr. *Penicillium purpurogenum, P. rubrum* (Mantle 1989), veľkou adaptačnou schopnosťou a prispôsobením sa nízkym hodnotám pH pôdy, napr. *Penicillium spinulosum* (Bååth et al. 1984). Zástupcov čeľade *Dematiaceae* sme izolovali iba na lokalitách 2-4 (tab. č. 3). Obidva izolované rody tejto čeľade, *Cladosporium* a *Alternaria* dobre rozkladajú celulózu. Z nízkeho percentuálneho zastúpenia tejto čeľade (tab. č. 4) môžeme na uvedených lokalitách predpokladať tiež nízku aktivitu rozkladu.

Druhové zloženie mikromycét je v jednotlivých pôdach rôzne a mení sa pod vplyvom ekologických faktorov (striedanie ročných období a s tým spojené zmeny teploty pôdy a jej vlhkosti) a závisí tiež od typu rastlinného spoločenstva. Neustálymi zmenami sa mení i spoločenstvo mikroorganizmov a vytvára tak dynamickú sústavu. V tomto spoločenstve mikroorganizmov nemajú všetky druhy mikromycét rovnaké postavenie. Niektoré druhy sú typické pre daný pôdny typ, tj. vyskytujú sa stabilne. Iné, vyskytujúce sa sporadicky, sú náhodilé. Podobnosť mykocenóz podľa druhového zloženia pôdnych mikromycét na sledovaných lokalitách uvádza tab. č. 5. Kritérium podobnosti mykocenóz S podľa Sörensena (Odum 1977), resp. Sxy podľa Jaccarda (Lamée 1976) sa pohybuje od 0 do 1,0, pričom o podobnosti dvoch mykocenóz uvažujeme pri hodnote S, resp. Sxy rovnej 0,6.

Hodnoty indexu podobnostii S (0,3-0,5) sú vždy o jednu až dve desatiny vyššie ako hodnoty indexu Sxy (0,2-0,4). Rozdiely sú však len v absolútnych hodnotách koeficientu, pričom poradie podobnosti mykocenóz jednotlivých lokalít je v obidvoch prípadoch rovnaké (tab. č. 5). I keď sme ani raz nedosiahli hodnotu vyššiu ako S = 0,5 i tak je zrejmá podobnosť mykocenóz medzi susediacimi lokalitami 1-2, 2-3 a 3-4. Čím sú lokality od seba viac vzdialené, tým sa index podobnosti mykocenóz S, resp. Sxy zmenšuje, napr. lokality 1-3 majú index podobnosti mykocenóz S = 0,4 a najvzdialenejšie lokality 1-4 majú i najmenší index podobnosti mykocenóz S = 0,3 (tab. č. 5).

Tab. 5 Index podobnosti mykocenóz S (sxy) a index rozdielnosti mykocenóz 1-S (1-Sxy) na lokalitách v Tichej doline

Lokality	S	1-S	Sxy	1-Sxy
1-2	0.5	0.5	0.4	0.6
1-3	0.4	0.6	0.3	0.7
1-4	0.3	0.7	0.2	0.8
2-3	0.5	0.5	0.3	0.7
2-4	0.5	0.5	0.3	0.7
3-4	0.5	0.5	0.3	0.7

Pri mikrobiologickom rozbore zeminy izolujeme podstatne menej druhov pôdnych mikromycét ako sa v nej v skutočnosti nachádza. Výpočet podobnosti mykocenóz len podľa výskytu mikromycét nedáva preto presný obraz o pôdnej mykocenóze. Je doplňujúcim ukazovateľom pri celkovej charakteristike pôd a ich spoločenstiev (Bernát et al. 1984).

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Štruktúra spoločenstva mikroskopických húb v lesných pôdach severného Slovenska. II. Podobnosť mykocenóz (Krížna, Kôprová a Furkotská dolina)

Microfungal community structure in forest soils of North Slovakia. II. Similarity of mycocenosis (Krížna, Kôprová and Furkotská Vallies)

Alexandra Šimonovičová

V doline Krížna, Kôprová a Furkotská (Vysoké Tatry) sme na piatich lesných lokalitách sledovali druhovú skladbu pôdnych mikroskopických húb a podobnosť mykocenóz. Podzol arenický a ranker podzolový predstavujú spracovávané pôdne typy. Pôdy majú nízku až veľmi nízku reakciu pôdneho prostredia a malý obsah organických látok. Z celkového počtu 48 izolovaných druhov pôdnych mikroskopických húb je najčastejšie zastúpený kozmopolitný rod *Penicillium* z čeľade *Moniliaceae*. Zhoršenie pôdnych vlastností vplyvom znečistenia životného prostredia celej tatranskej oblasti sa prejavilo tiež na potlačení druhov čeľade *Mucoraceae*. Najvyššiu podobnosť mykocenóz sme S = 0,6 zistili medzi lokalitami v susedných dolinách.

On five localities in vallies Križna, Kôprová and Furkotská (High Tatra Mts.) we investigated the species structure of soil microscopic fungi and the similarity of mycocenosis. The arenic podzol and podzolic ranker soils were studied. The soils had low to very low acid reaction and very low content of organic matter. In the global number of isolated soil microscopic fungi species (48), the cosmopolitic genus *Penicillium* of the family *Moniliaceae* was dominantly represented. The species of the family *Mucoraceae* were suppressed as the result of the soil quality decreasing which reflects the degradation of the quality of the whole environment in High Tatra Mts. The highest index of similarity - S = 0.6 - was proved between the localities in the neighboring vallies.

Úvod

Značné predimenzovanie celej tatranskej oblasti turistami (Strnka, Petro 1983), niekoľko násobne vyšší obsah ťažkých kovov (Pb, Cd, Cl a Zn) v smrekovom ihličí (Maňkovská 1978) a tiež v lišajníkoch nad hornou hranicou lesa (Maňkovská, Kyseľová 1987), znečistená voda mnohých tatranských jazier (Tržilová, Miklošovičová 1988) - to sú negatíva, ktoré vedú k zhoršeniu životného prostredia Tatranského národného parku. Tieto negatívne faktory sa však odrážajú aj na pôde a pôdnych organizmoch.

V príspevku, ktorý obsahovo nadväzuje na mykologickú charakteristiku Tichej doliny (Šimonovičová 1992), popisujeme mykocenózy a ich podobnosť v dolinách Krížna, Kôprová a Furkotská.

Materiál a metódy

Dolina Krížna je svojou rozlohou 655 ha pomerne malá. V nej bola zvolená jedna lokalita:

Lokalita 5 (1260 m n. m.): *Adenostylo alliariae-Abietetum* Kuoch 1954. Stredne hlboké (od 61 do 120 cm) a piesočnato-hlinité pôdy (s 20 až 30 % ílu) tvoria pôdny typ - podzol arenický.

Kôprová dolina patrí rozlohou k najväčším a 11 km dĺžkou i k najdlhším tatranským dolinám. V nej sa vybrali dve lokality.

Lokalita 6 (1200 m n. m.): *Mastigobryo-Piceetum* (Schmid et v. Gaisberg 1936) Br.-Bl. Sissing 1939.

Lokalita 7 (1280 m n. m.): *Vaccinio myrtilli-Piceetum* (Szafer et al. 1923) Šoltés 1976, variant s *Lycopodium annotinum*. Pôdny typ a jeho charakteristika je na lokalite 6 a 7 rovnaká ako na lokalite 5.

Doliny Tichá (Šimonovičová 1992), Krížna a Kôprová nemajú ešte typický vysokohorský charakter, na rozdiel od Furkotskej doliny (obr. č. 1), kde boli vybraté dve nasledujúce lokality.

Lokalita 8 (1525 m n. m.): *Pino cembrae-Piceetum* Myczkowski, Lesiński 1974. Stredne hlboká (od 61 do 120 cm) a piesočnato-hlinitá (s 20 až 30 % ílu) pôda predstavuje ranker podzolový.
Lokalita 9 (1400 m n. m.): *Vaccinio myrtilli-Piceetum* (Szafer et al. 1923) Šoltés 1976. Charakteristika pôdneho typu, ktorým je podzol arenický je rovnaká ako na lokalite 5, 6 a 7.

Materiál z celkovej hĺbky od 0 do 25 cm sme odobrali v roku 1985. Z piatich lokalít sme získali spolu 11 vzoriek rôzneho charakteru (tab. č. 1). Spracovanie pôdnych vzoriek, kultiváciu a identifikáciu druhov pôdnych mikroskopických húb sme podrobne opísali v predchádzajúcom príspevku (Šimonovičová 1992).

Výsledky a diskusia

Podzolové pôdy, tj. lokality 5, 6, 7 a 9 sa u nás nachádzajú v stredohorských polohách pod ihličnatými porastami. Surový humus, vytvorený ihličím v rôznom štádiu rozkladu, dosahuje na niektorých lokalitách značnú hrúbku (tab. č. 1). Vrchná časť pôdy je preto ochudobnená o rastlinné živiny. Pôdy kyslého charakteru sú chemicky a fyzikálne nepriaznivé, čo je odrazom podzolového procesu (Šály 1962). Ani kvalita humusu v podzolových pôdach charakterizovaná pomerom C/N od 13 do 22 (Bedrna 1989), nie je dobrá.

Tab. 1 Charakter odobratého materiálu z doliny Križnej (lokalita 5), Kôprovej (lokalita 6-7) a Furkotskej (lokalita 8-9)

Lokalita	Vzorka	Hĺbka v cm	Charakter odobratého materiálu
5	11	0-2	kompaktná vrstva slabo rozloženého ihličia jedle
	12	2-7	sivo-hnedá, stredne prekorenená zemina s obsahom štrku do 20 %
	13	7-25	čokoládovohnedá, hlinito-piesočnatá zemina, stredne prekorenená, s obsahom štrku do 5 %
6	14	0-3	slabo rozložená vrstva smrekového ihličia
	15	3-20	hnedočierna humusová vrstva stredne až silne prekorenená koreňmi drevín
7	16	0-1	slabo rozložená vrstva rastlinného opadu
	17	1-5	hnedočierna humusová vrstva, stredne prekorenená
8	18	0-15	vrstva polorozloženého až nerozloženého limbového ihličia
	19	15-20	sivo-čierny humusový horizont
9	20	0-10	málo rozložené až nerozložené smrekové ihličie
	21	10-15	sivo-hnedý horizont

Rankrové pôdy, tj. lokalita 8, sa u nás nachádzajú vo vyšších polohách, kde vytvárajú nesúvislé pôdne pásmo. Pôdy s vrstvou surového humusu sú silno skeletnaté, kyslého charakteru (Šály 1962) a s nízkym obsahom nekvalitného humusu (Bedrna 1989).

Hodnoty pôdnej reakcie stanovené v mol KCl sú vždy nižšie ako hodnoty pH vo vodnom výluhu. Pre podzolové pôdy uvádza Šály (1962) rozpätie pH 4,0-5,0 a pre pôdy rankrové 4,5-5,5. Značne nižšie hodnoty našich vzoriek stanovené vo vodnom výluhu (tab. č. 2) sú spôsobené dlhodobým účinkom kyslých zrážok. Ako uvádza Chudíková (1990), rozpätie pH sa na lesných plochách pohybuje od 2,58 do 6,32 s priemernou hodnotou 4,14. Acidita zrážok sa prechodom cez korunový a kmeňový priestor v lesných porastoch ešte zvyšuje v porovnaní so zrážkami na voľných plochách. Zrážky takéhoto charakteru sa dostávajú do pôdy, kde vplývajú na mnohé biologické procesy, pričom sa nedá rozlíšiť ich priamy vplyv od nepriameho vplyvu, tj. od zmien pH pôdneho roztoku, strát živín, zhoršenia kvality pôdy apod.

Tab. 2 Všeobecná charakteristika vzoriek z doliny Krížnej (lokalita 5), Kôprovej (lokalita 6-7) a Furkotskej (lokalita 8-9) doliny

Lokalita	Vzorka	pH_{H_2O}	pH_{KCl}	$\%C_{ox}$	$\%N_t$	C/N	% humusu
5	11	4,45	3,73	20,99	1,87	11,22	36,20
	12	3,22	2,83	19,10	0,39	23,22	15,69
	13	3,55	3,14	14,69	0,22	21,32	8,10
6	14	4,38	3,94	24,89	2,21	11,26	42,92
	15	3,90	2,96	26,69	1,56	17,11	46,03
7	16	3,89	2,79	25,30	1,87	13,53	43,6
	17	3,71	3,69	25,80	1,42	18,17	44,48
8	18	4,30	3,50	13,75	0,66	20,83	23,71
	19	3,90	2,90	14,12	0,50	28,24	24,34
9	20	3,72	2,80	13,80	0,70	19,71	23,79
	21	3,78	2,83	12,34	0,70	17,63	30,39

V terestrickom ekosystéme je známa pufrovacia schopnosť pôdy, ktorá prispieva k odolnosti voči kyslému prostrediu. Aj niektoré skupiny pôdnych mikroorganizmov, napr. mikroskopické huby majú schopnosť prispôsobiť sa týmto životným podmienkam. Adaptabilita jednej skupiny pôdnych mikroskopických húb sa však prejaví na úkor druhej skupiny, ktorá je potlačená a tak dochádza k následným zmenám v druhovej skladbe mikroskopických húb a tým i k zmenám mykocenóz.

Z piatich lokalít v troch tatranských dolinách sme izolovali spolu 48 druhov pôdnych mikroskopických húb (tab. č. 3). Ich druhové spektrum je na jednotlivých lokalitách rôzne, pričom najviac druhov (27) bolo izolovaných na lokalite 5 v Krížnej doline a 26 druhov vo Furkotskej doline na lokalite 8. Rovnaký počet druhov (18) sme zistili na lokalite 6 v Kôprovej doline a na lokalite 9 vo Furkotskej doline. Lokalitu 7 v Kôprovej doline charakterizuje najmenší počet zástupcov pôdnych mikroskopických húb, t.j. 11. Rozdiely v druhovom zložení pôdnych mikroskopických húb na uvedených lokalitách sú ešte výraznejšie v percentuálnom zastúpení tried, rodov a čeľadí (tab. č. 4). Zástupcovia čeľade *Mucoraceae* veľmi rýchlo kolonizujú substrát, ktorý obsahuje dostatočné množstvo ľahko prístupných organických látok. Percentuálne zastúpenie čeľade *Mucoraceae* (tab. č. 4) je na všetkých lokalitách značne potlačené. Na lokalite 8 vo Furkotskej doline sme neizolovali

Tab. 3 Druhy mikromycét z Križnej (lokalita 5), Kôprovej (lokalita 6-7) a Furkotskej (lokalita 8-9) doliny

Druhy	Lokality				
	5	6	7	8	9
Zygomycetes					
Mucorales - Mucoraceae					
Mucor pusillus Lindt	+	+	-	-	-
M. fragilis Bainier	+	-	-	-	-
M. hiemalis Wehmer	-	-	-	-	+
Rhizopus nigricans Ehrenberg	-	+	+	-	-
Thamnidium elegans Link	-	-	+	-	-
Mortierella ramanniana (Möller) Linnemann	+	-	-	-	-
Deuteromycetes					
Moniliales - Moniliaceae					
Acremonium strictum W. Gams	+	-	-	+	-
A. murorum (Corda) W. Gams	-	-	-	+	-
Trichoderma koningii Oudem.	-	+	-	+	+
T. viride Pers. ex Gray	-	+	+	-	-
Botryotrichum piluliferum Sacc. et March.	-	-	-	-	+
Penicillium thomii Maire	+	+	+	+	+
P. frequentans Westling	+	+	+	+	+
P. spinulosum Thom	+	+	+	+	+
P. roseopurpureum Dierckx	+	+	+	+	+
P. waksmanii Zaleski	+	+	-	+	-
P. chermesinum Biourge	+	+	+	+	+
P. decumbens Thom	+	+	-	+	-
P. fuscum (Sopp) Thom	-	-	-	+	-
P. restrictum Gilman et Abbott	+	+	-	-	-
P. brevicompactum Dierckx	+	-	-	-	-
P. notatum Westling	+	-	-	+	-
P. viridicatum Westling	+	-	-	-	-
P. funiculosum Thom	+	+	-	-	+
P. purpurogenum Stoll	+	-	-	-	-
P. variabile Sopp	+	+	-	+	+
P. diversum Raper et Fennell	+	+	+	+	+
P. spiculisporum Lehman	+	-	-	-	-
P. albidum Sopp	-	-	-	+	-
P. digitatum Saccardo	-	-	-	-	+
P. expansum Link ex Gray	-	-	-	+	-
P. canescens Sopp	-	-	-	+	-
P. granulatum Bainier	-	-	-	-	+
P. rubrum Stoll	-	-	+	-	+
P. rugulosum Thom	-	-	-	+	-
Aspergillus versicolor (Vuill.) Tiraboschi	+	-	-	-	-
A. candidus Link	+	-	-	-	-
A. repens (Corda) DeBary	-	-	-	+	-
A. fumigatus Fresenius	-	-	-	+	-
Moniliales - Dematiaceae					
Humicola nigrescens Omvik	+	-	-	-	-
Cladosporium cladosporioides (Fres.) de Vries	+	+	-	+	+
C. herbarum Link ex Fr.	-	-	-	+	+
C. sphaerospermum Penz.	-	-	-	+	+
Curvularia lunata (Wakker)	-	-	-	+	-
Alternaria alternata Fr. Keissler	-	+	-	+	-
A. tennuissima (Fries) Wiltshire	+	+	-	+	-
Ascomycetes					
Emericella nidulans (Eidam) Vuill.	+	-	-	-	-
Talaromyces flavus (Klöcker) Stolk et Samson	+	-	+	-	+
Spolu: 48	27	18	11	26	18

ani jedného predstaviteľa tejto čeľade. Podobnú situáciu sme zistili aj v Tichej doline na lokalite 3 (Šimonovičová 1992), kde mala čeľaď Mucoraceae v porovnaní s ostatnými lokalitami najmenšie percentuálne zastúpenie. Obidve spomínané lokality vo Furkotskej a v Tichej doline charakterizuje limbový porast, pričom je pôdny typ na každej z nich iný. Potlačenie zástupcov čeľade *Mucoraceae* na jednej strane a mohutný rozvoj zástupcov čeľade *Moniliaceae* na druhé strane indikuje zhoršenie mykocenóz vplyvom už spomenutého okyslenia pôdneho prostredia. Najčastejším rodom čeľade *Moniliaceae* je *Penicillium*, ktorého bohaté druhové spektrum je zastúpené na všetkých lokalitách. Najvyššie percentuálne zastúpenie čeľade *Moniliaceae* (79,9 %) je však na lokalite 8 vo Furkotskej doline reprezentovanej limbovým porastom. Podobne na lokalite 3 v Tichej doline, tiež s porastom limby, sme predstaviteľov tejto čeľade izolovali najčastejšie (Šimonovičová 1992). Kozmopolitné zastúpenie druhov rodu *Penicillium* je dané jeho vlastnosťami produkovať mnohé fungálne metabolity, dnes zaraďované medzi mykotoxíny (Betina 1990). Je to napr. kyselina mykofenolová (*P. brevicompactum; P. viridicatum*) kyselina penicilová (*P. thomii; P. canescens*), citrinín (*P. expansum; P. canescens*), patulín (*P. granulatum*) apod. Mantle (1989) uvádza, že predstavitelia rodu *Penicillium* spp. produkujú až okolo 400 rôznych metabolitov. Veľká adaptačná schopnosť voči pH (Bååth et al. 1984) im umožňuje vyskytovať sa tiež v substráte rôzneho charakteru.

Tab. 4 Percentuálne zastúpenie tried, radov a čeľadí pôdnych mikromycét z Križnej (lokalita 5), Kôprovej (lokalita 6-7) a Furkotskej (lokality 8-9) doliny

		5	6	7	8	9
	Zygomycetes					
	Mucorales	11,1	11,1	18,2	-	5,5
Mucoraceae		11,1	11,1	18,2	-	5,5
	Deuteromycetes					
	Moniliales	82,1	88,9	72,7	100,0	89,0
Moniliaceae		70,4	72,2	72,2	76,9	72,3
Dematiaceae		11,7	16,7	-	23,1	16,7
	Ascomycetes	7,4	-	9,1	-	5,5
	Počet druhov: 48	27	18	11	26	18

Ako uvádza Singh (1977), pre rast *P. nigricans* je optimálna hodnota pH 2,8. V kyslom prostredí je tento druh tolerantný k pomerne vysokým koncentráciám solí Fe, Ni, Co a Cr. Zástupcovia rodu *Penicillium* prenikajú do značnej hĺbky pôdneho horizontu. Behera a Mukerji (1985) ich napr. izolovali z hĺbky až 100 cm. Peniciliá produkujú tiež značné množstvo enzýmov, napr. celulázy, lipázy, proteázy, pektinolytické enzýmy - čo im umožňuje degradovať rôzny materiál. Schopnosť zástupcov rodu *Penicillium* produkovať takúto širokú škálu rôznorodých látok im umožňuje kolonizovať substrát alebo prostredie, ktoré iným druhom nevyhovuje. Sú schopné potlačiť alebo i celkom zastaviť rast nežiadúcich konkurenčných druhov a sú tiež odolné voči antropogénnym vplyvom (Marfenina, Mirčink 1988).

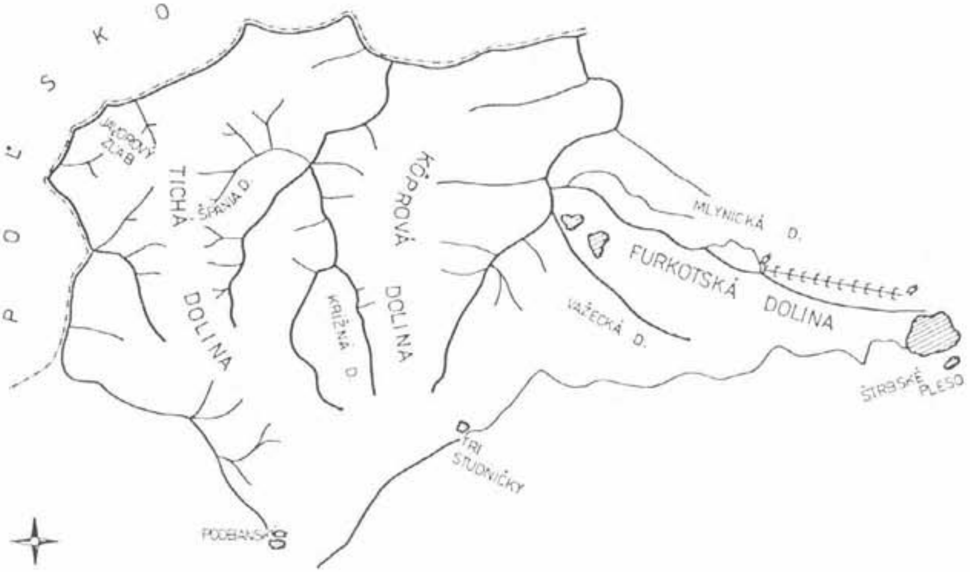
Čeľaď *Dematiaceae* predstavujú štyri rody a sedem druhov mikroskopických húb. Je to čeľaď pomerne málo zastúpená, pričom na lokalite 7 sme neizolovali ani jedného jej predstaviteľa. Triedu *Ascomycetes* zastupuje iba druh *Emericella nidulans* a *Talaromyces flavus*, ktorí na lokalite 6 a 8 chýbajú (tab. č. 4).

Index podobnosti mykocenóz S podľa Sörensena (Odum 1977), resp. Sxy podľa Jaccarda (Lamée 1976) stanovený na základe druhovej skladby pôdnych mikroskopických húb na jednotlivých lokalitách vyjadruje tabuľka č. 5.

Tab. 5 Index podobnosti mykocenóz S (Sxy) a index rozdielnosti mykocenóz 1-S (1-Sxy) na lokalite 5 v Križnej, 6-7 v Kôprovej a 8-9 vo Furkotskej doline

Lokality	S	1-S	Sxy	1-Sxy
5-6	0,6	0,4	0,4	0,6
5-7	0,3	0,7	0,2	0,8
5-8	0,4	0,6	0,3	0,7
5-9	0,4	0,6	0,3	0,7
6-7	0,5	0,5	0,4	0,6
6-8	0,6	0,4	0,4	0,6
6-9	0,5	0,5	0,4	0,6
7-8	0,3	0,7	0,2	0,8
7-9	0,5	0,5	0,4	0,6
8-9	0,5	0,5	0,3	0,7

Tak isto ako pri stanovení podobnosti mykocenóz v Tichej doline (Šimonovičová 1992), aj v Križnej, Kôprovej a Furkotskej doline sme na susedných lokalitách zistili index podobnosti S = 0,5; resp. Sxy = 0,4. Najvyšší index podobnosti S = 0,6 sme zistili medzi mykocenózami na lokalite 5-6 a 6-8. Križna dolina (lokalita 5) a Kôprová dolina (lokalita 6) majú celkový charakter veľmi podobný. Pôdny typ, ktorým je podzol arenický, je na oboch rovnaký a tiež rozdiel v nadmorskej výške týchto dvoch lokalít je veľmi malý. Rastlinné spoločenstvo je však na každej z nich iné. Medzi Kôprovou dolinou (lokalita 6) a Furkotskou dolinou (lokalita 8) sú rozdiely podstatne väčšie. Celkový charakter každej z dolín je iný, tiež rastlinné spoločenstvo ako i pôdny typ. Rozdiel vyše 300 m v nadmorskej výške dáva tiež predpoklad na iné, drsnejšie klimatické podmienky.



1. Doliny Tichá, Križna, Kôprová a Furkotská vo Vysokých Tatrách.

A. Šimonovičová del.

Druhová skladba pôdnych mikroskopických húb sa mení pod vplyvom ekologických faktorov. V tejto súvislosti ide vždy o interakciu viacerých faktorov pôsobiacich ako regulačné a autoregulačné mechanizmy reprodukcie v mikrobiálnych spoločenstvách. Vzťah medzi pôdnymi mikroskopickými hubami, rastlinným spoločenstvom a vlastnosťami pôdy v terestrickom ekosystéme je veľmi úzky. Preto je značne obtiažne jednoznačne určiť, ktorý z týchto faktorov je primárny a určujúci pri stanovení podobnosti dvoch mykocenóz.

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Dichomitus albidofuscus a Gelatoporia subvermispora - dva nové choroše pro Československo

Dichomitus albidofuscus and Gelatoporia subvermispora - two new polypores for Czechoslovakia

Petr Vampola a *Josef Vlasák*

Autoři publikují nálezy dvou velmi vzácných resupinátních chorošovitých hub, *Dichomitus albidofuscus* (Domań.) Domań. a *Gelatoporia subvermispora* (Pilát) Neimelä, které jsou nové pro Československo.

Two very rare resupinate polypores, *Dichomitus albidofuscus* (Domań.) Domań. and *Gelatoporia subvermispora* (Pilát) Niemelä, are reported as new species for Czechoslovakia.

Československo, díky své zeměpisné poloze na rozhraní působení atlantických a kontinentálních vlivů a také vzhledem k poměrně značnému počtu dosud pozoruhodně zachovalých přírodních lokalit, patří k zemím s mimořádně bohatou mykoflórou. U tradičně pilně studovaných skupin vyšších hub, jako jsou např. choroše, lze jen obtížně jmenovat evropské druhy (s výjimkou středozemních - mediteranních druhů), které se na území našeho státu nevyskytují. I druhy velmi vzácné nebo druhy nedávno popsané bývají u nás většinou brzy nalezeny, jakmile jsou jejich znaky jasně definovány a soustředí se na ně pozornost mykologů. Toto platí i pro dva velmi vzácné druhy chorošů - *Dichomitus albidofuscus* a *Gelatoporia subvermispora.* Oba druhy jsou nápadné bílé pórnatky, tvořící na padlých kmenech tlusté a rozsáhlé povlaky a rostoucí převážně v zachovalých biotopech typu jedlobukového pralesa nižších poloh.

Dichomitus albidofuscus (Domań.) Domań. - pórnatka hnědobílá

Syn.: *Poria albidofusca* Domań.

Dichomitus albidofuscus (Domań.) Domań. byl jako nový druh pro vědu popsán na základě opakovaných nálezů v Bělověžském pralese ve východní části Polska. Poprvé jej tam v roce 1958 nalezl polský mykolog S. Domański a o osm let později jej popsal pod jménem *Poria albidofusca* (Domański 1966). Stejný autor později (v roce 1972) přeřadil *Poria albidofusca* do Reidova rodu *Dichomitus* (Domański 1972). V tomto rodě jsou dnes v Evropě zařazeny tři choroše s dimitickým hyfovým systémem se skeletovými, na vrcholu rozvětvenými hyfami, a to *D. squalens* (P. Karst.) Reid, *D. campestris* (Quél.) Domań. et Orlicz a *D. albidofuscus* (Domań.) Domań. Podle našeho názoru je však rod *Dichomitus* značně umělý a nesourodý. Především *D. albidofuscus* nejeví žádnou příbuznost k ostatním druhům v tomto rodě; to se týká i skeletových hyf, lišících se způsobem větvení, barvou, lámavostí apod. Pro potřebu tohoto článku však zatím jméno *Dichomitus albidofuscus* akceptujeme, neboť tento druh nelze uspokojivě přeřadit do žádného z dosud popsaných evropských rodů chorošů a příbuzenské vztahy k mimoevropským druhům jsme nestudovali. Vzhledem ke kontrastnímu zbarvení rourek a pórů současně navrhujeme pro tento druh nové české jméno pórnatka hnědobílá.

Pórnatka hnědobílá roste v Bělověžském pralese na starších a již částečně zetlelých ležících kmenech smrků (*Picea abies*), vzácně i habru obecného (*Carpinus betulus*) a působí bílou plátkovou hnilobu dřeva. Nová československá lokalita je vůbec prvním dokladem o existenci této houby mimo její originální naleziště a současně i prvním dokladem o růstu tohoto druhu na jedli bělokoré (*Abies alba*).

Následující popis je sestaven podle plodnic nalezených druhým z autorů u Hluboké nad Vltavou, které ve všech znacích přesně odpovídaly originálnímu popisu. Správnost určení však byla přesto ještě ověřena srovnávacím studiem dvou herbářových položek z Bělověžského pralesa, které sbíral a určil samotný autor druhu.

Plodnice jsou jednoleté, na dřevu zcela rozlité, okrouhlé nebo po délce kmene trochu protáhlé, u prvního nálezu asi 15 x 30 cm, u druhého 12 x 15 cm velké, na povrchu značně nerovné a cca 0,5 - 1 cm tlusté. Za čerstva jsou měkce masité. Sterilní plstnatý okraj je zpočátku až 1 cm široký, později však zcela mizí. Celé plodnice jsou nejprve čistě bílé, jakoby stříbřitě blýskavé, po otlačení a na lomu tmavě hnědé (asi jako druhy rodu *Phellinus*), při dozrávání hnědnou i na povrchu do odstínu bílé kávy. Rourky jsou až 1 cm dlouhé, již od počátku nápadně tmavé. Póry jsou drobné, 4 - 5 na 1 µm, dlouho bílé nebo bělavé. Plodnice rostou velmi rychle (rourky dosahují délky 5 mm asi za 10 dní), ale žijí krátce; asi za dva týdny se rozpadnou a oddělí se od substrátu. Hyfový systém je dimitický s hyfami dvou typů. Generativní hyfy jsou 1,5 - 3 µm tlusté, tenkostěnné, na přehrádkách s přezkami. V plodnici převládají vegetativní hyfy, které jsou 2,5 - 5 µm tlusté a cca 500 µm dlouhé, od poloviny délky ke špičce nejprve s tenkými pokroucenými výběžky, později hojně větvené. Nejtenčí koncové větve jsou cca 1 µm tlusté. Tyto hyfy jsou tlustostěnné až plné, křehké, nahnědlé a v KOH tmavnoucí. Bazidie jsou tetrasporické, široce kyjovité, 10 - 16 x 4 - 6 µm velké. Výtrusy jsou elipsoidní, 5 - 6,5 x 2,5 - 3 µm velké, hyalinní, tenkostěnné, hladké a neamyloidní.

Nová lokalita *D. albidofuscus* v Československu: Bohemia merid. - Hluboká n/Vlt., silva „Boky" ad ripam fluminis Vltava, cca 400 m s. m., ad truncum iac. *Abietis albae*, 16. VII., 27. VII., 7. VIII. 1986, ibid. ad truncum iac. *Piceae abietis*, 27. VIII. 1990, leg. et det. J. Vlasák (herb. J. Vlasák).

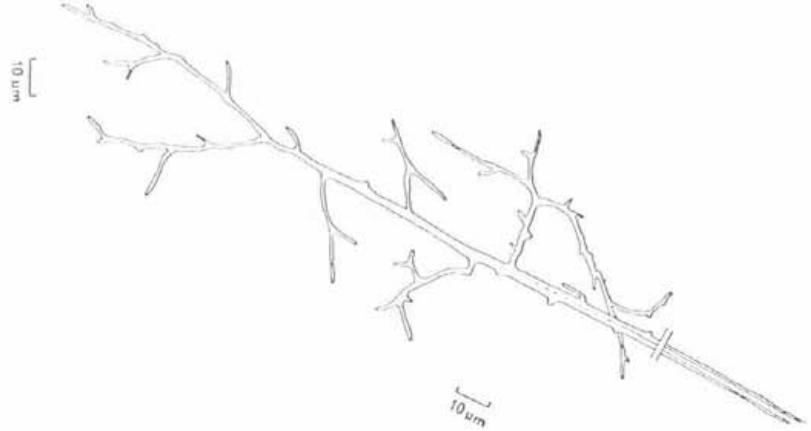
Nejlepším terénním znakem pro určení pórnatky hnědobílé je nápadný kontrast mezi bílými póry a hnědou stěnou rourek, podobný jako u pórovky šedé - *Aporpium caryae* (Schw.) Teix. et Rogers. Pórovka šedá však nikdy netvoří tak mohutné plodnice a neroste na jehličnanech, nýbrž na listnáčích. Velikostí a stříbřitým leskem pórů je dosti podobná také pórnatka velkopórá - *Donkioporia expansa* (Desm.) Kotl. et Pouz., avšak její povrch je vždy hnědý. Navíc je pórnatka velkopórá druhem vytrvalým a rostoucím hlavně na dřevu dubů (*Quercus*). Mikroskopicky zcela unikátním znakem pórnatky hnědobílé jsou světle hnědé, ke konci rozvětvené vegetativní hyfy.

Plodnice pórnatky hnědobílé nalezl druhý z autorů poprvé v červenci 1985 v lese „Boky'', cca 5 km severně od Hluboké n/Vlt., a to na prudkém svahu k řece Vltavě (nedoloženo). Plodnice rostly na padlém a již dosti zetlelém kmenu jedle bělokoré (*Abies alba*), porostlém mrtvými plodnicemi troudnatce růžového - *Fomitopsis rosea* (Alb. et Schw.: Fr.) P. Karst. Považoval tento nález za pórnatku čulymskou - *Skeletocutis tschulymica* (Pilát) Keller a nálezu nevěnoval pozornost dokud nezjistil, že houba po třech týdnech „zmizela''. Následující rok (1986) pak sbíral na stejném místě další exempláře 16. VII., 27. VII. a 7. VIII.; plodnice houby se však opět brzy poté zcela rozpadly. Časný růst a rychlý rozpad plodnic jsou zřejmě pro tento druh charakteristické. Také všechny exempláře z Polska byly nalezeny od června do srpna, tedy v období, kdy podobné velké pórnatky sotva začínají růst. O rychlém rozpadu plodnic se však Domański ve svém popisu nezmiňuje. Následující dva roky (1987, 1988) vyrostla na stejném místě pouze plodnice bělochoroše rozlitého - *Antrodia gossypia* (Speg.) Ryv., což je kupodivu jediný choroš, který je stejně efemérní. Další plodnice pórnatky hnědobílé byla nalezena až 27. VIII. 1990, a to ve vzdálenosti asi 30 m od místa prvního nálezu. Vyrůstala na ležícím smrkovém kmenu, opět porostlém mrtvými plodnicemi *Fomitopsis rosea*.

Gelatoporia subvermispora (Pilát) Niemelä - pórnatka slámožlutá

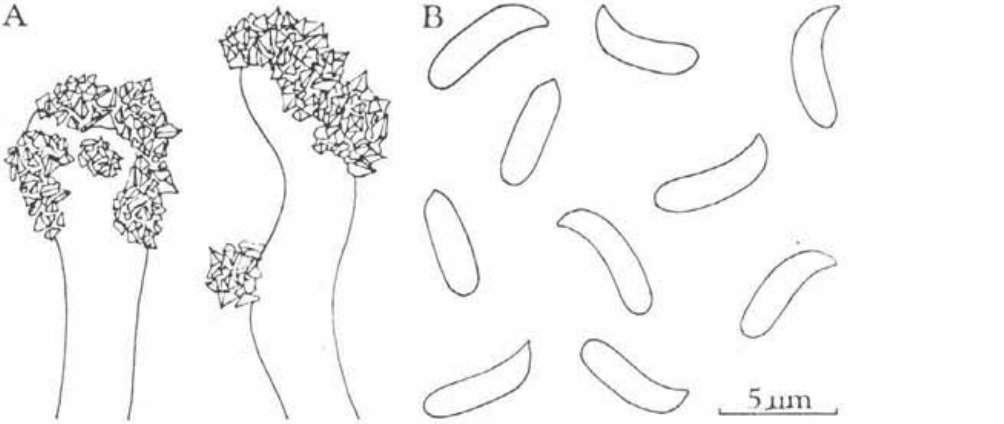
Syn.: *Poria subvermispora* Pilát, *Fibuloporia subvermispora* (Pilát) Domań., *Tyromyces subvermisporus* (Pilát) Ryv., *Spongiporus subvermisporus* (Pilát) Ryv. et Gilbn., *Ceriporiopsis subvermispora* (Pilát) Gilbn. et Ryv., *Poria notata* Overh. (nom. inval.), *Poria quercuum* Baxt.

Gelatoporia subvermispora byla pod jménem *Poria subvermispora* popsána A. Pilátem jako nový druh pro vědu před více než padesáti lety, a to podle čtyř položek z herbáře L. O. Overholtse, pocházejících ze tří různých lokalit v Severní Americe. Jako typus vybral Pilát položku No. 8821 (herb. Overholts), která je nyní uložena v herbáři mykologického oddělení Národního muzea v Praze (PRM 200515). Tuto položku sbíral A. S. Rhoads 16. IV. 1922 na mrtvém kmenu *Quercus alba* v Mountain Grove ve státě Missouri v USA (Pilát 1940). V Severní Americe však byl tento druh později popsán ještě dvakrát, a to poprvé neplatně (bez latinské diagnózy) jako *Poria notata* Overholts (1942), podruhé pak jako *Poria quercuum* Baxter (1949). Obě tato jména patří tedy do synonymiky. Postupným rozpadem širokého rodu *Poria* vznikla otázka, do kterého z menších rodů zařadit *Poria subvermispora*, což se odrazilo v několika nových kombinacích. První se snažil vyřešit problém zařazení této houby Domański (1969), když publikoval novou kombinaci *Fibuloporia subvermispora* (Pilát) Domań. Typovým druhem rodu *Fibuloporia* Bond. et Sing. ex Sing. je *Poria mollusca* (Pers.:Fr.) Cooke s. Bres. 1897 = *Poria mucida* (Pers.:Fr.) Cooke, u nás známá pod jmény *Fibuloporia donkii* Domań. nebo *Porpomyces mucidus* (Pers.:Fr.) Jülich. Podle našeho názoru však zahrnutí těchto dvou druhů hub do jednoho rodu není nejšťastnější, neboť obě houby jsou značně rozdílné. Do rodu *Tyromyces* P. Karst. kombinoval naši houbu Ryvarden (1973), avšak ani toto řešení nebylo vhodné, neboť příliš široce pojatý rod *Tyromyces* je v posledních letech již také neudržitelný. Z těchto důvodů zřejmě Ryvarden společně s Gilbertsonem provedli později další novou kombinaci, a to do rodu *Spongiporus* Murrill (Ryvarden et Gilbertson 1984) a zcela nedávno ještě do rodu *Ceriporiopsis* Domań. (Gilbertson et Ryvarden 1985). Zdá se však, že obtížnou situaci dobře vyřešil až Niemelä (1985), když vystavěl nový rod *Gelatoporia* a *Poria subvermispora* stanovil jeho typovým druhem. Do rodu *Gelatoporia* současně přeřadil ještě jeden druh pórnatky v Československu známý pod jménem slizopórka nazelenalá - *Gloeoporus pannocinctus* (Romell) J. Erikss. Vzhledem k tomu, že Niemeläovo řešení považujeme z uvedených kombinací za nejvhodnější, používáme tedy jméno *Gelatoporia subvermispora* (Pilát) Niemelä; k tomuto řešení se přiklonili též Kotlaba a Pouzar (1990). Současně navrhujeme pro tento druh i nové české jméno pórnatka slámožlutá. Nevyužíváme tak překladu latinského druhého jména „subvermispora", které volně přeloženo znamená „s červům podobnými výtrusy", ale navrhujeme jméno vyjadřující jeden z nejnápadnějších makroznaků dospělých plodnic tohoto druhu.



1. *Dichomitus albidofuscus* (Domań.) Domań. - rozvětvená vegetativní hyfa.

Pórnatka slámožlutá je druhem známým dosud pouze ze Severní Ameriky a z Evropy. Ze Severní Ameriky, kde je dosti rozšířená, byla publikována z USA ze států Montana, Arizona, Colorado, New Mexico, Texas, Missouri, Georgia, North Carolina, Virginia, Pensylvania a z Kanady pak z Ontaria a poloostrova Nova Scotia (Gilbertson et Ryvarden 1986). V Evropě, kde je však velmi vzácná, byla dosud nalezena jen na několika lokalitách ve Finsku (Niemelä 1985), na jedné lokalitě v Polsku (Domański 1969) a v Jugoslávii (Tortić 1984). Československo je tedy čtvrtou evropskou zemí, kde tato houba prokazatelně roste.



2. *Gelatoporia subvermispora* (Pilát) Niemelä - A) krystalové růžice na hyfách v ostří rourek, B) výtrusy.

Co se týče pórnatky slámožluté, lze tento druh charakterizovat jako saprofytický, rostoucí na mrtvém dřevu listnáčů i jehličnanů a působící bílou hnilobu dřeva. Ze Severní Ameriky jsou jako hostitelské dřeviny uváděny z jehličnanů druhy rodů *Abies, Picea, Pinus* a *Pseudotsuga,* z listnáčů pak *Acer, Populus* a *Quercus* (Pilát 1940, Baxter, 1949, Gilbertson 1974, Gilbertson et al. 1975, Lowe 1966, Martin et Gilbertson 1978, Nakasone 1981, Gilbertson et Ryvarden 1986.) V Evropě je převládajícím hostitelem smrk ztepilý (*Picea abies*), byly však zaznamenány i nálezy na jívě (*Salix caprea*) a střemše obecné (*Padus avium*) (Domański 1969, Niemelä 1985, Tortić 1984).

Jak již bylo uvedeno, je *Gelatoporia subvermispora* v Evropě velmi vzácná a pro většinu československých mykologů tedy zřejmě neznámá. Pro ně je určen níže uvedený popis, který je sestaven podle plodnic nalezených druhým z autorů v Adamově u Brna.

Plodnice jsou jednoleté, na dřevě zcela rozlité, nejprve tvořící tenké okrouhlé skvrny až 2 cm široké, později splývající v souvislé povlaky až 25 cm dlouhé, 10 cm široké a 0,5 cm tlusté. Za čerstva jsou celé plodnice bílé, později se šedohnědým nádechem, za sucha pak špinavě slámově zbarvené. Sterilní okraj je 0,5 - 1,5 µm široký, vatovitý nebo přitiskle pavučinovitý, bílý a za sucha kontrastující se slámově zbarvenými rourkami. Subikulum je velmi tenké, bílé, nehygrofánní. Rourky jsou až 4 µm dlouhé, na šikmém podkladu potrhané, za čerstva bílé a vodnatě hygrofánní, za sucha slámově žluté a křehké. Póry jsou poměrně drobné, 3 - 5 na 1 µm (za sucha se však některé rozesychají do značné šířky), jsou hranatě okrouhlé, za sucha na ostří bíle ojíněné. Hyfový systém je monomitický, tj. tvořený pouze generativními hyfami. Hyfy jsou 2 - 3,5 µm tlusté, většinou tenkostěnné nebo se slabě ztloustlými stěnami, na přehrádkách s přezkami, v tramě rourek slabě amyloidní. Nejnápadnějším mikroznakem jsou velmi hojné krystaly, vyskytující se převážně na hyfách v ostří rourek a vytvářející jakési kulovité růžice o průměru 5 - 10 µm. Hymenium je tvořeno bazidiemi, bazidiolami a nehojnými vřetenovitými cystidiolami. Bazidie jsou tetrasporické, kyjovité, 13 - 20 x 4 - 5 µm velké. Výtrusy jsou úzce válcovité, mírně zakřivené a k poutku (apikulu) přišpičatělé, 5 - 6 x 1 - 1,6 µm velké, hyalinní a neamyloidní.

Nová lokalita *G. subvermispora* v Československu: Moravia centr. - Adamov ap. Brno, in silva supra stat. Adamov - zastávka (area tuta = SPR „Coufavá''), cca 250 m s. m., ad truncum iac. *Abietis albae*, 30. VIII. 1989 leg. et det. J. Vlasák ut *Skeletocutis tschulymica* (= *S. odora*), 11. II. 1991 rev. P. Vampola ut *Gelatoporia subvermispora* (Pilát) Niemelä (PRM 868537).

Jak je již z citace etikety herbářového dokladu patrné, byl tento nález v terénu předběžně určen jako pórnatka čulymská - *Skeletocutis tschulymica* (Pilát) Keller. Pod tímto terénním určením byl také v roce 1990 publikován jako první pro Moravu v seznamu druhů nalezených v průběhu exkurzí VIII. celostátní mykologické konference v Brně (viz Mykol. listy no. 39 : 24). Teprve následné podrobné studium tohoto sběru, provedné prvním z autorů počátkem roku 1991, přineslo příjemné překvapení. Mikroskopickým vyšetřením bylo totiž zjištěno, že uvedený nález není *Skeletocutis tschulymica,* ale mnohem vzácnější *Gelatoporia subvermispora* a že je vlastně prvním nálezem pro Československo. Správnost tohoto určení byla ověřena studiem holotypu *Poria subvermispora* Pilát v herbáři Národního muzea v Praze (PRM 200515).

Čerstvé plodnice pórnatky slámožluté se velice podobají některým dalším druhům bílých pórnatek, usušené však získávají charakteristické špinavě slámožluté zbarvení, někdy až se slabě olivovým nádechem. Pro nápadnou inkrustaci hyf, nejlépe patrnou v ostří rourek, jsou mikroskopicky snadno určitelné.

Summary

Two species of polypores, *Dichomitus albidofuscus* and *Gelatoporia subvermispora* were found in Czechoslovakia for the first time.

Dichomitus albidofuscus that has been known from Bialowieża virgin forest in Poland only appeared twice on a locality near Hluboká n/Vlt. in south Bohemia on rotten trunks of *Abies alba* and *Picea abies*. It is a large, fleshy, up to 10 µm thick *Poria* with the conspicuous contrast between whitish pores and dark brown tubes as the main field character. Basidiocarps develop very early (June, July) and quickly but after only one month

completely disintegrate. Microscopically the brownish, in the upper half ramified and in KOH darkening vegetative hyphae are quite unique. The position of this fungus in the genus *Dichomitus* is discussed.

Gelatoporia subvermispora grows in North America and Europe. This species is very rare in Europe and meanwhile it has been found in Finland, Poland and Yugoslavia. The new Czechoslovak locality at Adamov near Brno in central part of Moravia is reported. *G. subvermispora* is very similar to some white species from the group *Poria* s. l. but microscopically it is different by the prominent crystal rosettes on hyphae of the disepiments.

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Two Gerronema species growing on Marchantia thalli. 1. G. marchantiae Sing. et Clém., 2. G. postii (Fr.) Sing.

Dvě kalichovky rostouci na stélce porostnice. 1. kalichovka porostnicová, 2. kalichovka Postova

Jaroslav Klán

Description of two rare *Gerronema* species growing on *Marchantia* thalli is presented. The main distinguishing features of both species, their ecology, and distribution, are described. *G. postii* is associated with fireplace mosses. *G. marchantiae*, an alpine element, has been recorded in Czechoslovakia for the first time.

Je podán popis dvou vzácných druhů rodu *Gerronema* rostoucích na stélce porostnice. Jsou uvedeny hlavní rozlišovací znaky obou druhů, jejich ekologie a rozšíření. *G. postii* je vázána svým výskytem především na starší spáleniště. *G. marchantiae*, alpinský prvek, je poprvé publikována z Československa.

Gerronema marchantiae Sing. et Clém. 1971 in Schweiz. Zeit. Pilzk. 49 : 119.
Syn.: *G. daamsii* Merxm. et Clém., Schweiz. Zeit. Pilzk. 1982 A, 123 : 18, Mycol. Helv. 1982.
Icon.: Watling et Romero 1989 : 193; Senn-Irlet et al. 1990 : 17; Breitenbach et Kränzlin 1991 : 214.

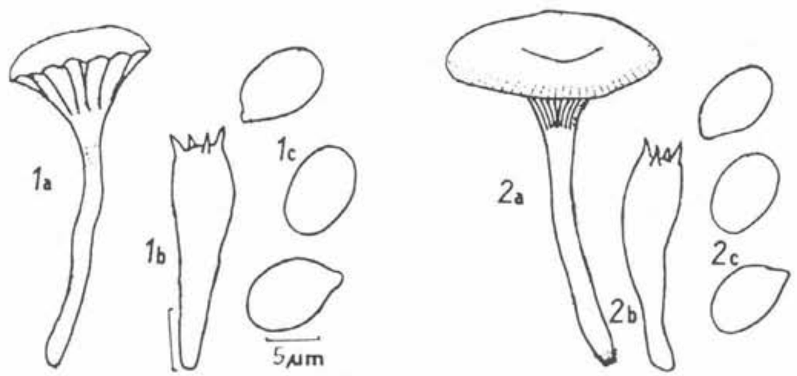
Pileus 2 - 10 µm diam., slightly hygrophanous, at first convex, later plano-convex to somewhat depressed centre, margin crenulate; smooth. Vivid orange red when young, bright tawny orange to ochre with darker, almost rust-colored centre. Lamellae L = 8 - 12, l = 0 - 1, deeply decurrent, almost triangular, distant, forked, slightly thickish; whitish or yellowish. Stipe 8 - 15 x 0.8 - 1.4 µm hollow, concolours with pileus or slightly paler, smooth, pruinose at apex. Contex thin, concolours with pileus; odour and taste indistinct. Spore print white. Spores 8.5 - 10.5 (11.5) x 5 - 6.5 (7) µm, Q = 1.50 - 1.75, elongate ellipsoid, broadly ellipsoid, hyaline; smooth, inamyloid, acyanophilous. Basidia 30 - 40 x 7 - 10 µm, clavate, 4-spored. Hymenophoral trama regular. Stipitipellis with scattered, flexuose, slightly clavate caulocystidia 30 - 50 x 5 - 10 µm. Pileipellis slightly differentiated, radially arranged hyphae 3 - 5 µm broad, with abundant yellow intracellular pigment. Hymenial cystidia and clamps absent.

Collections examined: Bohemia merid.: montes Šumava, in decliv. montis "Popelná hora" pars supra Popelná ap. Nicov pr. Stachy in alt. 940 m.s.m., ad *Marchantiam polymorpham*, 21. VI. 1987, F. Kotlaba (PRM 853322). Slovakia borealis: montes Bielské Tatry, in ripa lacus Biele Pleso, in alt. 1 750 m.s.m., ad *Marchantiam alpestrem*, 26. VII. 1978, J. Klán (herb. Klán).

Ecology and distribution

This bryophilous species grows solitary or in small groups exclusively on dead and living thalli of hepatics (*Marchantia polymorpha*, *M. alpestris* and *M. paleacea*), on humid soils. The main fructification period is the aestival season (June - July). *G. marchantiae* was found predominantly in (sub)alpine zone - the Swiss Alps (Singer et Clémençon 1971;

Senn-Irlet et al. 1990), the French Alps (Senn-Irlet et al. 1990), the Austria Alps (Schmid-Heckel 1990), alpine sites in Norway (Senn-Irlet et al. 1990) and the High Tatra Mts., Slovakia. In submontane zone it is reported from Germany (Krieglsteiner 1980) and the Šumava Mts., Bohemia. It was also observed in arctic areas - Alaska (Senn-Irlet et al. 1990) and Greenland (Lamoure et al. 1982). Only one finding was reported from lowlands in Great Britain by Watling and Romero (1989), who found it in an area around a water channel but take it for very probably adventive in its present site.



1 a-c. *Gerronema marchantiae* Sing. et Clém. - b-basidium, c-spores. 2a-c *G. postii:* b - basidium, c - spores.
J. Klán del.

Note: *G. marchantiae* comes very close to *G. daamsii* Merxm. et Clém. It differs however by a larger quantity of clubshaped hair on the stipe. As intermediates occur, the demarcation between the two species is still impossible because of lack of material. More material might enable to distinguish between them.

Gerronema postii (Fr.) Sing. 1961 in Sydowia 15: 50.

Syn.: *Agaricus postii* Fr. 1863, Monogr. Hymen. Suec. 2: 291.
Omphalina postii (Fr.) Sing. 1947, Mycologia 39: 83.
Icon.: Cejp 1936, tab. 6, fig. 118-119, photo 14a; Pilát 1952, photo 312a, Spooner 1987: 19; Senn-Irlet et al. 1990: 19.

Pileus 20 - 30 (40) µm diam, slightly hygrophanous, convex, plane almost depressed and umbilicate centre. Margin slightly incurved, entire, smooth. Orange yellow, bright orange. Lamellae L = 20 - 55, l = 3 - 5, deeply decurrent, close, not forked. Whitish, pale yellowish or pale cream. Stipe 20 - 55 x 1 - 2 µm, equal, smooth, with white basal tomentum, solid to hollow. Concolorous or paler with pileus. Contex thin, whitish to yellowish; odour and taste slightly farinaceous. Spore print white. Spores 7.5 - 9.5 x 4 - 5.6 µm, Q = 1.4 - 1.8, ellipsoid, hyaline, smooth, inamyloid, acyanophilous. Basidia 25 - 35 x

6 - 10 µm, cylindric, 4-spored (2-sp.). Hymenophoral trama regular to subregular. Stipitipellis with scattered flexuose, protruding terminal cells (?caulocystidia) 35 - 70 x 4-6 µm, yellow intracellular pigment present. Pileipellis of repent to ascending hyphae, 5 - 7 µm broad; subpellis of loosely interwoven hyphae; golden yellow intracellular pigment abundant. Hymenial cystidia and clamps absent.

Collections examined: Bohemia merid.: in silva "Velký Pálenec" prope Blatná, VIII. 1926, K. Cejp (PRC); monte Brdy, pr. Mýto, in carbonariis silvaticis, IX. 1928, K. Cejp (PRC); in monte Kočka (Brdy), VIII. 1929, K. Cejp (PRC); montes Šumava, pr. Č. Kříž, in pinetis ad *Marchantiam*, VIII. 1929, A. Pilát (PRC) (Pilát 1930; Cejp 1936). Bohemia borealis: Lovosice, in portu mercatorio prope orbitas viae ferreae, ad terram humidam particulis carbonum tostorum et cinere permixtam (slag), ad *Marchantiam polymorpham*, 12. X. 1984, 26. IX. 1985, V. Jehlik. Malá Bělá, in vico Velký Rečkov, in valle rivi Rokytka, in carbonariis inter muscos (*Funaria hygrometrica*), 17. VI., 12. VII. 1970 J. Herink (herb. Herink 127/70). Slovakia sept.: Tatrae Magnae, inter pagos Východná et Važec, 850 m. s. m., in carbonario inter thallos *Marchantiae polymorphae*, 17. IX. 1972; Važec, tabernaculum "Hotel Važec", in stratu hepaticarum, 14. VIII. 1987, J. Kuthan (BRA).

Ecology and distribution

G. postii grows solitary among dead thalli of hepatics (*Marchantia polymorpha*) and mosses (*Funaria hygrometrica, Ceratodon purpureus*). Most records of fructification have been made in serotinal season (August-September). It occurs from hilly country to the mountain belt (the High Tatra Mts.). According to Senn-Irlet et al. (1990), it is a predominantly lowland species, but found also in subalpine, alpine zone and subarctic regions. All Czechoslovakian habitats are older burns. *G. postii* seems to be associated with fireplace mosses. *G. postii* does not appear on the burns until a moss carpet has been established and disappears when the moss carpet is broken up. The fungus was collected by Petersen (1970) on burns from 64 to at least 187 weeks after fire.

Coenologically, the localities may mostly be placed in different pioneer Bryophyta communities subass. *Funarietum hygrometricae* Hübsch. 1957, *Marchantietosum polymorphae* Hübsch. 1957. These communities are mesophytic to hygrophytic, with rich content of salts and nitrogen. *G. postii* is a saprotrophic species with ruderal strategies. It grows occasionally on peat among *Sphagnum* and *Polytrichum*. It is rare in North temperate zone.

Tab. 1
Main distinguishing features between *G. marchantiae* and *G. postii.*

	G. marchantiae	*G. postii*
Pileus - diam	2-10 µm	>10 µm
- margin	crenulate	entire
Lamellae	distant, forked	close, not forked
Spores - width	5-6.5 µm	4-5.6 µm

Note: *Rickenella fibula* (Bull.: Fr.) Raith., *R. mellea* (Sing. et Clém.) are similar in shape, colour of carpophores and by growing on similar ecotopes as *G. marchantiae* and *G. postii*, are easily recognized by presence of hymenial cystidia and clamp connections.

2. *Gerronema postii* (Fr.) Sing. - Fruitbodies on *Marchantia polymorpha* thallus, Lovosice, Bohemia, 26. IX. 1985.

Photo J. Klán

3. *Gerronema marchantiae* Sing. et Clém. - Fruitbodies on *Marchantia alpestris* thallus, High Tatra Mts., Slovakia, 26. VII. 1978.

Photo J. Klán

Acknowledgments

I express my sincere thanks to Dr. Gro Gulden (Oslo, Norway) for providing me with valuable mycological books unaccessible in Czechoslovakia and to Dr. V. Jehlik for coenological literature. I am greatly indebted to Dr. J. Herink for critically reading and correcting of the manuscript.

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New records of micromycetes from Czechoslovakia. II. Filobasidiella depauperata (Petch) Samson, Stalpers et Weijman

Nové nálezy mikromycetů v Československu. II. Filobasidiella depauperata (Petch) Samson, Stalpers et Weijman

Alena Kubátová

The microscopic fungus *Filobasidiella depauperata* is recorded from Czechoslovakia for the first time. It was isolated from the surface of a *Verticillium lecanii* colony obtained from mycelial overgrowth on a caterpillar of tortricid (*Carpocapsa pomonella*, Lepidoptera). The strain is maintained in the Culture Collection of Fungi, Department of Botany, Charles University, Prague, as CCF 2746. Description and illustration are given.

Z povrchu kolonie houby *Verticillium lecanii* izolované z housenek obaleče jablečného byla vyizolována houba *Filobasidiella depauperata*. Tento druh nebyl dosud v Československu zaznamenán. Kultura houby je uložena ve Sbirce kultur hub katedry botaniky Př. f. UK v Praze pod č. CCF 2746. Je uveden jeji popis a vyobrazeni.

In 1991 the following entomopatogenous fungi were isolated from dead caterpillars of a tortricid: *Verticillium lecanii* (Zimm.) Viégas, *Beauveria bassiana* (Bals.) Vuill. and *Paecilomyces farinosus* (Holm) Brown et Smith. After some weeks small whitish sporodochia-like formations of a very slowly growing fungus were recorded on one of a *Verticillium* colony. The fungus was isolated and determined as *Filobasidiella depauperata* (after Malloch et al. 1978; Samson et al. 1983). Description of this strain is recorded below.

Filobasidiella depauperata (Petch) Samson, Stalpers et Weijman 1983

Syn.: *Aspergillus depauperatus* Petch 1931
Filobasidiella arachnophila Maloch, Kane et Lahaie 1978

Studied material:

The fungus was isolated from a surface of *Verticillium lecanii* colony obtained from a dead caterpillar of tortricid *Carpocapsa pomonella* (Lepidoptera) in XII. 1991 by A. Kubátová as No. 174/91. The caterpillars were collected on apple-trees in Holovousy, Eastern Bohemia, Czechoslovakia by P. Syrovátko in V. 1991. The strain was deposited in the Culture Collection of Fungi (CCF), Department of Botany, Charles University, Prague, as CCF 2746.

Description:

The fungus was cultivated on the following media:

- Czapek yeast extract agar (CYA),

- CYA with cca 2 % of dried and powdered *Carpocapsa caterpillars* (CYA2C),
- water agar with cca 2 % of dried and powdered *Carpocapsa caterpillars* (WA2C),
- water agar with dead mashed *Verticillium* (WAV),
- WAV with 2 % yeast extract (WAV2YE),
- wort-beer agar (WBA).

Colonies on all of the media were whitish to white, plane, velutinous, very slowly growing, with uncoloured reverse. On CYA, CYA2C and WA2C at 25°C the colonies attained about 25 μm in diam. after 30 days. On WAV and WAV2YE at 25°C the colonies attained cca 10-20 μm in diam. after 30 days. On WBA at 25°C the growth was very poor, with colonies attaining 4 μm after 30 days. At 37°C after 30 days the growth was nil.

Hyphae hyaline, septate, without clamps, sometimes swollen at the base of the sporophores, cca 1.6-2.5 μm wide, at about 5 μm in diam. at the swellings. Sporophores of clavate form with long cylindrical stipe, cca 30-80 x 4.7-5.4 μm, often growing in verticils of 2 to 4, with 4 apical sporogenous loci on the head, without sterigmata. Spores produced in chains, hyaline, oblong to pentagonal, truncate at the base, cca 3-3.9 x 2.3-2.9 μm (see figure). Budding cells known in a pathogen *F. neoformans* as *Cryptococcus* anamorpha were not observed. Chlamydospores noted by Malloch, Kane and Lahaie (1978) in *F. arachnophila* were not observed either.

Permanent mounts of *F. depauperata* in a polyvinylalcohol are preserved in the CCF.

Notes on ecology:

F. depauperata was originally described as an entomopatogenous fungus on a *Aspidiotus* sp. (Homoptera) in Sri Lanka by Petch (1931). He reported this fungus as rather abundant on *Lepidosaphes ulmi* (Homoptera) in Norfolk, England also.

Rockwood (1951) found "a pretty little *Aspergillus*, which answers to the description of *A. depauperatus* Petch (1931)" on aphids in the Pacific Northwest of USA.

Malloch et al. (1978) isolated *F. depauperata* from a dead spider in Ontario, Canada, together with *Verticillium lecanii*. Noteworthy is another strain isolated from aphids in Wageningen, The Netherlands, together with *V. lecanii* (Samson et al. 1983). Malloch et al. (1978) noted better sporulation of *F. depauperata*, when *V. lecanii* was inoculated near a colony of *F. depauperata*.

According to the above cited data and to own observations, *F. depauperata* is considered as an entomopatogenous fungus with affinity to *Verticillium lecanii*. In contrast to the dangerous pathogen *Filobasidiella neoformans*, *F. depauperata* grows very poorly or not at all at 37°C and is nonpathogenic for homoiothermic animals (Malloch et al. 1978).

Koval' (1974) reported *A. depauperatus* on Homoptera in Crimea, but her description of this fungus (viz. dark green colonies, ellipsoidal conidia) is not in accordance with the description presented here.

Notes on systematic position:

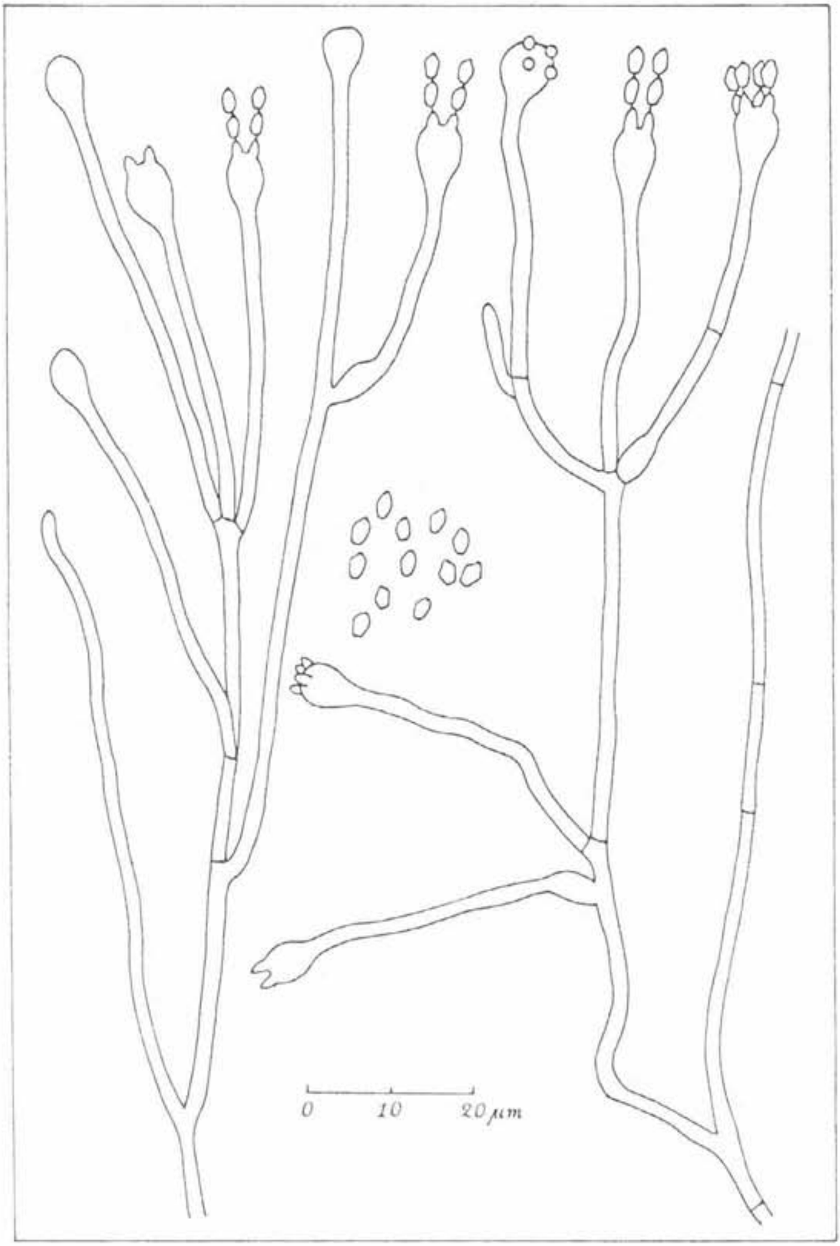
From a systematic point of view, the genus *Filobasidiella* is included in *Sporidiales, Ustilaginomycetes, Basidiomycotina* (after Hawksworth, Sutton et Ainsworth 1983). Kwon-Chung has suggested the inclusion of this genus in the *Filobasidiaceae* of the *Ustilaginales* and later a new order, *Filobasidiales* (Kwon-Chung 1975, 1987).

With regard to the morphological resemblance, Malloch et al. described *F. arachnophila* as differing from *F. neoformans* by spore shape and the absence of a yeast-like growth phase and clamp connections. Samson et al. (1983) found that *F. arachnophila* is identical with *Aspergillus depauperatus* Petch and they made, therefore, a new combination *Filobasidiella depauperata* (Petch) Samson, Stalpers et Weijman.

Khan et al. (1981), Samson et al. (1983) and Kwon-Chung (1987) have maintained the accomodation of *F. depauperata* in the genus *Filobasidiella*, but they have accepted it with some reservations:

- *F. depauperata* has sporogenous structures strongly resembling basidia of *F. neo-formans* and its spores are produced in chains as those of *F. neoformans* (they are not discharged) but *F. depauperata* lacks clamp connections and yeast like growth phase.
- After Khan et al. (1981), who investigated the ultrastructure of *F. arachnophila* by transmission and scanning electron microscopes, the septa in *F. depauperata* have dolipores with septal swellings, without the pore caps, resembling the septal pore apparatus of *F. neoformans* and some yeast-like fungi. The type of spore formation in *F. depauperata*, however, is enteroblastic; in *F. neoformans* the spore formation is holoblastic. These authors also reported the inability of *F. depauperata* to hydrolyze urea, oxidize phenolic compounds, and synthesize starch (physiological features characteristic of *F. neoformans*).
- According to Samson et al. (1983), the carbohydrate profile of two investigated strains of *F. depauperata* revealed basidiomycetous affinities. On the contrary, the vast majority of the mycelial cells are monocaryotic, demonstrating that *F. depauperata* is not a typical basidiomycete.

Regarding Samson et al. (1983), further genetic studies are required to determine whether the spores are sexual or not and thus whether the fungus is an anamorph or a teleomorph. On the basis of the above mentioned facts, the generic position of *F. depauperata* is considered to be uncertain.



Filobasidiella depauperata (Petch) Samson, Stalpers et Weijman, strain CCF 2746 grown on CYA, sporophores with spores.

A. Kubátová del.

Acknowledgement

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Charakteristika huby Tilletia controversa Kühn a jej novej lokality na pýre (Elytrigia Desv.)

Characteristic of the fungus Tilletia controversa Kühn and its new locality on dog´s grass (Elytrigia Desv.)

Peter Paulech

V práci je opísaná nová lokalita huby *Tilletia controversa* Kühn na pýre sivom (*Elytrigia intermedia* (Host) Nevski) a pýre plazivom (*E. repens* (L.) Desv.). Nachádza sa na svahu kóty Vrchná hora, v katastrálnom území Mást I, v najzápadnejšej časti pohoria Malé Karpaty, pri obci Stupava. U populácie huby je uvedená morfologická a ekofyziologická charakteristika jej chlamydospór a výsledky analýzy rastovej depresie infikovaných hostiteľských rastlín. Ku klíčeniu chlamydospóry vyžadovali svetlo a nízku teplotu. Doba ich dormancie trvala 28-30 dní. Infekcia preukazne znížila dĺžku klasu a vysopreukazne výšku rastlín, dĺžku stebla a vrchného internódia, ako aj počet internódií.

In this contribution is described a new locality of the fungus *Tilletia controversa* Kühn on *Elytrigia intermedia* (Host) Nevski and *E. repens* (L.) Desv. It occurs on the slope of the Vrchná hora hill in the land register Mást I, in the western part od the Malé Karpaty Mountains, near village Stupava. The fungus population is defined by morphological and ecophysiological characteristics of its chlamydospores and by results of growth depression analysis of infected host plants. The light and low temperature were necessary for the germination. Dormancy period of the fungus was 28-30 days. The infection lowered significantly the lenght of the spike and highly significantly the height of plants, lenght of the stem and upper internodium as also the number of internodes.

Úvod

Tilletia controversa je známa ako hospodársky významný patogén ozimnej pšenice (Duran et Fischer 1961, Paulech 1964 a iní). Jej výskyt na ďalších druhoch tráv je nielen u nás, ale i vo svete zriedkavý. Bäumler (1927) a neskoršie i Paulech a Maglocký (1988) uvádzajú ju i u nás aj na pýre plazivom (*Elytrigia repens* (L.) Desv.) a na pýre sivom (*E. intermedia* (Host) Nevski), subsp. *intermedia* a subsp. *trichophora* (Link.) Á. et D. Löve. V súčasnosti sú na Slovensku známe iba dve lokality *T. controversa* na pýre: Malý Kamenec a Malý Horeš (Paulech et Maglocký 1988). Obe sa nachádzajú na východnom Slovensku v okrese Trebišov. Koncom roka 1990 sme zistili ďalšiu - tretiu lokalitu jej výskytu nachádzajúcu sa na západnom Slovensku, v oblasti Malých Karpát, neďaleko obce Stupava. V našom príspevku prinášame jej bližšiu charakteristiku a základné údaje o morfológii a ekofyziológii chlamydospór populácie huby z uvedenej lokality.

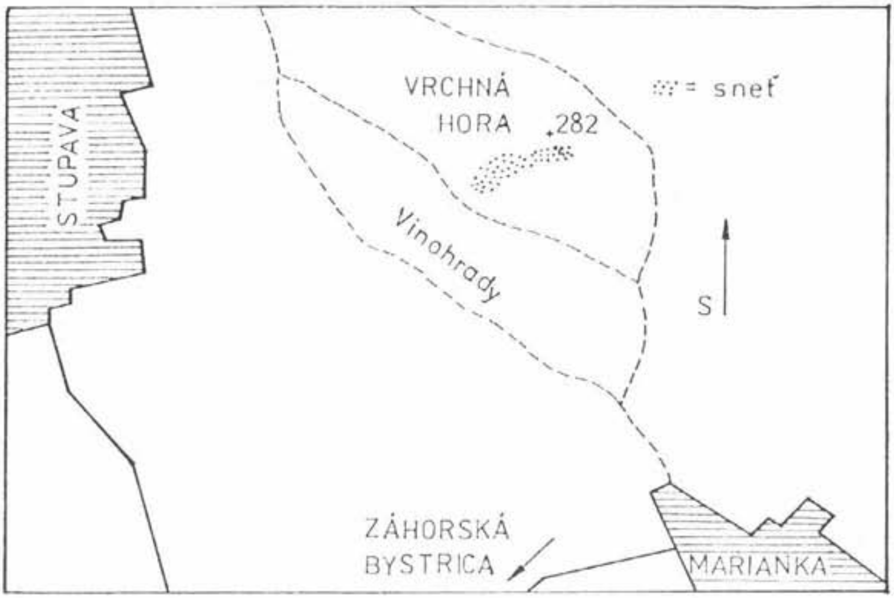
Materiál a metódy

Tilletia controversa sme zistili pri terénnom výskume fytopatogénnych mikromycét rodu *Tilletia* na našom území, pri ktorom sme zvýšenú pozornosť venovali druhom rodu *Elytrigia*, známym u nás ako hostiteľov uvedeného rodu. Výskum sme robili hlavne na xerotermných stanovištiach, v čase od polovice júla do konca vegetácie. Zistenú lokalitu sme v budúcom roku bližšie charakterizovali (rozsah, ekologické podmienky, rastlinné druhy apod.) a zistili sme základné, hlavne morfologické a ekofyziologické charakteristiky chlamydospór populácie uvedenej huby.

Rozmery chlamydospór, hrúbku hyalinného obalu a počet očiek retikulácie na priemer chlamydospóry sme zistili u 100 spór z dobre vyvinutých sórusov. Percento hyalinných a asferických spór uvádzame z 500 hodnotení. Chlamydospóry sme mikroskopovali v laktofenole (Vánky 1985), ich rozmery uvádzame bez výšky lišt retikulácie a hrúbky hyalinného obalu. Mikroskopické preparáty sme zahriali nad liehovým kahanom a po vychladnutí mikroskopovali. Percento asférických spór sme zisťovali v bezvodom propanole (Trione et Krygier 1977). Získané biometrické údaje sme štatisticky vyhodnotili a výsledky zostavili do tabuľky. Sú v nej uvedené rozpätia tzv. typických hodnôt (= priemer ± smerodatná odchylka) a v zátvorkách priemery najmenšej a najväčšej meranej chlamydospóry v hodnotenom súbore.

Klíčenie chlamydospór (dĺžku dormancie) sme zisťovali v Petriho miskách na vyplavenej nesterilizovanej ilovitohlinitej pôde (Niemann 1957) v troch opakovaniach. Petriho misky sme umiestnili do klimatizovaných boxov (KTLK Ilka, NDR) so stabilnou teplotou 7°C, 12hodinovou svetelnou periódou (12 000 luxov) a s relativnou vlhkosťou vzduchu 60 % (±5 %).

Fotografickú dokumentáciu sme robili rastrovacím mikroskopom zn. TESLA BS 301. Názvy rastlín sú podľa Dostála (Dostál 1989).



1. Nákres lokality Vrchná hora s výskytom *Tilletia controversa* Kühn na pýre *(Elytrigia* Desv.).

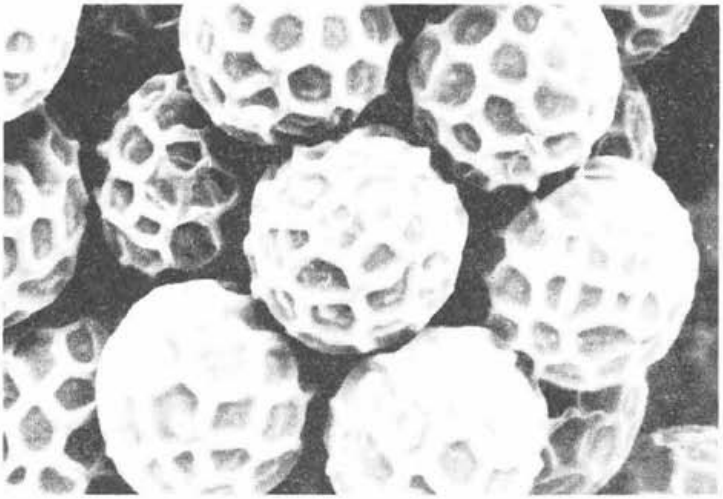
Výsledky

Novú lokalitu výskytu huby *Tilletia controversa* na pýre (*Elytrigia* Desv.) sme zistili 5. 9. 1990 v katastrálnom území Mást I, nachádzajúcom sa medzi obcami Stupava, Záhorská Bystrica a Marianka. Leží na juhozápadnom až juhovýchodnom svahu kóty

Vrchná hora (282 m n. m.), v najzápadnejšej časti pohoria Malé Karpaty. Infikované rastliny sa tu vyskytovali nad poľnou cestou prechádzajúcou nad horným okrajom vinohradov, okolo chatiek so záhradkami, od nadmorskej výšky cca 210 m až po horizont (obr. 1). Svah je trávnatý a miestami riedko porastený krami a stromami. Sneťou tu bol napadnutý pýr sivý (*Elytrigia intermedia*) a pýr plazivý (*E. repens*).

Tab. 1.
Charakteristika chlamydospór *Tilletia controversa*
(Lokalita: Stupava, Mást I, zber-september 1990)

Hodnotené parametre	Zistené hodnoty
Rozmery spór v µm	(14-)15-17(-19) x (12-)13,5-15,5(-17)
Hrúbka hyalinného obalu v µm	(1,5-)1,7 - 2,4(-3)
Percento asférických spór (v bezvodom propanole)	5 - 13
Počet očiek na priemer spóry	4 - 7
Percento hyalinných spór	0 - 4
Konzistencia spórového prachu	semiaglutinózna
Farba spórového prachu	tmavohnedá



2. Chlamydospóry *Tilletia controversa* Kühn na pýre sivom (lokalita Vrchna hora). Zv. 3 000 x.

Infikované rastliny mali pozmenený tvar lichoklasu. Ich obilky boli zmenené v snetivé hálky (sórusy) a vyplnené chlamydospórami huby. Lichoklasy boli širšie, klásky a kvetné obaly mali odstávajúce a snetivé hálky v niektorých miestach čiastočne odkryté, dobre viditeľné medzi obalmi. Sórusy v dôsledku vyššej vlhkosti boli nabobtnané, praskali a uvoľňovali tmavú hmotu spór. Napadnuté rastliny a najmä chlamydospóry huby mali charakteristický nepríjemný zápach. Mikroskopické pozorovania ukázali, že chlamydospóry huby sú guľaté až takmer guľaté, s dobre vyvinutou retikuláciou povrchu (obr. 2) a s hyalinným obalom. Ich bližšiu charakteristiku uvádzame v tabuľke 1.

U populácie *T. controversa* z lokality Mást sme zistili i ekofyziologickú charakteristiku chlamydospór (Tab. 2). Je z nej vidieť, že chlamydospóry vyžadujú ku klíčeniu svetlo a nízke teploty. Dĺžku dormancie majú 28-30 dní.

Tab. 2.
Ekofyziológia klíčenia chlamydospór *Tilletia controversa*
(Lokalita: Stupava, Mást I, zber-september 1990)

Podmienky klíčenia		Začiatok klíčenia
svetlo	teplota v °C	po dňoch expozície
Nepretržité osvetlenie	8	28 - 30
	18	neklíčia
Nepretržitá tma	8	neklíčia
	18	neklíčia
Striedanie 12 hod. svetlo a 12 hod. tma	8	28 - 30
	18	neklíčia

V poraste bolo ťažko spoľahlivo posúdiť vplyv huby na výšku rastlín. V snahe zodpovedať túto otázku sme na lokalite zozoberali priemernu vzorku 50 zdravých a 50 infikovaných rastlín a v laboratóriu získali z nich príslušné biometrické údaje, ktoré sme štatisticky vyhodnotili a zhrnuli do tabuľky 3.

Z údajov v tabuľke 3 vyplýva, že *T. controversa* znížila vysokopreukazne výšku rastlín (priemerne o 38,44%), dĺžku stebiel (o 41,79%), priemerný počet internódií (o 17,28%) a dĺžku vrchného internódia (o 43,75%). Dĺžku lichoklasu skrátila preukazne o 15,75 %. Najvýraznejšie sa jej vplyv prejavil na skrátenie dĺžky vrchného internódia. Podobné závislosti sme zaevidovali i u rastlín pšenice infikovanej uvedenou hubou (nepublikované).

Tab. 3.
Rastová depresia pýru sivého *(Elytrigia intermedia)* infikovaného *Tilletia controversa.**)

Hodnotené parametre	Variant	$x \pm 3.s_{\bar{x}}$	Percento
Výška rastlín v cm	K	79,60 ± 3.1,90	100
	I	49,00 ± 3.2,91	61,56
	∂	30,60	38,44
	$t_{(98)}$	8,00	
	P	++	

Dĺžka stebla v cm	K	69,44 ± 3.1,83	100
	I	40,42 ± 3.2,72	58,21
	∂	29,02	41,79
	$t_{(98)}$	8,86	
	P	++	
Dĺžka lichoklasu v cm	K	10,16 ± 3.0,57	100
	I	8,58 ± 3.0,50	84,25
	∂	1,58	15,75
	$t_{(98)}$	2,08	
	P	+	
Dĺžka vrchného internódia v cm	K	25,60 ± 3.1,19	100
	I	14,40 ± 3.1,08	56,25
	∂	11,20	43,75
	$t_{(98)}$	9,56	
	P	++	
Priemerny počet internódií	K	4,86 ± 3.0,11	100
	I	4,02 ± 3.0,08	82,72
	∂	0,84	17,28
	$t_{(98)}$	6,02	
	P	++	

*)K = kontrola
I = infikované rastliny
∂ = rozdiel

$t_{(98)}$ = vypočitané
+ = preukazné ($t_{(98)} > 1,98$)
++ = vysokopreukazné ($t_{(98)} > 2,63$)

Z rastlinných rodov, ktorých druhy sú v zahraničí známe ako hostitelia huby *T. controversa*, rástli na lokalite, okrem uvedených druhov rodu *Elytrigia*, nasledovné: *Festuca rupicola* Heuff., *Dactylis polygama* Horvátovszky, *Arrhenatherum elatius* (L.) Beauv. ex J. et C. Presl, *Koeleria macrantha* (Ledeb.) Schult. a *Bromopsis erecta* (Huds.) Fourr. Na žiadnom z nich sa však huba *T. controversa* nevyskytovala. V snahe bližšie charakterizovať lokalitu uvádzame i ďalšie (nehostiteľské) druhy rastúce na danom území: *Brachypodium pinnatum* (L.) Beauv., *Pimpinella saxifraga* L., *Centaurea scabiosa* (L.) Holub, *Aster amellus* L., *Tithymalus cyparissias* (L.) Scop., *Orthantha lutea* (L.) A. J. Kerner ex Wettst., *Astragalus cicer* L., *Coronilla varia* L., *Artemisia campestris* L., *Arabis hirsuta* (L.) Scop., *Libanotis pyrenaica* (L.) Bourg., *Melilotus officinalis* (L.) Pallas, *Salvia pratensis* L. a *Stachys recta* L. (záznam bezprostredne z lokality).

V širšom okolí sme na lokalite zistili druhy: *Hieracium umbellatum* L., *Solidago virgaurea* L., *Carlina vulgaris* L., *Prunus domestica* L., *Robinia pseudo-acacia* L., *Crinitina linosyris* (L.) Soják, *Campanula rapunculoides* L., *Polygonatum odoratum* (Miller) Druce, *Scabiosa ochroleuca* L., *Origanum sanguineum* L., *Clinopodium vulgare* L. a *Xeranthemum annuum* L.

Celkove sa jedná o xerotermnú lokalitu s piesčitou až piesčitohlinitou pôdou.

Diskusia

Prvú správu o výskyte *Tilletia controversa* na pýre rastúcom na území Slovenska podal Bäumler (1927). Uvádza v nej údaj o zistení na *Elytrigia repens* z brehov Dunaja v Bratislave. Bližšie údaje o mieste výskytu a ani herbárové doklady z tejto lokality nie sú k dispozícii. Napriek doterajšiemu našemu úsiliu, ako aj úsiliu iných autorov nepodarilo sa doteraz uvedenú lokalitu potvrdiť. Paulech a Maglocký (1988) vyslovili domienku, že úpravou brehov Dunaja, prípadne rozsiahlou výstavbou mohla uvedená lokalita zaniknúť. Svah kóty Vrchná hora je v súčasnosti jediné známe miesto výskytu *T. controversa* v oblasti západného Slovenska. V súčasnosti známe slovenské lokality sú si ekologickými podmienkami podobné. Nachádzajú sa na xerotermných stanovištiach najteplejších oblastí nášho územia, v blízkosti vinohradov a na zistených lokalitách sa huba vyskytuje každoročne. Okrem lokalít Malý Kamenec pri Strede nad Bodrogom, Malý Horeš pri Kráľovskom Chlumci a Vrchnej hory pri Stupave podobné ekologické podmienky majú i známe lokality na južnej Morave v oblasti Pouzdranskej stepy (Nováková et Zacha 1975, Paulech et Maglocký 1988).

Morfologická a ekofyziologická charakteristika chlamydospór *T. controversa* na pýre z lokality Vrchná hora je v podstate podobná ako z iných v ČSFR a v zahraničí známych lokalít. Menšie, nie však podstatnejšie rozdiely existujú napr. vo veľkosti chlamydospór. Ich priame porovnanie nie je však dobre možné, nakoľko jednotliví autori používali k meraniu odlišné média (voda, chloralhydrát, lactofenol), prípadne merali spóry spoľu i s hyalinným obalom, rôzne staré spóry a pod. Okrem toho pri porovnávaní je potrebné brať v úvahu i ďalšie faktory podmieňujúce prirodzenú variabilitu druhu. U nás sú pre porovnávanie k dispozícii dva pramene charakteristík chlamydospór *T. controversa* na pýre. Pochádzajú z lokalít Pouzdranská step (Nováková et Zacha 1975) a z dvoch lokalít na východnom Slovensku (Paulech et Maglocký 1988). Rozdiel medzi ich a našimi údajmi z Vrchnej hory je v zázname o vplyve huby na výšku rastlín. Nováková a Zacha (1975) uvádzajú, že na Pouzdranskej stepi odnože infikovaných rastlín neboli skrátené. Uvedení autori však súčasne poukazujú na to, že v herbári R. Picbauera z Hercegoviny (BRNM) sa nachádzajú rastliny zo silným skrátením odnoží. Je známe, že rastová reakcie pýru na infekciu môžu byť veľmi variabilné a že niekedy je len ťažko možné v poraste spoľahlivo tento symptóm posúdiť. V našej práci sme ho preto zisťovali meraním u priemernej vzorky v laboratóriu. U infikovaných rastlín na Vrchnej hore sa rastová depresia prejavila preukazne až vysokopreukazne. Na lokalitách Malý Kamenec a Malý Horeš boli infikované rastliny tiež skrátené (Paulech et Maglocký 1988). Výskyt *T. controversa* na pýre je zriedkavý nielen u nás, ale i v zahraničí (Hardison et al. 1959). Zistená lokalita, jej charakteristika, ako aj bližšia charakteristika samotnej huby je príspevkom k bližšiemu poznaniu jej populácie u nás.

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Taphrina potentillae (Farl.) Johans. on Parageum montanum (L.) Hara - a new species in Slovakia

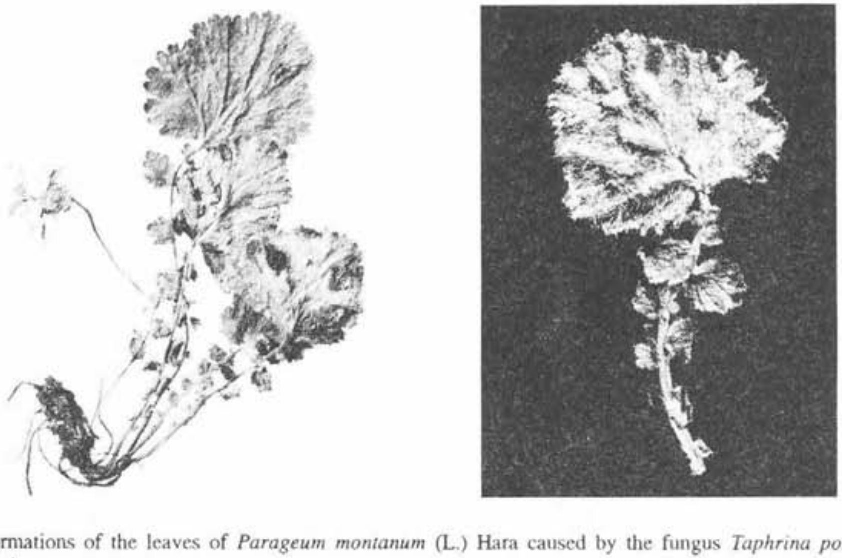
Taphrina potentillae (Farl.) Johans. na Parageum montanum (L.) Hara, nový druh pre Slovensko

Kamila Bacigálová

Taphrina potentillae (Farl.) Johans. is described for the first time in Slovakia territory on the host plant *Parageum montanum* (L.) Hara [syn. *Sieversia montana* (L.) R. Br.]. The mentioned host plant-fungus combination was unknown in our conditions; it was recorded only in Monte Rotondo Mts. on Korsica (Mix 1949). The present paper describes symptoms and anatomical-morphological characters of the mentioned fungus on its host plant.

Je popisaný na Slovensku doposiaľ nezaevidovaný druh rodu *Taphrina* Fr., *Taphrina potentillae* (Farl.) Johans. na *Parageum montanum* (L.) Hara [syn. *Sieversia montana* (L.) R. Br.]. Ide o ojedinelý výskyt uvedenej hostiteľsko-parazitickej kombinácie doteraz známej z pohoria Monte Rotondo na Korzike (Mix 1949). V článku je opísaná symptomatológia a anatomicko-morfologická charakteristika huby.

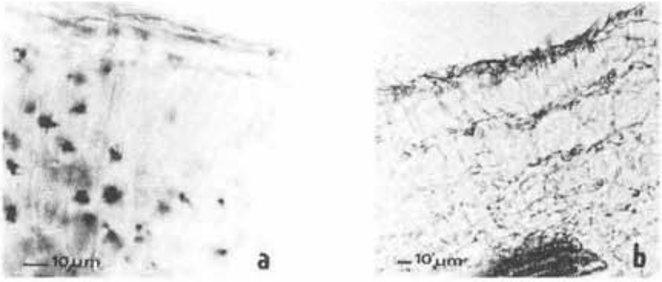
By the study on ecology and distribution of the genus *Taphrina* sp. and their host plants in Slovakia in National Park of High Tatra Mts. we observed in the period 1990 - 1991 the occurrence of infected overground parts of the plants *Parageum montanum* (L.) Hara. The leaves and flower stalks were attacked by *T. potentillae* (Farl.) Johans. Considering the first record in our conditions, we studied mainly anatomical-morphological characters of the pathogen and the ecological conditions of its occurrence.



1. Deformations of the leaves of *Parageum montanum* (L.) Hara caused by the fungus *Taphrina potentillae* (Farl.) Johans.

Infection symptoms: The intramatrical pathogen *T. potentillae* causes on host plants of *Parageum montanum* leaf deformations, which have a character of differently great, round to heteromorphic spots (fig. 1). *T. potentillae* belongs to those species of the genus *Taphrina* which don't infect the whole leaves [as opposed to *T. tosquinetii* (Westend.) Magn. on *Alnus glutinosa* (L.) Gaertn.] but it causes the local, demarcated, convex or concave deformations of leaf tissues. The greater part of the leaf area is not injured and it remains alive till the end of vegetative period (fig. 1).

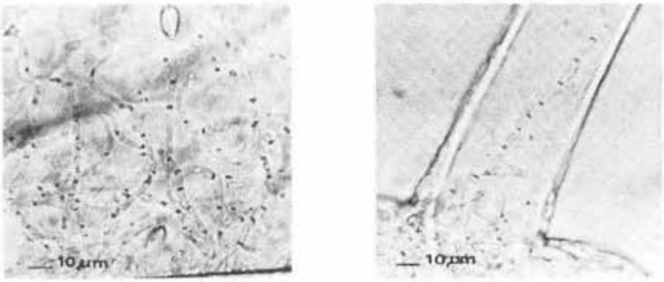
The infected leaf parts are at first yellow, then reddish to red, roughen and on convexly deformed part there are covered by white coat. After dying of cells of infected leaf tissue in consequence of hypertrophy and hyperlasia of cells, the spots turn brown, dry and remain on the leaf (fig. 1).



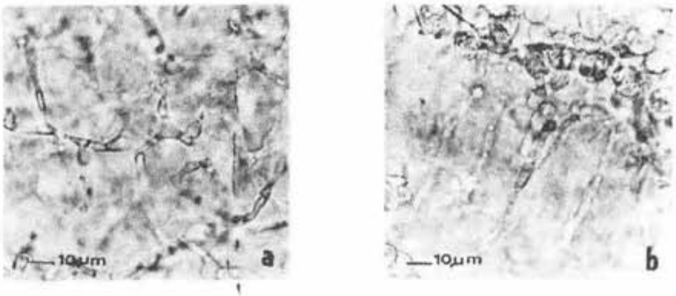
2. Cross section of healthy (a) and infected (b) leaf tissues of *Parageum montanum* (L.) Hara.

The anatomical-morphological characters of the fungus

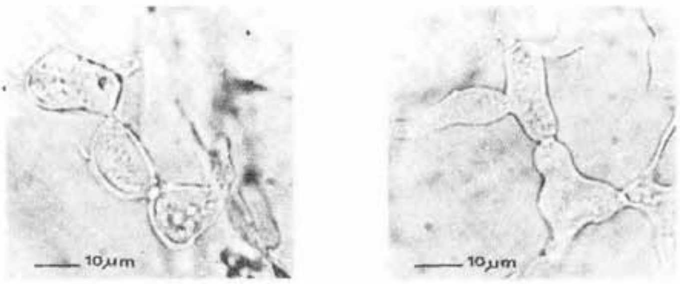
The thin cross sections were made by the aid of blade from naturally infected leaves of *Parageum montanum* and then observed in the drop of 50% lactic acid. The evaluation was made by the help of interferential microscope Amplival with microphotographic equipment.



3. Vegetative mycelium of the fungus *Taphrina potentillae* (Farl.) Johans. in subepidermal layer of leaf.



4. Vegetative mycelium of the fungus *Taphrina potentillae* (Farl.) Johans. in intercellular spaces of spongy parenchyma (a) and of palisade parenchyma (b).

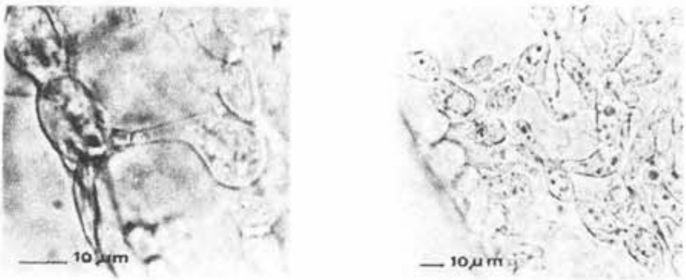


5. The formation of ascogenous cells of the fungus *Taphrina potentillae* (Farl.) Johans. in the subepidermal layer of the leaf tissue of *Parageum montanum* (L.) Hara.

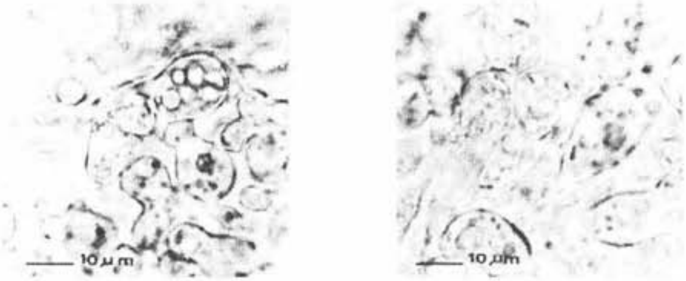
The vegetative mycelium grows in intercellular spaces of leaf parenchyma of the host plant (fig. 2b). The mycelial cells are elongated, divided by layered septa (fig. 3). They are changed in dependance on the size of intercellular spaces of parenchyma. In the spongy layer the mycelial cells are shorter and broader (fig. 4a); growing through the palisade parenchyma they are prolonging. (fig. 4b). The cells of mycelium in the subepidermal layer of the leaf increase in their size in association with their change into ascogenous cells (fig. 5). Ascogenous cells are at first ovoid, later increase their size and they are dispersed in subepidermal layer (fig. 6). They don't form a compact layer between cuticle and epidermis, as it is by *T. deformans* on *Prunus persica.* The asci are differentiated in subepidermal layer from ascogenous cells (fig. 6).

The asci are one-celled, oval, prolonged, club-shaped, in the apical part rounded, in the basal part they form differently long "foot" by which they are attached to the cells of epidermis (fig. 6, 7).

The asci are formed largely on the dorsal side of the leaf (above the palisade parenchyma), on convex infected parts of leaf tissues. If the swelled parts are on the ventral side of the leaves, the asci may differentiate also on ventral side of the leaf. The asci are at first slender, elongated, later they increase the size and penetrate the cuticle. The ascus has 8 ascospores, which are budding into blastospores in the ascus (fig. 7).



6. Differentiation of asci from the ascogenous cells of the fungus *Taphrina potentillae* (Farl.) Johans. in the subepidermal layer of leaf tissue of *Parageum montanum* (L.) Hara.



7. Differentiation of asci and ascospores of the fungus *Taphrina potentillae* (Farl.) Johans. in the leaf epidermis.

The asci are 20 - 58 µm x 8 - 20 µm most frequently 24 - 29 - 33 µm x 10 - 12 µm [according Mix (1949) 17 - 58 µm x 7 - 17 µm]. Ascospores are oval or round 4 - 5 µm x 3 - 5 µm, budding into blastospores of ovoid size, 2,5 - 3,5 µm x 2 - 3 µm, later they reach the size of ascospores.

T. potentillae (Farl.) Johans. parasitizes on host plants of the genus *Potentilla* in Europe, North America and Japan (Mix 1949, Salata 1974). It occurs in Norway on *Potentilla erecta* (L.) Räuschel and on *P. rupestris* L. at 540 m a. s. l. and higher (Gjaerum 1964), in Poland, Germany, France and Sweden (Salata 1974, 1975), on *P. thuringica* var. *genuina* Th. Wolf in Rumania (Bechet 1973), on *P. erecta* in Bohemia (Jeschková 1957). It appers on *P. silvestris* in Germany and in Poland (Mix 1949), in North America on *P. arguta*

Pursh, *P. canadensis* L., *P. glandulosa* Lindl., *P. flabellifolia* Hook., in Japan on *P. nipponica* Wolf (Mix 1949, Salata 1974).

The occurrence of *T. potentillae* (Farl.) Johans. on host plant *Parageum montanum* (L.) Hara is known only from Monte Rotondo Mts. on Korsica, recorded on July, 22nd, 1902 (Mix 1949).

The occurrence of *T. potentillae* on European continent is recorded mainly from north areas. On the base of literature data about the appearing of *T. potentillae* on Poland side of High Tatra Mts. on *P. erecta* (L.) Räuschel (Salata 1974, 1975), we supposed its occurrence on Slovak side of High Tatra Mts. However, we did not note here the occurrence of this fungus on host plants of the genus *Potentilla* till now. But we found the new localities of *T. potentillae* (Farl.) Johans. on *Parageum montanum* in our territory.

The new localities are situated at altitudes above 1 700 m a. s. l. and on the base of our observations it appears, that the elevation is a limiting factor. This assumption confirms Gjaerum (1964) who recorded occurrence of the mentioned fungus on *Potentilla erecta* in Norway at altitudes above 540 m a. s. l. With regard to the occurrence of the fungi on moist stands in the vicinity of mountain lakes, temperature and moisture are also very important factors.

The localities in Slovakia (all on *Parageum montanum*):

Pleso nad Skokom (mountain lake) 1 801 m a. s. l., 20. 7. 1991, in the north-eastern part of the mountain lake on wet stands, sporadically. Dolina Zlomisk, the mead of Ľadový potok, about 1 700 m a. s. l., 29. 7. 1990, 27. 8. 1990, 19. 7. 1991, on norht-eastern side, sporadically. Ľadové Pleso (mountain lake), about 1 925 m a. s. l., on northwestern side, 27. 8. 1990, 19. 7. 1991, abundantly. Magistrála na Ostravu, at 1 800 m a. s. l., at pavement, 21. 7. 1991, sporadically. Batizovské Pleso (mountain lake), at 1 898 m a. s. l., on north-eastern side of the lake, 27. 7. 1991, sporadically; all collected and determined by K. Bacigálová, the herbarium specimens are preserved in the Institute of Botany, Slovak Academy of Science, Bratislava.

Summary

The new knowledge on the biology and ecology of *Taphrina potentillae* was obtained and some new localities of its occurrence on *Parageum montanum* in Slovakia were recorded. The link-up of its occurrence to ecological conditions of subalpine and alpine vegetation degrees (1 700 m - 1 925 m a. s. l.) in High Tatra Mts. points out that the fungus may be distributed also in other mountains of Central Europe.

The autor is grateful to Mr. I. Vološčuk for his permission to work on the territory of National Park of High Tatra Mts. and to Mrs. Gabriela Vosátková for technical assistance.

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Nálezy dřevomorky domácí - Serpula lacrymans v přírodě
Finds of Serpula lacrymans in nature

František Kotlaba

V Československu známe v přírodě 12 lokalit *Serpula lacrymans* (Wulf. in Jacq.: Fr.) Schroet. Roste většinou paraziticky na živých kořenech a bázich kmenů smrku ztepilého (*Picea abies*) a v několika případech též saprofyticky na padlých kmenech, větvich a pařezech smrku. Všechna ostatni pozorováni a nálezy této jinak běžné houby jsou u nás z vnitřku domů nebo jiných staveb.

Twelve localities are known in nature (open forests) in Czechoslovakia for the dry-rot fungus, *Serpula lacrymans* (Wulf. in Jacq.: Fr.) Schroet. It grows mostly parasitically on the roots and bases of living Norway Spruce *(Picea abies)* but, in a few cases, is also saprophytic on dead, fallen trunks, branches or stumps of spruce. All other observations and finds in this country of this otherwise frequent fungus are within houses and other buildings.

Dřevomorka domácí - *Serpula lacrymans* (Wulf. in Jacq.: Fr.) Schroet. = *Merulius lacrymans* (Wulf in Jacq.): Fr. - patří k obávaným dřevokazným houbám v domech, bytech, sklepích, kůlnách a chatách: když se v nich rozroste, ničí vše, co je ze dřeva nebo co alespoň zčásti obsahuje celulózu. Její růst na opracovaném dřevu ve stavbách byl příčinou, proč dostala druhové jméno „domácí''. Přesto však už Bourdot a Galzin (1928) citují dva nálezy dřevomorky domácí z přírody (M. Ludwiga a L. Romella), z Německa a ze Švédska.

I když jen nemnozí mykologové sbírali *Serpula lacrymans* mimo lidské stavby (tj. ve „volné'' přírodě), přece jen určitý počet nálezů i u nás v přírodě existuje a dokonce jich v posledních letech přibylo (snad v důsledku zvýšené pozornosti mykologů po publikaci F. Soukupa a Z. Hájka). Nálezy dřevomorky domácí v přírodě jsou zajímavé především proto, že většina z nich je na živých stromech, kde tento druh - považovaný jinak za typického saprofyta na mrtvém dřevu - vystupuje evidentně jako parazit.

V české mykologické literatuře byly dosud uveřejněny tři lokality *Serpula lacrymans* v přírodě u nás (podle podrobných map jsem doplnil nadmořské výšky):

1. Průhonický park (botanická zahrada) u Prahy, ve smrkovém porostu poblíž hráze rybníku „Bořín'', asi 320 m n. m., na bázi a kořenech živého smrku ztepilého (*Picea abies*), 3. IX. 1974 (PRM 805255), VII. 1975, XI. 1976, VII. 1977, 6. XI. 1977 (PRM 874169), leg. et det. F. Soukup (Jančařík, Soukup et Zezula 1982, Soukup 1979); nedaleko soutoku Zdiměřického potoka s Botičem v parku (nad rybníkem „Labeška''), asi 310 m n. m., na bázi živého smrku ztepilého (*Picea abies*), VI. et XI. 1977, V. 1978 (Soukup 1979).
2. Polesí „Svanka'' = „Švank'' mezi železn. stanicemi Kozolupy a Plešnice z. od Plzně, 380 m n. m., mezi kořenovými náběhy živého smrku ztepilého (*Picea abies*), 24. IX. 1978, leg. Z. Hájek jun., det. Z. Pouzar (PRM 815945), 1979, 21. VII. 1980, leg. et det. J. Baier (herb. ČSMS Praha, no. 206), 21. VII. 1980, leg. et det. Z. Hájek jun. (Hájek 1981, 1990; Soukup 1979).
3. Les „Bradlo'' asi 5 km z. od Jihlavy, 520 m n. m., na poraněných kořenech a kořenových nábězích živého smrku ztepilého (*Picea abies*), 21. VIII. 1988 (MJ 685/88), 1989, leg. et det. P. Vampola (Vampola 1992).

Protože se mi za pomoci některých našich mykologů (kteří jsou dále uvedeni jako nálezci a jimž děkuji za spolupráci) podařilo získat údaje k dalším devíti lokalitám dřevomorky domácí u nás v přírodě, uvádím je v chronologickém pořádku níže; dále připojuji své poznámky a úvahy.

4. Polesí „Bučín" jv. od Rosic u Brna, asi 400 m n. m., na kořenech a bázi živého smrku ztepilého (*Picea abies*), 1975, leg. et det. A. Černý (osobní sdělení).

5. Při lesní cestě nedaleko pískovny „Na slaným" mezi obcemi Ostrov a Milín u Příbrami (asi 2 km sv. od Ostrova), 560 m n. m., mezi kořenovými náběhy živých smrků ztepilých (*Picea abies*) i jejich pařezů, 1980, leg. E. Lippert, det. J. Baier (herb. Baier, Praha, no. 12), 9. VIII. 1981, 18. XI. 1984, 30. VIII. 1985, 21. VIII. 1986, 19. IX. 1987, let. et det. E. Lippert (in litt. e 30. I. 1988).

6. Lesní úsek „Peliškův most" mezi Kácovem a Soběšínem u Zruče n. Sáz. (asi 3 km v. od Soběšína, na levém břehu Sázavy), 350 m n. m., na bázi živého smrku ztepilého (*Picea abies*), IX. 1984, leg. P. Šrůtka, det. F. Soukup (PRM 873861).

7. Polesí „Bílý kámen" sz. od Jihlavy, asi 560 m n. m., na bázi živého smrku ztepilého (*Picea abies*), 1986, leg. et det. A. Černý (osobní sdělení).

8. SPR „Žákova hora" sv. od Cikháje u Žďáru n. Sáz., asi 770 m n. m., na kořenech živého a na kmenu ležícího smrku ztepilého (*Picea abies*), 1987, leg. et. det. A. Černý (osobní sdělení). Z této lokality uvádí dřevomorku domácí i Láznička (1990), avšak bez bližších údajů; v dopise ze 16. 3. 1992 mi sdělil, že tam tento druh nalezl dr. F. Šmarda 14. IX. 1960 na ležícím kmenu *Fagus sylvatica*, avšak doklad v herbářích se nepodařilo nalézt. Také vzhledem k hostitelské dřevině nepovažuji tento údaj za věrohodný - buď šlo o mylné určení houby nebo snad dřeviny. Věrohodný je ovšem údaj A. Černého.

9. Polesí „Olomučany", ŠLZ Křtiny ssv. od Brna, 400 m n. m., na mrtvých kmenech smrku ztepilého (*Picea abies*), 1987 - 1991, leg. et det. A. Černý (osobní sdělení).

10. V lese 1 km j. od Řevnic u Prahy (poblíž místa „V moklinách"), asi 360 m n. m., na kořenech a bázi živého smrku ztepilého (*Picea abies*), od r. 1988 každoročně, leg. et det. F. Soukup (osobní sdělení).

11. V lese sv. od Bělé pod Bezdězem u Mladé Boleslavi, z. od kóty 306 „Kozí hřbet", asi 290 m n. m., na mrtvých větvích a na bázi odumřelého kmene smrku ztepilého (*Picea abies*), 15. IX. 1991, leg. R. Knížek, det. F. Kotlaba (PRM 873075).

12. Ve skupině stromů a keřů mezi „Stodůleckým vrchem" a Pohořím na Šumavě j. od Benešova n. Čer., 920 m n. m., na ležícím kmenu smrku ztepilého (*Picea abies*), 22. IX. 1991, leg. et det. Z. Hájek sen., J. Šutara, F. Kotlaba et al. (PRM 873074).

S výjimkou jediné - Žákova hora - jsou všechny ostatní naše lokality dřevomorky domácí v přírodě situovány v kulturních porostech - nikoli tedy v přirozených lesích, což má svůj důvod (viz dále). Většina plodnic byla nalezena od července do října (výjimečně i v květnu, červnu a listopadu), tj. v nejteplejším období roku; v budovách nacházíme plodnice dřevomorky téměř po celý rok, neboť tam má stabilní podmínky (podle mých excerpt od konce ledna do konce listopadu - ovšem i tam vyrůstají plodnice hlavně koncem jara a v létě). Pokud jde o vertikální rozšíření, sedm z dvanácti lokalit dřevomorky v přírodě leží u nás v pahorkatině (konkrétně mezi 290 až 400 m n. m.), čtyři v podhorském stupni (v 520, dvakrát v 560, a v 770 m n. m.) a pouze jedna lokalita leží v horském stupni (v 920 m n. m.). - Zajímavé též je, že všechny dosud známé lokality *Serpula lacrymans* v přírodě jsou z území Čech a Moravy, avšak zatím žádná ze Slezska a ze Slovenska*). Dále je velmi zajímavé, že u nás v přírodě nebyla dřevomorka domácí prokázaně zjištěna na ničem jiném než na smrku ztepilém (*Picea abies*), ačkoli ve stavbách napadá jakékoli dřevo, ať už jehličnanů nebo listnáčů včetně např. bukových parket.

Soukup (1979) v závěru své práce píše: „. . . naskýtá se otázka, zda je takový výskyt (tj. v přírodě, F. K.) skutečně výjimečný, nebo pouze přehlížený, zda se tato houba vyskytuje pouze na lokalitách synantropního charakteru . . . či i v běžných lesnicky obhospodařovaných lesích a pralesních rezervacích." Dnes už lze na základě většího počtu lokalit *Serpula lacrymans* v přírodě uvedené otázky celkem uspokojivě zodpovědět: 1. Výskyt dřevomorky domácí v přírodě zůstává i nadále výjimečný, není však už většinou přehlížený. 2. Tato houba se u nás v přírodě vyskytuje téměř výhradně v druhotných porostech, tj. vlastně na synantropních lokalitách. 3. Dosud známe pouze jedinou lokalitu dřevomorky domácí v pralesní rezervaci (Žákova hora, která je ovšem po řadu desetiletí velmi frekventovaná a nález byl u cesty, takže i tam šlo zřejmě o zanesení člověkem); neznáme však žádný nález např. z přirozené klimaxové, prameništní nebo podmáčené smrčiny apod., tj. ze skutečně původních a člověkem minimálně navštěvovaných lokalit smrku ztepilého. Lze tedy uzavřít, že *Serpula lacrymans* je v podstatě průvodcem člověka při svém výskytu i ve „volné" přírodě, neboť roste vlastně tam, kde člověk svou činností vegetaci spoluformuje.

Výskyt dřevomorky domácí v přírodě (a to nejen u nás) nám dává i odpověď na otázku, kde rostla předtím, než člověk vůbec začal používat dřevo ke stavbám obydlí, zásobáren, stájí apod. Protože dřevní druhy *Aphyllophorales* jsou fylogeneticky velice staré a vznikly podstatně dříve než sám člověk, nemohla dřevomorka domácí vzniknout jako druh až v době, kdy už člověk měl dřevěné stavby, a musela tedy přirozeně růst původně v přírodě jako ostatní houby (třebaže asi také tehdy velmi vzácně). Teprve v průběhu mnohatisíciletého rozvoje dřevěných staveb lidí v nich dřevomorka nalezla přímo ideální

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*) V herbáři BRA je uložen sběr dřevomorky domácí („In trunco *Abietis*. Štefultov [j. od Ban. Štiavnice], VI. 1892, leg. [et det.?] A. Kmeť), který by popř. snad mohl pocházet z přírody (plodnice jsou na vnitřní straně kůry jedle), avšak není uvedeno, že to bylo v lese, mimo obec.

podmínky ke svému životu - dostatek dřeva v přiměřeně temperovaném a hlavně příhodně vlhkém, nedostatečně větraném prostředí; tam pak bujně rostla, bohatě plodila a dále se šířila . . .

Vyjdeme-li z úvahy, že kdysi pradávno se dřevomorka dostala z přírody do lidských obydlí, v nichž pak „zdomácněla", je k tomu zapotřebí nalézt na podporu přijatelný důkaz. Myslím, že jím jsou údaje o výskytu *Serpula lacrymans* v přírodě v takových oblastech, které jsou člověkem minimálně ovlivněné. Tak z Asie uvádí dřevomorku domácí v přírodě z Pákistánu Ahmad (1972) na kmenech *Cedrus deodara* a z Indie Bagchee (1954) na *Abies pindrow a Picea smithiana* (= *P. morinda)* v záp. Himálaji v Paňdžábu, a to z nadmořské výšky 2 600 - 3 400 m, kde je ovlivnění člověkem (zanesení výtrusů apod.) téměř vyloučené. Zdá se tedy nasnadě, že právě v Asii - snad v oblasti Himálaje - je třeba hledat původní pravlast *Serpula lacrymans*.

Situace s výskytem dřevomorky domácí v přírodě u nás (a snad i v celé Evropě) je ovšem jiná. Protože chybí v přirozených (i původních) lesích, musíme z tohoto faktu uzavřít, že na lokality ve „volné" přírodě byla zavlečena až druhotně z lidských staveb, do nichž se dostala někdy pradávno spolu se šířením lidí.

Nakonec pravopisná poznámka. V literatuře se od starých dob až dodnes setkáváme střídavě s psaním druhového jména dřevomorky domácí v latině jako *lacrymans* nebo *lacrimans* (tj. s -y- nebo -i-). Během tisíciletého používání latiny se v klasické latině (k ní se latináři vrátili opět v 19. a 20. století) psalo v tomto a podobných případech -i-, zatímco ve středověké latině (která byla používána až do 18. stol., kdy vznikla většina jmen rostlin a živočichů) se používalo -y- (viz např. *sylvestris, sylvaticus* apod.). Z nomenklatorického hlediska ale máme správně podle Mezinárodních pravidel botanické nomenklatury (1988, kap. VI, čl. 73) zachovat tu formu psaní jmen - pokud není v hrubém rozporu s pravopisem (a to není náš případ) - jaké používali původní autoři druhů, které popsali. V případě dřevomorky domácí, řazené tehdy do široce pojímaného rodu *Boletus* jako *B. lacrymans*, to byl F. X. Wulfen (ve sborníku prací N. J. Jacquina, Miscellanea austriaca 2: 111, 1781), který použil v druhovém jménu *lacrymans* tvrdé -y-. O 40 let později použil Fries v Systema mycologicum (1821) ve slově *lacrimans* měkké -i-, což používají i někteří současní autoři. Jak však bylo dovozeno výše, správné je psát *Serpula (Merulius, Gyrophana) lacrymans* s tvrdým -y-.

Děkuji kolegovi prom. biol. Zdeňku Pouzarovi, CSc., za cenné připomínky a diskusi ke konceptu tohoto článku.

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Ohlášeni „Mykologického kursu''

Katedra botaniky přírod. fakulty Univerzity Karlovy bude ve škol. r. 1993/94 opět pořádat „Mykologický kurs'' pro absolventy vysokých škol s pracovnim zaměřenim na mykologickou problematiku, a to v rozsahu 200 hodin (5 týdnů rozvržených do 4 semestrů: únor, červen, záři 1993 a únor, záři 1994). Náplni kursu je mykologický systém (přednášky a praktická mikroskopická cvičeni), dále doplňujici přednášky z ekologie, fytopatologie, genetiky hub, lékař. mykologie a toxikologie. Kurs je ukončen pisemnou praci a ústni zkouškou. Absolventi ziskávaji vysvědčeni.

Závazné přihlášky s doporučenim zaměstnavatele přijimá do řijna 1992 dr. O. Fassatiová, katedra botaniky Přír. fak. UK, 128 01 Praha 2, Benátská 2. Počet mist je omezen. Začátek prvniho týdne bude pro přijaté účastniky včas oznámen. Cena kursu je 4 000 - 5 000 Kčs, rovněž nocleh a stravné si účastnici zajišťuji a hradi sami. Katedra může zajistit stravováni v menze.

Úmrtí – Obituary

Dr. Anna Kocková-Kratochvílová

It is with great sadness that we have to announce you the death o Professor Dr. A. Kocková-Kratochvílová, DrSc., a promiment scientist of the Institute of Chemistry, Slovak Academy of Sciences in Bratislava, Czechoslovakia, and also a former associate editor of the Yeast Newsletters. She passed on July 22, 1992, in the age of 77, after a prolonged illness. Her death is a great loss to Czechoslovak science and international yeast research community. She belonged to those Czechoslovak scientists who gained international reputation under conditions of the previous system in the country, as a result of her enourmous working activity and total devotion to scientific work. Her most important achievement is the Czechoslovak Collection of Yeast and Yeast-like Microorganisms, which she founded and directed for several decades. The Collection is one of the largest in Central Europe and represents a source of strains for research and fermentation industry. She contributed by more tha 300 original papers to yeast taxonomy, ecology and biochemistry. She wrote several textbooks and monographs, published several Yeast Catalogues. Her last title published in English is „Yeasts and Yeast-like Organisms" (VCH Publishers). Her last book „Taxonomy of Yeasts and Yeast-like Microorganisms", which was completed only recently and published in Slovak, awaits its translation to foreign languages.

During her whole life Dr. Kocková-Kratochvílová was extremely active in promoting international scientific contacts and cooperation. She was the founder of the tradition of general and specialized international yeast symposia. She organized the First International Symposium on Yeasts in 1964 in Smolenice Castle near Bratislava. She was also in charge of the Second International Symposium on Yeasts held in 1966 in Bratislava. During this confrence she initiated the creation of the International Commission for Yeasts which became the driving force of international acitivies of yeast researches in the years to come. Dr. Kocková-Kratochvílová served as the first chairman of this international body (1966 - 1969). She also was an outstanding teacher. She lectured at various Universities at home and abroad. She supervised 16 PhD students and more than 20 graduate students. Her meritorious work lives in her pupils.

An unlimited devotion of Dr. Kocková - Kratochvílová to science, her unbelievable energy and enthusiasm, her love for the nature, will remain a light example for all those who knew her.

Peter Biely

ČESKÁ MYKOLOGIE

MYKOLOGIA ČECHICA

Čtvrtletník Čs. vědecké společnosti pro mykologii k šíření znalostí hub po stránce vědecké i praktické

Ročník XXXXV

V Praze 1991

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