Mycoflora of large-scale greenhouse plantation of salad cucumbers

Houby kultur salátových okurek ve velkoplošných sklenicích

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

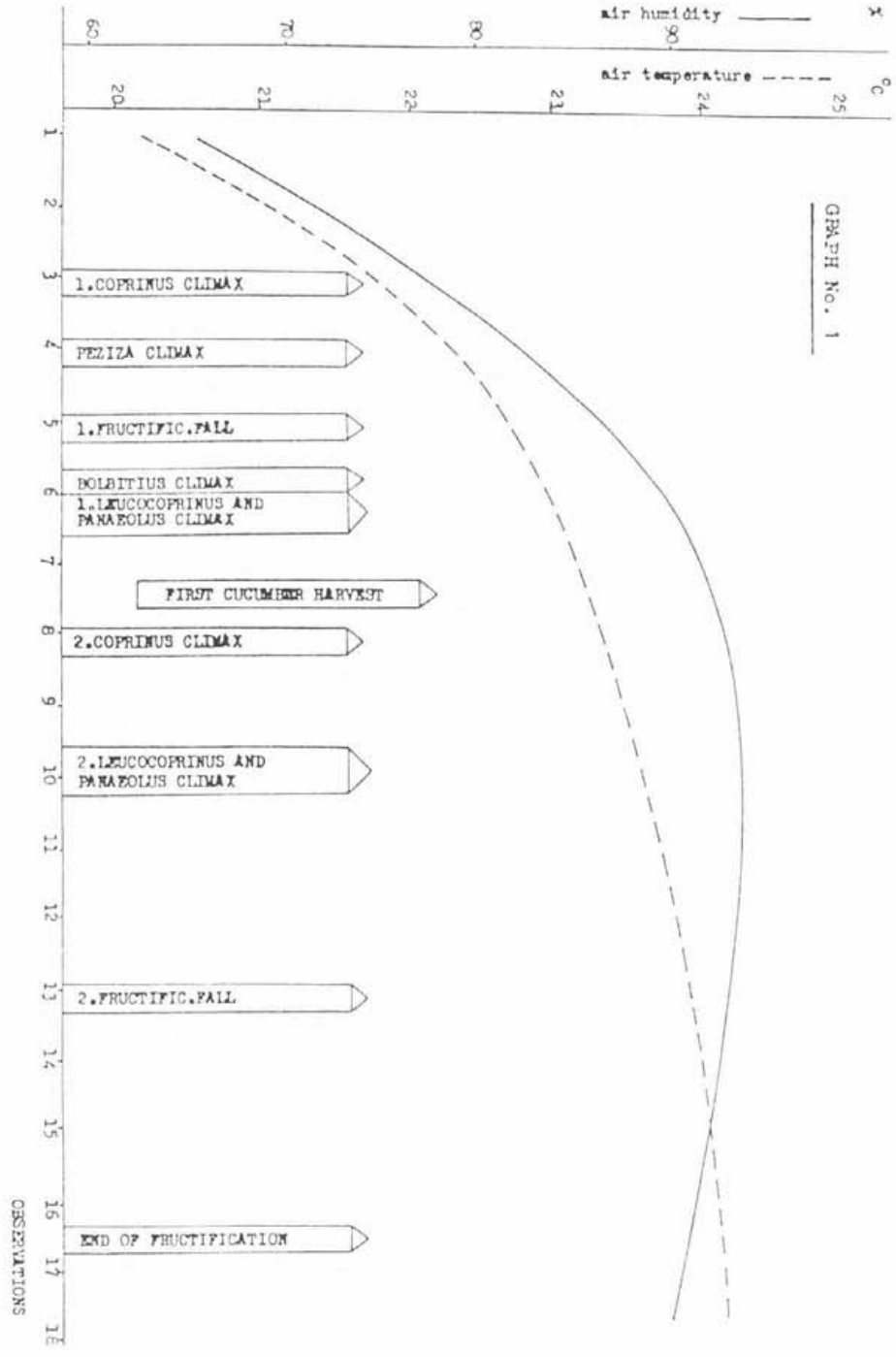
TAB. No. 1

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

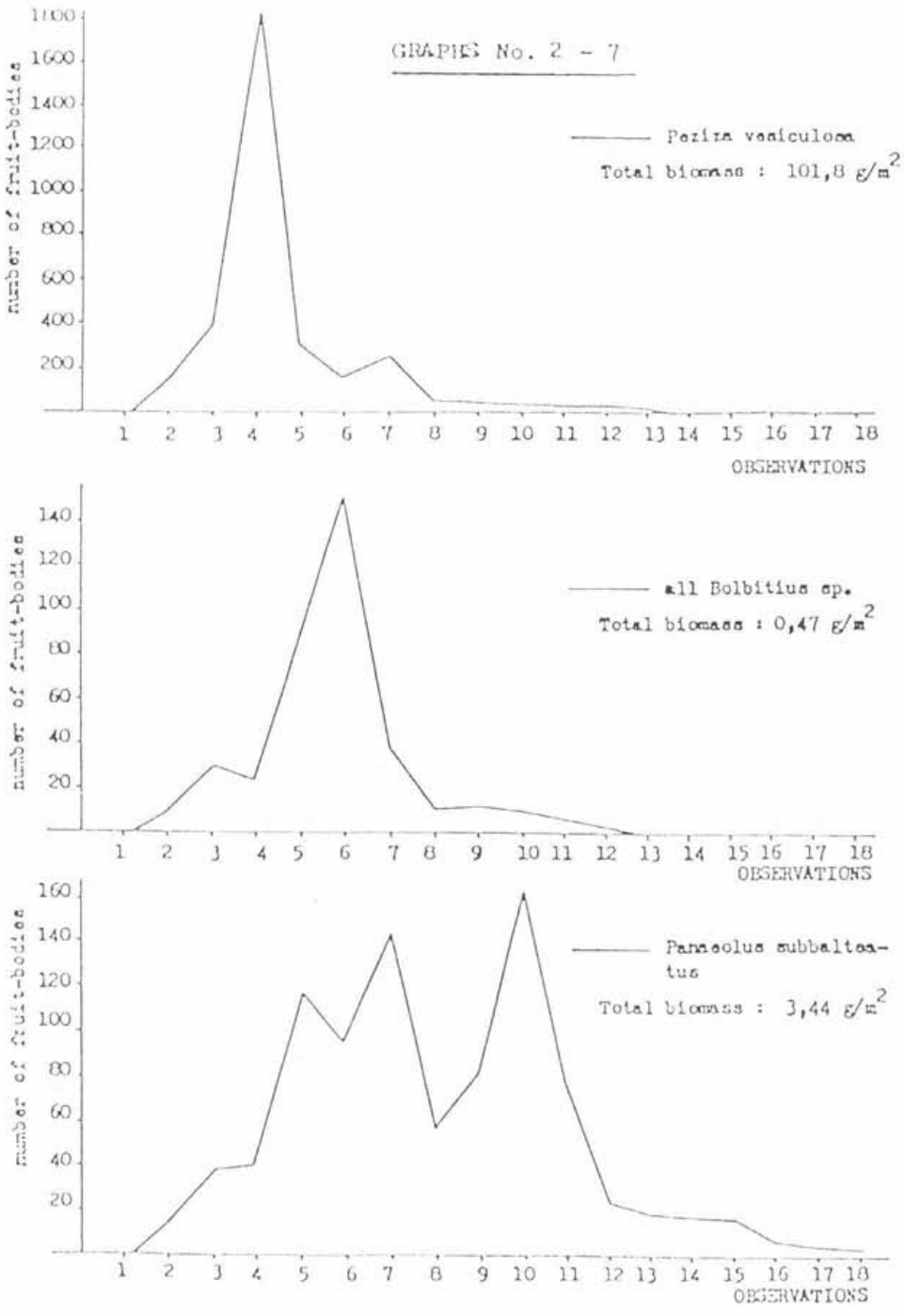
COPRINUS lagopus	S		20	80			40	460	280	40	80	30	40	20			35	25		1140	364,8
																				0,32	0,03
COPRINUS marculentus	S		60	140	60	20	20	40	280	20										640	102,4
																				0,16	0,01
COPRINUS patouillardii	S	8	48	336	64	48														504	60,5
																				0,12	0,005
COPRINUS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

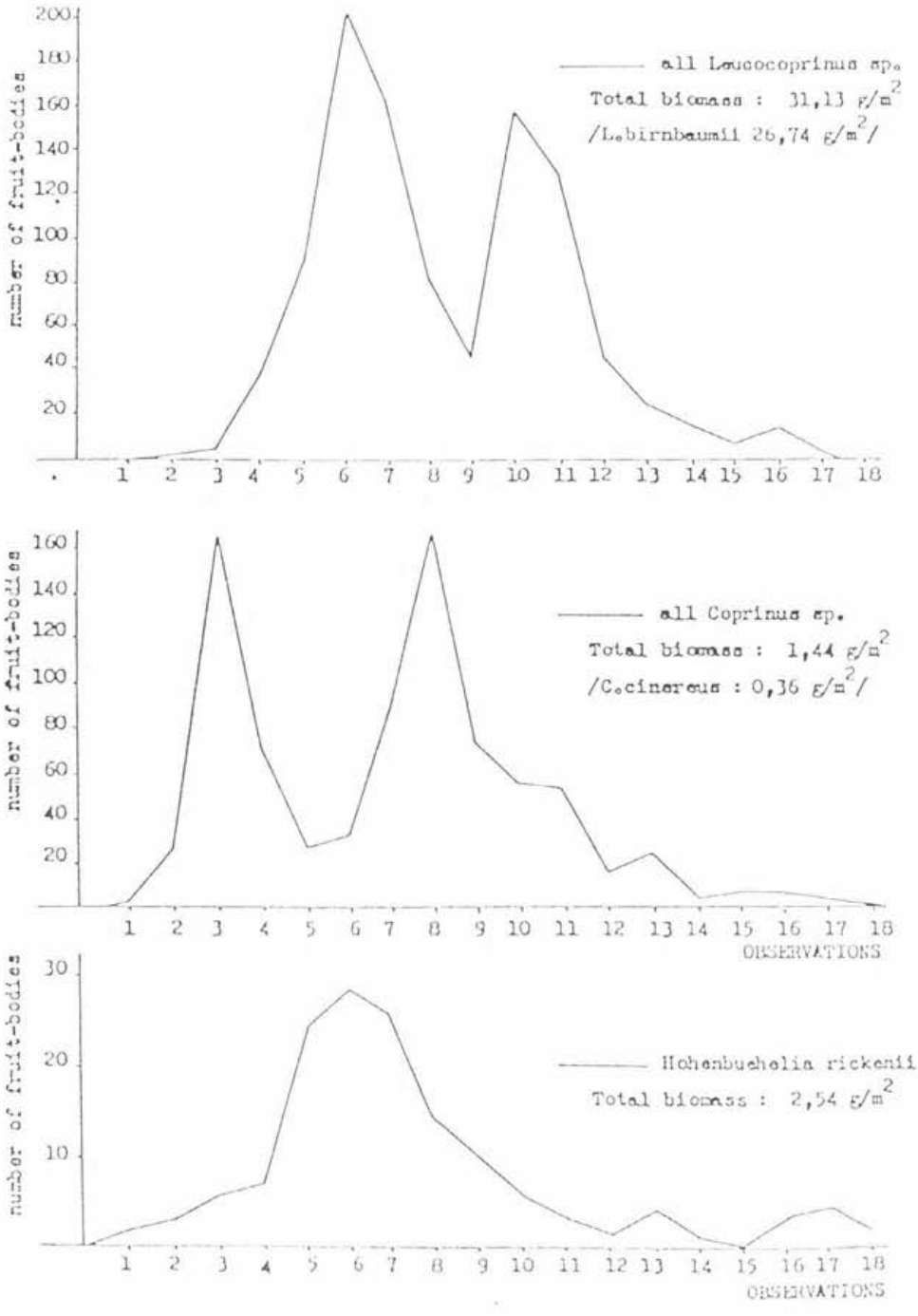
Table No. 2:
List of species according to their specific biomass

	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
23
24
25
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

GRAPH No. 1


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
all Leucocoprinus sp.
Total biomass : 31,13 g/m2
/L.birnbaumii 26,74 g/m2/
number of fruit-bodies
all Coprinus sp.
Total biomass : 1,44 g/m2
/C.cinereus : 0,36 g/m2/
OBSERVATIONS
number of fruit-bodies
Hohenbuehelia rickenii
Total biomass : 2,54 g/m2
OBSERVATIONS

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.

The author thanks for the help with determination or revision of some collected species to Mr. H. Bender (GFR), MUDr. J. Herink (ČSFR), RNDr. V. Holubová-Jechová, CSc. (ČSFR), RNDr. L. Kotilová-Kubičková (ČSFR), Mr. J. Moravec (ČSFR), RNDr. M. Svrček, CSc. (ČSFR), Dr. E. Vellinga (the Netherlands), and to Dr. R. Watling (Great Britain, Scotland), to Mr. J. Slaviček (ČSFR) for the help with translation, and also to Ing. M. Babiak, a manager of the enterprise Sempra at Paskov to Ing. A. Karasová and Ing. M. Konečná from the same enterprise (all ČSFR) for the informations and for the help with technical problems of my research. Thanks belongs also to RNDr. V. Antonín, CSc. (ČSFR) for some critical notes in the uneasy problem of scientific names of fungi according the newest nomenclatorical rules.

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. brebissonnii*, 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.

References

BABOS M. (1979): The Species of the "Rubescens" Group in the Genus Leucocoprinus. -Festschr. für R. Singer. Annal. Mycol., Horn, Ser. II. Beiheft zur Sydowia VIII., p. 33-53.

BABOS M. (1981): Mycological examination of sawdust depots in Hungary. Stud. Bot. Hung., Budapest, 15: 31-44.

BON M. (1977): Les Lépiotes do l'Herbiér "Boudier". Doc. mycol., Lille, 7 (27-28): 11-22.

BON M., VALLÉE L. et JACOP M. (1979): Une nouvelle Lépiote toxique: Macrolepiota venenata Bon, sp. nov. Doc. mycol., Lille, 9 (35): 13-21.

BON M. et VAN HALUWYN CH. (1983): Macromycetes des terrils de charbonages du nord de la France. 4éme note. Doc. mycol., Lille 13 (49): 43-55.

CANDUSSO M. et LANZONI G. (1990): Lepiota s. l. 743p. Fungi Europaei 4. Saronno.

ENDERLE M., KAJAN E. et KRIEGLSTEINER G. J. (1985): Studien in der Gattung Bolbitius Fr. APN-Mitteilungsblatt der Arbeitsgem. Pilzk. Niederrhein, Duisburg, 3 (1): 5-34.

ENTS J. et SEDLÁČEK J. (1990): Bolbitius variicolor Atk. Mykol. Listy, Praha, 39: 6-8.

HAUSKNECHT A. et RÜCKER T. (1989): Über zwei interessante Pilzfunde aus Salzburg, Österreich. Z. f. Mykol., Schw. Gmünd, 55:105-110.

KREISEL H. (1987): Michael-Hennig-Kreisel: Handbuch für Pilzfreunde. Bd. III. 4. Aufl., 484 p., Jena.

KREISEL H. et al. (1987): Pilzflora der Deutschen Demokratischen Republik. 281 p., Jena.

KRIEGLSTEINER G. J. (1991 a): Leucoagaricus bresadolae (Schulzer) Bon und der "Leucocoprinus badhami" Komplex in Mitteleuropa. AMO Beitr. zur Kennt. der Pilze Miteleurop., Schw. Gmünd, 7: 39-60.

KRIEGLSTEINER G. J. (1991 b): Über neue, seltene, kritische Makromyzeten in Westdeutschland (ehem. BR Deutschland, Mitteleuropa). XII. Röhrlinge und Blätterpilze. AMO Beitr. zur Kennt. der Pilze Mitteleurop., Schw. Gmünd, 7:61-79.

KRIEGLSTEINER G. J. et al. (1983): Über neue, seltene, kritische Makromyzeten in BR Deutschland. IV. Z. f. Mykol., Schw. Gmünd, 49:73-106.

KUTHAN J. (1966): Hnojnik šestihranovýtrusý - Coprinus hexagonosporus Joss. - jako škůdce žampiónových kultur. Čas. čs. Houbař, Praha, append.: Pěstování žampiónů 3:28-30.

KUTHAN J. (1972): Makromycety na povrchu a v nejbližším okolí Dolu Jan Šverma v Ostravě. Přír. Sbor., Ostrava, 25:183-200.

KUTHAN J. et KOTLABA F. (1981): Makromyzeten des Nationalparkes Ropotamo in Bulgarien. Sbor. Nár. Muz., Praha, 37B (2):77-136.

KÜHNER R. (1953) in KÜHNER R. et ROMAGNESI H. (1953): Flore analytique des champignons supérieurs. 557p. Paris.

MIGLIOZZI V. (1987): Leucocoprinus heinemannii Migliozz nov. sp. Micologia Italiana, Bologna, 16 (2):8-13.

MOSER M. (1983): Die Röhrlinge und Blätterpilze. In Gams H.: Kleine Kryptogamenflora, IIb/2. Stuttgart-New York.

PILÁT A. (1951): Klíč k určování hub hřibovitých a bedlovitých (Agaricales). 719p., 661 phot. Praha.

REID D. A. (1989). Notes on some leucocoprinoid fungi from Britain. Mycol. Res., 93:413-424.

REID D. A. (1990): The Leucocoprinus badhamii complex in Europe: species which redden on bruising or become green in ammonia fumes. Mycol. Res. 94:641-670.

SINGER R. (1952, 1986): The Agaricales in modern taxonomy. Lilloa 22: 1-832 (1952); 981p., 88 pl., Koenigstein (1986).

SINGER R. et KUTHAN J. (1980): Comparison of some lignicolous white-spored American agarics with European species. - Čes. Mykol., Praha, 34:57-73.

VELLINGA E. C. (1990) Pluteaceae Kotl. et Pouz. (VELLINGA E. C.: 1. Pluteus Fr.; BOEKHOUT T.: 2. Volvariella Speg.). In Bas C. et al.: Flora Agaricina Neerlandica, Rotterdam-Brookfield, 2:31-64.

VELLINGA E. C. et SCHREURS J. (1985): Notulae ad Floram agaricinam neerlandicam, VIII. Pluteus Fr. in West Europe. Persoonia, Leiden 12:337-374.

WATLING R. (1982): Bolbitiaceae: Agrocybe, Bolbitius, Conocybe. 139 p. In Henderson D. M. et al.: British Fungus Flora 3. Edinburgh.

Adress of author: Ing. Jan Kuthan, Opavská 1127, CS - 708 00 Ostrava-Poruba, ČSFR.