STUDIA BOTANICA HUNGARICA
(Antea: Fragmenta Botanica)
XV. 1981 p. 31-44

Mycological examination of sawdust depots in Hungary

By

M. BABOS

(Received November 28, 1980)

Abstract: The fungus communities of sawdust depots of Hungary have been examined. In sawdusts of deciduous trees and in those obtained from deciduous trees mixed with pine, the composition of fungi flora does not depend on the composition of the tree species but first of all on the thickness of the sawdust layer. In addition to floristical data, observations relating to the ecology of certain species were also made.

Introduction

By-products (bark, sawdust, shavings, etc.) yielded on different places and in different phases of conversion of timber must be removed from the workshops, in accordance with the relevant regulations. Sawdust is occasionally used as litter in live-stock farming, it is however mostly not utilized and the storage of it causes problems. Frequently, it is used to fill up marshy dips, or carried into mining pits, or rubbish pits in the vicinity of settlements.

According to data published by the Institute for Wood-Industry Research (SZALAY, ORTUTAY & OROSZ 1975), the foreseeable quantity of timber by-products in Hungary will be 2.773.000 m^3 for 1980, and 2.828.000 m^3 for 1990 (35.6% resp. 34.2% of gross fell).

In countries rich in wood, the quantity of by-products yielded conversion of timber is several times more than that of Hungary. An especially great number of environmental worries are caused by the great quantity of bark by-product in cellulose combines. In the huge waste stockpiles, "bark-mountains", there are produced organic decomposition products with poisoning effect during the slow process of decaying and rotting. These products, accompanying the precipitation water, lead into the soil and cause damage to the fresh water (PONGÓ 1979). There have been several methods elaborated and applied all over the world for the microbiological use of the by-product wood material, and for using it as biological energy in biomass production. In this country however, the biological utilization of wood by-product occurs at most in the course of compost preparation, but not in a considerable quantity (TAKÁTS 1978). The Team of Forest Microbiological Research of the Hungarian Academy of Sciences (University of Forestry and Wood Industry, Sopron) carries on experiments to draw xylophagous fungus species into production i.e. in bringing about the mycelium mass of xylophagous fungi. One of the important tasks of researchers is to select the fungus species suitable for various purposes so that in addition to the well-known fungi that can be grown in wood and wood material also other fungi could be utilized.

The results of the observations, the data presented in this paper may promote the accomplishment of practical targets, since in the characteristic species community growing on sawdust such edible fungus species can be found that often produce mass growth and also their mycelium mass which interlace the sawdust is of a remarkable quantity.

Material and methods

The purpose of my examinations was the floristical and ecological exploration of fungi - above all Basidiomycetes - occurring in sawdust depots in Hungary.

In the course of observations at site, samples were taken of all the species; moreover the type of growth, and the quantitative conditions of the specimens were recorded. The rare, or problematic fungus species were greatered and preserved in a greater number of specimens. The herbarium specimens of the material dealt with in our paper are deposited in the mycological herbarium of the Botanical Department of the Hungarian Natural History Museum (BP).

For determining the heat requirement and heat endurance capacity of certain species, the temperature of the sawdust was measured at 10 and 20 cm depths under the fruit body.

After that sporadical observations had been made in earlier years (1966, 1974, etc.), the fungus flora of the following sawdust depots was examined from 1976 to 1980 in the SW and NE boundaries of the country (Map 1.).

In the examined wood-depots, above all frondose trees (msinly Quercus petraea, Quercus robur, Quercus cerris, Fagus silvatica, in certain shops Robinia pseudoacacia and Populus species, too) are processed. Coniferous trees (Pinus nigra, Pinus silvestris, Picea abies) got into the waste only to a small extent or only in a quite insignificant quantity. Exceptions are those wood-depots where import coniferous trees are received (e.g. Tuzsér, Mátészalka) and where therefore the waste material consists of almost 100% of pinus bark and pinus sawdust.

In the collecting work, my regular collaborators were Mr. L. BABOS, Mr. A. FRIESZ, Mr. E. VÉSSEY, Mrs. M.VIRÁG, Mr. I. ZIRKELBACH, Mr. K. OTTO, Mr. L. ALBERT and Mr. Z. SARKADI. I express my thanks for their kind assistance also in this way.

Problems: No accurate information could be obtained about the proportion of the species composition of the sawdust occurring in sawmills.

Coenological examinations and species productivity measurements could not be carried out because conditions at sawmills are influenced by production circumstances and by the volume of production, by people living in the neighbourhood and by other factors, so that the marking of standard plots was impossible. This is even more regrettable because sometimes such good conditions could be observed that the characteristic species community grew at once in an area of 1-3 m^2. Some of the factors that are obstacles in the examinations are worth to mention. In certain shops, the daily quantity of waste is great, and that of the fresh discharge deposited on them is also great, therefore, the depot is regularly bulldozered; the older sawdust which was already a producing layer will be covered with a new sawdust-shavings layer. In other depots, a great quantity of slat and plank are placed outside and these either cover the sawdust, or where they get into the sawdust piles loosen the sawdust too much. As a result, the conditions for the fungi become more unfavourable, the nutrient media dries out easily, cannot warm up. For the wood by-product becoming dense, for the re-appearance of the fruit bodies a longer period is needed. Intentional and spontaneous burning, regularly change the conditions of habitat as well. In areas where the sawdust is delivered to a rubbish pit the objects thrown out into the pit cover the surface or the chemical materials poured out there cause damage to fungi. Besides, in most of the depots, the workers or the people living in the neighbourhood regularly pick up the fungi for food.

It occurred not only once that we found only the stems of the great quantity of fungi cut by people gathering fungi.

Map 1. The localities of the examined sawdust depots



1. Lenti
2. Zalahaláp
3. Uzsa
4. Monostorapáti
5. Franciavágás
6. Bakonyszentlászló: "Vinye-major"
7. Pusztavám
8. Szárliget
9. Dömös
10. Visegrád: "Lepence-völgy"
11. Budakeszi
12. Budapest: Tahi Street
    Kén Street
    Háros
13. Csévharaszt
14. Pusztavacs
15. Gödöllő: Incső
16. Isaszeg
17. Miskolc
18. Nyirmeggyes (Mátészalka)
19. Tuzsér

Table 1. Characteristic fungus community of some sawdust depots, on the basis of examinations carried out in 1979-1980.

Species 1979	Miskolc 18.06.	Budakeszi 17.06	Budakeszi 20.06	"Lepence-völgy" 26.06.	"Lepence-völgy" 7.07.	Budakeszi 29.08.	Budakeszi 8.09.	Lenti 14.09.	Zalaháp 16.09	Franciavágás 28.09	"Vinye-major" 29.09	F
P.atricapillus		+			+				+		+	4
P.patricius	+	+	+	+	+	+	+	+	+	+	+	11
P.variabilicolor		+	+	+	+	+		+	+	+		8
H.geogenia				+	+	+		+	+	+		6
L.bresadolae (incl.var.biornatus)	+	+	+	+	+	+	+	+	+	+		10
L.meleagris	+	+	+	+		+	+	+		+		8
L.cepaestipes (incl.var.rorulentus)	+			+	+			+			+	5
V.volvacea	+	+	+	+	+		+			+		7
Number of species	5	6	5	7	7	5	4	6	5	6	3[x]	

x = in very dry weather

Species 1980	"Vinye-major" 24.07	Pusztavám 24.07.	Budakeszi 27.07	Zalaháp 31.07.	"Lepence-völgy" 28.08	"Vinye-major" 7.09.	Pusztavám 7.09.	Incső 11.09.	Budakeszi 26.09.	"Lepence-völgy" 27.09.	Incső 22.10.	F
P.atricapillus	+	+		+		+			+	+		6
P.patricius	+	+	+	+	+	+	+	+	+	+	+	11
P.variabilicolor		+	+	+	+	+	+	+	+	+	+	10
H.geogenia	+			+				+	+		+	5
L.bresadolae (incl.var.biornatus)	+	+			+		+	+	+	+		7
L.meleagris	+	+	+		+	+	+	+		+	+	9
L.cepaestipes (incl.var.rorulentus)	+		+		+	+	+	+	+	+	+	9
V.volvacea	+		+		+	+	+		+	+		7
Number of species	7	5	5	4	6	6	6	6	7	7	5	

Results

The sawdust depots proved to be very suitable for carrying out taxonomical examinations, in addition to the floristical data collected. Rare species which have undergone hardly any examinations so far could be found regularly and in a great number of specimens.

Certain species showed full morphological identity on the occasions of collecting them either from different sawdust depots or even from sawdusts of different composition (Volvariella volvacea, V. bombycina, etc.). On the other hand, some species posses a great morphological variability: Pluteus patricius; Leucoagaricus bresadolae and var.biornatus (BABOS, 1979); Leucoagaricus meleagris (BABOS, 1980); Pluteus variabilicolor (BABOS, 1978). In addition to the papers cited in connexion with the data processing, I shall deal with certain questions and with the description of two new taxa.

Of the species belonging to the Agaricales order, there are 10 taxa (8 species + 2 varieties) which are the most characteristic of the mycocoenoses to be found in sawdust depots in Hungary. The 10 taxa mentioned belong taxonomically into two families - with the exception of Hohenbuehelia geogenia - viz. Pluteaceae (Pluteus, Volvariella), and Agaricaceae (Leucoagaricus, Leucocoprinus). Their order of frequency is as follows:

Pluteus patricius
Pluteus variabilicolor
Leucoagaricus bresadolae (incl. var.biornatus)
Leucoagaricus meleagris
Volvariella volvacea
Leucocoprinus cepaestipes (incl. var.rorulentus)
Hohenbuehelia geogenia
Pluteus atricapillus

This fungus community is very stable. The characteristic species could be regularly found in the same periods of time at several depots, or in different periods of time at the same depots, and even these species not once fructified exclusively (see Table 1.).

Fructification is of course not independent of factors of the surroundings, but it is more balanced here than in other habitats. The maximum or near-maximum species number of the characteristic mycocoenosis could be registered from June to September. In April and May mainly Pluteus species grow only on sawdust. It can be mentioned as a curiosity that the thermophilous Volvariella volvacea appears in May. The fructification of this species in our climatic conditions at such an early date was possible only because the warm up sawdust kept the temperature at the required degree. Factors related to temperature regulate the decrease in species number in October, too (See Table 2.).

Table 2. Growth period of characteristic Agaricales species in two sawdust depots examined regularly on the basis of a summation of data (Szárliget 1976-1978 and Budakeszi 1978-1980)

Species	Month April	May	June	July	Aug.	Sept.	Oct.	F
Pluteus atricapillus			+	+		+	+	4
Pluteus patricius	+	+	+	+	+	+	+	7
Pluteus variabilicolor	+	+	+	+	+	+	+	7
Hohenbuehelia geogenia				+	+	+		3
Leucoagaricus bresadolae (incl.var.biornatus)			+	+	+	+	+	5
Leucoagaricus meleagris			+	+	+	+		4
Leucocoprinus cepaestipes (incl.var.rorulentus)			+	+	+	+	+	5
Volvariella volvacea		+	+	+	+	+		5
Number of species	2	3	7	8	7	8	5	

As can be seen from Table 1, 5-6 taxa of the characteristic species community can be found at sawmills which were examinated only one or two times (e.g. in Miskolc, Lenti, Franciavágás, etc.). In case of repeated examinations it is probable that the total or almost total number of characteristic species could have been observed in these sawmills as well (as e.g. in Budakeszi, Szárliget, "Lepence-völgy"). Such a great agreement in the species composition, and the regularly, year after year, repeated appearance of the characteristic species, lasting from spring to autumn, could not be experienced in the course of mycocoenological examinations related to terricolous macroscopic fungi.

It is interesting from an ecological viewpoint that only a rather small proportion of the necroparasitic-saprophytic species living on wood or wood-material in Hungary, could be found in habitats providing ample quantities of water and nutrient material. On the other hand, such saprophytic fungi also live on sawdust that are not mentioned in the literature as living on sawdust and wood shaving, too.

In comparison between the species composition of fungi living on sawdust and the results of succession examinations carried out on trunks of frondose trees (KREISEL 1961; RUNGE 1969, 1975), the following statements can be made: in the decomposition of trunks Poriales and Polyporales species take part primarily in. No tinder fungi could be found on sawdust; the species that occur in the species lists in a small number (Trametes, Schizophyllum, etc.) grew on planks decaying in sawdust. Of the Agaricales species growing also on sawdust, it was only the Pluteus atricapillus, P. romellii (= P.lutescens), Hypholoma fasciculare and H. sublateritium species that were observed by RUNGE (1975) and KREISEL (1961) on trunks of Quercus robur and Fagus silvatica. The proportion of various frondose trees and coniferous trees in mixed sawdust changes continually because coniferous trees are processed rarely and in a smaller quantity. However this fact has no influence on the occurence of the characteristic species. Mycocoenosis changed in certain depots only to the extent that some fungi, living on pines and pine punks also appeared (e.g. Paxillus panuoides, Collybia exsculpta, Collybia impudica, etc.). In punks consisting only of pine sawdust and pine bark (Nyirmeggyes, Tuzsér) the only species was Pluteus patricius from the characteristic species community of mixed sawdusts, that could be found. The examination of this question should however be continued, since it was only on one occasion that I could examine depots containing pine-wood waste only.

The appearance of different fungi was determined much rather by the "size" of the waste than by the proportion of different kinds of wood in the waste. Sawdust proved to be the best medium. The very fine wood flour, the loose wood-shavings, plank pieces, and bark themselves are less satisfactory; however, in the course of their continuous mixing with sawdust, by their splitting into pieces and their becoming compact, the mixture can be utilised as well.

The composition of mycocoenoses is mostly controlled by the thickness of the sawdust layer, and the temperature conditions closely related to this. Such thermophilous species as e.g. Volvariella volvacea and Leucoagaricus meleagris (living in hotbeds or greenhouses), could be picked up in mass from sawdust which was stored in thick layers (2-3.5 m), from early summer till autumn. The heat and vapour of the decaying sawdust can provide even in the open air the conditions necessary for these species to produce fruit bodies. Data were obtained (Table 3.) on the heat requirement and heat endurance capacities of the mycelium in certain species.

On unwarmed, flatly stored sawdust - even if the sawdust depot was farther away from the forest (e.g. at Zalahaláp) - species growing on trunks and on their decaying roots (Hypholoma fasciculare, H.sublateritium) were found in mass. Species with lower temperature demand, characteristic of sawdust (e.g. Pluteus patricius, P.atricapillus, Leucoagaricus bresadolae var. biornatus) also regularly produced fruit bodies. The species, however, the heat requirement of which could not be satisfied by the temperature of the sawdust stored in thin layer (Volvariella volvacea, Leucoagaricus meleagris) were missing.

On the decaying matter of bark heaps which is covered with litter in the forest year by year (Uzsa, Szárliget), littercolous saprophytic fungi develop in great quantity (Lepiota aspera, L.cristata, Collybia dryophila, C.distorta var. ?, Lepista nebularis, Agrocybe praecox, Lycoperdon perlatum, etc.). These could be gathered - obviously because of the advantagous water-storing capacity of the bark - even on such occasions when owing to dry weather no fungi could be found in the neighbouring forest. On the bark heaps the saprophytic forest fungi living on decaying wood also appeared. For example, Lycoperdon pyriforme and Xylaria digitata grew in mass (see the species list on p. 41-44).

The appearance of the forest species could also be seen on the edges of sawdust depots being in forest environment (e.g. "Vinye-major", "Lepence-völgy"). The influence of environment of the

developing mycocoenosis could be best observed at Pusztavacs. Here, on the rubbish-covered thin layered sawdust, there grew Pluteus patricius, P. atricapillus, Leucoagaricus bresadolae, Coprinus lagopus, Cyathus stercoreus and Peziza micropus. Besides, there occurred also some of Macrolepiota rhacodes var. hortensis living on compost. On the part of the compost lying towards the grassland Macrolepiota excoriata was found on the sawdust, while on the part edging toward the forest, there grew Lepiota cristata and Collybia dryophila.

Table 3. Sawdust temperature in the vicinity of fruit bodies of 3 frequent fungus species

Leucoagaricus meleagris				
Locality	Period	Air temp. °C at a height of 1 m	Sawdust temperature 10 cm	°C at a depth of 20 cm+
Budakeszi	20 June 1979	19-20	33 31.4	
	29 Aug. 1979	20	26 37 41.5	27.5 39 44
Lenti	14 Sept. 1979	22	30.5 35 35 37 38 39 41.5	32 37 38 40 42 42 43.5
Pusztavám	24 July 1980	22	33	38
Visegrád: "Lepence-völgy"	28 Aug. 1980	27	32.5 34.5 38.5	34 40.5 40
		average values $\bar{x}$	= 35.2	38.4
		temperature limits	= 26-41.5	27.5-43.5

+ = Since there were decaying planks and pieces of wood in the sawdust, the temperature of the sawdust could not be measured as deep as 20 cm here and there.

	Volvariella volvacea			
Locality	Period	Air temp. °C at a height of 1 m	Sawdust temperature 10 cm	°C at a depth of 20 cm
Budakeszi	20 June 1979	19-20	29 30.5 30.5 31	
Visegrád: "Lepence-völgy"	7 July 1979	16-20	28	32
	28 Aug. 1980	27	38.5 39 40	42.5 44.5 42
		average values $\bar{x}$	= 33.3	40.3
		temperature limits	= 28-40	32-44.5

(Continuation of table 3)

Pluteus patricius				
Locality	Period	Air temp. °C at a height of 1 m	Sawdust temperature 10 cm	°C at a depth of 20 cm
Lenti	14 Sept. 1979	22	34 37.4	36 42.2
Zalahaláp	16 Sept. 1979	15.5	18 18.5	21 20
Franciavágás	28 Sept. 1979	22	16 22 28	20 24 32
Pusztavám	24 July 1980	22	18	22
Visegrád: "Lepence-völgy"	7 July 1979	16-20	20 25 29.5 30 31 31 34	22 30 36 34 37 37 37
	28 Aug. 1980	27-29	38.5++ 21 21 31	42.5++ 20 22 33
Bakonyszentlászló: "Vinye-major"	7 Sept. 1980	23	23 24 27 27 33++	24 25 30 31 35++
		average values $\bar{x}$	= 26.6	28.2
		temperature limits	= 16-38.5	20-42.5

++ = Grew together with Volvariella volvacea

The fresh bark-waste occurring in forest shops during bark-shaving is characterised by ephemerous fungus communities (Table 4.). In two areas lying far from each other (150 air km) identical species could be found on Fagus silvatica bark in different periods.

Table 4. Ephemerous fungus communities occurring on fresh beech-tree bark waste

Species	Mt. Börzsöny: Királyrét 31 July 1979	Mt. Bakony: between Bakonybél and Fenyőfő 29. Sept. 1979
	In dry, warm weather	In wet, cool weather
Bolbitius variicolor	+	+
Bolbitius vitellinus	+	+
Coprinus lagopus	+	+

In one cattle-pen (Csévharaszt) it was possible to examine sawdust mixed with cattle-dung, occurring in forest environment. Here a mass of coprophilous, littercolous and wood decaying fungi could be found together. The size of the fruit bodies was also large, and also those species grew in groups - large groups - of which this is not characteristic. Gigantism and increased grouping can rather frequently be experienced with fungi living on sawdust, but these two phenomena were even more increased in the case of sawdust with dung.

In the course of the examinations the importance, in relation of the decaying of wood matter, of the fungi species living on sawdust could be demonstrated very well. The mycelium mass of the frequent and characteristic species is very great. The dense mycelium interlacing can be seen not only in the areas below the fruit bodies but the mycelium mass also appears from the sagging footprints. The same can be seen if the planks are lifted. The rate of mycelium growth of certain species can be also extremely high. This can be the reason why the fruit bodies appear very shortly (2-4 weeks) after burning of the sawdust even if burning took place through a thick layer (e.g. at Nyirmeggyes: Pluteus patricius; at Budakeszi: Volvariella volvacea).

The humification of mixed sawdust consisting of frondose and coniferous species, is quick. In certain places, the period of site observations was limited by that the carting out of fresh sawdust was stopped, and following this, the wood waste became decayed during 2-5 years to such an extent that the plantage growing on it could cover it. Usually, however, it was not the original plantage that appeared on it again but nitrophilous weed plants of human size (Artemisia vulgaris, Urtica dioica, Lactuca serriola, etc.) covered the decayed sawdust heaps. At depressions in moorlands, however, the reed (Phragmites communis) can become dominant again. The terrain becoming overgrown with grass could be seen only in on site.

List of species concerning the localities

Ascomycetes

Peziza echinospora Karst.- Budakeszi, 16.05.1979.
Peziza micropus Pers. ex Fr.-Zalahaláp, 21.10.1978; Pusztavacs, 13.09.1980.
Peziza petersii Berk. & Curt.-Nyirmeggyes, 6.06.1980.
Peziza proteana (Boud.) Seav. cf. fm.sparassioides (Boud.) Korf.-Budakeszi, 27.07.1980.
Peziza repanda Pers.-Zalahaláp, 30.10.1978; "Vinye-major", 29.10.1974; Budakeszi, 16.05.1979, 17.05.1980; 29.09.1980; Pusztavacs, 12.05.1980.
Peziza vesiculosa Bull. ex St.Amans-"Vinye-major", 29.10.1974.
Xylaria digitata (L.) Grev.-Uzsa, 21.10.1978, 30.10.1978, 16.09.1979, 31.07.1980.
Xylaria polymorpha (Pers.) Grev.-Uzsa, 31.07.1980.
Xylaria sp.-Szárliget, 6.07.1977, 24.07.1980.

Basidiomycetes
Hymenomycetidae
Poriales

Coriolopsis extenuata (Dur. & Mont.) Dom.-Franciavágás, 28.09.1979, det.: Z. Igmándy.
Ganoderma lucidum (Curt. ex Fr.) Karst.-"Lepence-völgy", 27.09.1980.
Meripilus giganteus (Pers. ex Fr.) Karst.-Uzsa, 16.09.1979, 31.07.1980.
Trametes versicolor (L. ex Fr.) Pilát -Franciavágás, 28.09.1979; "Vinye-major", 7.09.1980; "Lepence-völgy", 27.09.1980.

Polyporales

Panus tigrinus (Bull. ex Fr.) Sing.-Miskolc, 18.06.1979.
Pleurotus pulmonarius Fr.-Franciavágás, 28.09.1979; "Vinye-major", 29.09.1979; "Lepence-völgy", 28.08.1980; Budakeszi, 6.06.1979.
Schizophyllum commune Fr. ex Fr.-"Vinye-major", 29.09.1979, 24.07.1980, 7.09.1980; Pusztavám, 7.09.1980; "Lepence-völgy", 26.06.1979, 7.07.1979, 27.09.1980; Miskolc, 18.06.1979.

Boletales

Paxillus involutus (Batsch) Fr.-Uzsa, 16.09.1979.
Paxillus panuoides Fr.-"Vinye-major", 24.07.1980; Budakeszi, 16.12.1977, 18.07.1978.
Paxillus panuoides Fr. var. ionipus Quél.-Zalahaláp, 21.10.1978, 30.10.1978; "Vinye-major", 7.09.1980.

Agaricales

Agaricus bisporus (Lge.) Sing.-Szárliget, 24.07.1980; Budakeszi, 6.06.1979.
Agrocybe arvalis (Fr.) Sing.-Franciavágás, 28.09.1979.
Agrocybe dura (Bolt. ex Fr.) Sing.-Budakeszi, 29.06.1979, 29.08.1979.
Agrocybe praecox (Pers. ex Fr.) Fay.-"Lepence-völgy", 24.05.1980; Budakeszi, 13.05.1979, 16.05.1979, 22.05.1979, 24.05.1980; Nyirmeggyes, 6.06.1980; Tuzsér, 6.06.1980.
Bolbitius aleuriatus (Fr.) Sing.-"Vinye-major", 29.09.1979.
Bolbitius reticulatus (Pers. ex Fr.) Ricken -Szárliget, 6.07.1977, 9.10.1977.
Bolbitius variicolor Atk. -Franciavágás, 28.09.1979; between Bakonybél and Fenyőfő, 29.09.1979; Szárliget, 6.07.1977; Budakeszi, 26.09.1980; Börzsöny Mts.: Királyrét, 31.07.1979; Csévharaszt, 18.05.1972.
Bolbitius vitellinus (Pers.) Fr.-Szárliget, 20.06.1976, 16.07.1978; between Bakonybél and Fenyőfő, 29.09.1979; Börzsöny Mts.: Királyrét, 31.07.1979; Csévharaszt, 18.05.1972; Pusztavacs, 12.05.1980.
Bolbitius vitellinus (Pers.) Fr. var. fragilis (L. ex Fr.).-"Lepence-völgy", 26.06.1979.
Collybia acervata (Fr.) Karst.-Uzsa, 16.09.1979.
Collybia distorta (Fr.) Quél. var.?-Uzsa, 21.10.1978, 30.10.1978, 16.09.1979, 31.07.1980.
Collybia dryophila (Bull. ex Fr.) Kummer -Pusztavám, 24.07.1980; Pusztavacs, 13.09.1980.
Collybia exsculpta (Fr.) Gill. -Tuzsér, 6.06.1980.
Collybia impudica (Fr.) Sing.-Pusztavám, 24.07.1980; Nyirmeggyes, 6.06.1980; Tuzsér, 6.06.1980.
Conocybe lactea (Lge.) Métr.-Szárliget, 6.07.1977.
Conocybe cf. pubescens (Gill.) Kühn.-Csévharaszt, 18.05.1972.
Coprinus atramentarius (Bull. ex Fr.) Fr.-Szárliget, 27.04.1980; Pusztavacs, 12.05.1980; Isaszeg, 11.09.1980.
Coprinus cinereus (Schff. ex Fr.) S.F.Gray -"Vinye-major", 24.07.1980.
Coprinus comatus (Müll. in Fl. Dan. ex Fr.) S.F.Gray -Szárliget, 27.04.1980; Budakeszi, 10.10.1978, 26.09.1980.
Coprinus flocculosus DC. ex Fr.-Pusztavacs, 12.05.1980.
Coprinus lagopides Karst.-Szárliget, 26.06.1977; Budakeszi, 20.06.1979.
Coprinus lagopus Fr.-Zalahaláp, 21.10.1978; between Bakonybél and Fenyőfő, 29.09.1979; Szárliget, 24.07.1980; "Lepence-völgy", 28.08.1980, 27.09.1980; Budakeszi, 10.10.1978, 26.09.1980; Börzsöny Mts.: Királyrét, 31.07.1979, 13.07.1980; Pusztavacs, 13.09.1980; Gödöllő-Incső, 11.09.1980, 22.10.1980; Miskolc, 18.06.1979.
Coprinus plicatilis (Curt. ex Fr.) Fr.-Zalahaláp, 31.07.1980; Pusztavacs, 13.09.1980.
Coprinus truncorum (Schff.) Fr.-"Lepence-völgy", 27.09.1980.
Crepidotus caspari Vel.-"Vinye-major", 7.09.1980.
Crepidotus mollis (Schff. ex Fr.) Kummer -"Lepence-völgy", 27.09.1980.
Flammulaster limulata (Weinm. ex Fr.) Watl.-Lenti, 14.09.1979.
Gymnopilus spectabilis (Fr.) Sing. var. junonia (Fr.) Lge.-Zalahaláp, 30.10.1978.
Hemimycena cucullata (Pers. ex Fr.) Sing.-Szárliget, 24.07.1980.
Hohenbuehelia geogenia (DC. ex Fr.) Sing. ss. Kreisel (Michael, Henning & Kreisel, 1977) -Lenti, 14.09.1979; Zalahaláp, 21.10.1978, 16.09.1979, 31.07.1980; Franciavágás, 28.09.1979; Szárliget, 11.08.1976, 26.06.1977, 6.07.1977, 25.10.1977; "Lepence-völgy", 26.06.1979, 7.07.1979; Budakeszi, 18.07.1978, 10.10.1978, 29.08.1979, 26.09.1980; Gödöllő-Incső, 11.09.1980, 22.10.1980; Isaszeg, 23.09.1967.
Hypholoma fasciculare (Huds. ex Fr.) Kummer -Uzsa, 16.09.1979; Zalahaláp, 21.10.1978, 30.10.1978, 16.09.1979; "Vinye-major", 29.09.1979, 24.07.1980, 7.09.1980; "Lepence-völgy", 27.09.1980; Budakeszi, 10.10.1978.
Hypholoma sublateritium (Fr.) Quél.-Zalahaláp, 21.10.1978, 30.10.1978; "Vinye-major", 7.09.1980.

Lepiota aspera (Pers. in Hofm. ex Fr.) Quél.–Uzsa, 16.09.1979, 31.07.1980; Szárliget, 20.08. 1978, 24.07.1980.

Lepiota cristata (Alb. & Schw. ex Fr.) Kummer –Szárliget, 9.10.1977, 25.10.1977, 16.07.1978, 24.07.1980; Budakeszi, 26.09.1980; Pusztavacs, 13.09.1980.

Lepista glaucocana (Bres.) Sing.–Uzsa, 21.10.1978, 30.10.1978.

Lepista nebularis (Fr.) Harmaja,–Uzsa, 21.10.1978, 30.10.1978.

Lepista nuda (Bull. ex Fr.) Cke.–Uzsa, 30.10.1978; Szárliget, 27.04.1980.

Leucoagaricus bresadolae (Schulz.) Bon, incl. var.biornatus (Berk. & Br.) Bon –Lenti, 14.09.1979; Zalahaláp, 16.09.1979; Monostorapáti, 31.07.1980; Franciavágás, 28.09.1979; "Vinye-major", 24.07.1980; Pusztavám, 24.07.1980, 7.09.1980; Szárliget, 19.08.1974, 18.07.1976, 8.08.1976, 11.08.1976, 26.06.1977, 3.07.1977, 6.07.1977, 9.10.1977, 16.07.1978, 20.08.1978; Dömös, 29.05.1968, 23.07.1968; "Lepence-völgy", 26.06.1979, 7.07.1979, 28.08.1980, 27.09.1980; Budakeszi, 18.07.1978, 5.09.1978, 17.06.1979, 20.06.1979, 29.08.1979, 8.09.1979, 26.09. 1980; Budapest: Háros, 18.07.1979; Budapest: Tahi Street, 5.09.1979; Pusztavacs, 13.09.1980; Gödöllő-Incső, 11.09.1980; Isaszeg, 21.08.1966, 20.09.1966, 31.10.1966, 11.09.1980; Miskolc, 18.06.1979; Mátészalka, - 07.1974; Komoró-Tuzsér, 18.06.1969.

Leucoagaricus meleagris (Sow. ex Fr.) Bon –Lenti, 14.09.1979; Franciavágás, 28.09.1979; "Vinye-major", 24.07.1980, 7.09.1980; Pusztavám, 24.07.1980, 7.09.1980; "Lepence-völgy", 26.06.1979, 28.08.1980, 27.09.1980; Budakeszi, 2.07.1978, 24.08.1978, 3.09.1978, 5.09.1978, 14.06.1979, 17.06.1979, 20.06.1979, 24.08.1979, 29.08.1979, 8.09.1979, 27.07.1980; Gödöllő-Incső, 11.09.1980, 22.10.1980; Miskolc, 18.06.1979.

Leucocoprinus cepaestipes (Sow. ex Fr.) Pat.–"Vinye-major", 29.09.1979, 24.07.1980, 7.09.1980; "Lepence-völgy", 28.08.1980, 27.09.1980; Budakeszi, 10.10.1978; Gödöllő-Incső, 11.10.1980.

Leucocoprinus cepaestipes (Sow. ex Fr.) Pat. var. rorulentus (Panizzi) Babos –Lenti, 14.09.1979; Monostorapáti, 31.07.1980; Pusztavám, 7.09.1980; Szárliget, 8.08.1976, 11.08.1976, 26.06. 1977, 3.07.1977, 6.07.1977, 25.09.1977, 9.10.1977, 25.10.1977, 16.07.1978, 24.07.1980; "Lepence-völgy", 26.06.1979, 7.07.1979, 27.09.1980; Gödöllő-Incső, 11.09.1980, 22.10.1980; Miskolc, 16.06.1979.

Lyophyllum fumosum (Pers. ex Fr.) Kühn. & Romagn.–Uzsa, 16.09.1979.

Macrolepiota excoriata (Schff. ex Fr.) Moser –Pusztavacs, 13.09.1980.

Macrolepiota procera (Scop. ex Fr.) Sing.–Uzsa, 30.10.1978.

Macrolepiota rhacodes (Vitt.) Sing. var. hortensis Pilát –Pusztavacs, 13.09.1980.

Melanoleuca cf. polioleuca (Fr.) Kühn. & Mre.–Budakeszi, 26.09.1980.

Melanoleuca sp. Szárliget, 9.10.1977.

Oudemansiella platyphylla (Pers. ex Fr.) Moser –"Vinye-major", 24.07.1980; Szárliget, 9.10.1977.

Oudemansiella radicata (Relh. ex Fr.) Sing.–Uzsa, 16.09.1979.

Panaeolus sphinctrinus (Fr.) Quél.–Csévharaszt, 18.05.1972.

Pholiota multifolia (Pk.) Smith Hesler - Zalahaláp, 15.10.1978, 21.10.1978, 30.10.1978; Monostorapáti, 31.07.1980; Franciavágás, 28.09.1979; Budakeszi, 18.07.1978, 10.10.1978; Gödöllő-Incső, 26.09.1969.

Pholiotina cyanopus (Atk.) Sing.–Nyirmeggyes, 6.06.1980.

Pholiotina subverrucispora (Ves. & Watl.) Moser –Szárliget, 24.07.1980; Gödöllő-Incső, 22.10.1980.

Pluteus atricapillus (Secr.) Sing.–Uzsa, 30.10.1978, 16.09.1979; Zalahaláp, 21.10.1978, 30.10. 1978; "Vinye-major", 29.09.1979, 24.07.1980, 7.09.1980; Pusztavám, 24.07.1980; Szárliget, 11.08.1976, 3.07.1977, 16.07.1978; "Lepence-völgy", 24.05.1980, 27.09.1980; Budakeszi, 18.07.1978, 10.10.1978, 17.06.1979, 20.06.1979, 26.09.1980; Csévharaszt, 18.05.1972; Pusztavacs, 12.05.1980, 13.09.1980.

Pluteus atromarginatus (Konr.) Kühn.–"Vinye-major", 7.09.1980.

Pluteus hispidulus (Fr. ex Fr.) Gill.–Szárliget, 24.07.1980.

Pluteus minutissimus R. Mre.–Szárliget, 24.07.1980.

Pluteus nigroviridis (in herb.)–Uzsa, 21.10.1978, 30.10.1978, 16.09.1979.

Pluteus patricius (Schulz.) Boud.–Lenti, 14.09.1979; Zalahaláp, 21.10.1978, 30.10.1978, 16.09. 1979, 31.07.1980; Monostorapáti, 31.07.1980; Franciavágás, 28.09.1979; "Vinye-major", 29.09.1979, 24.07.1980, 7.09.1980; Pusztavám, 24.07.1980, 7.09.1980; Szárliget, 5.10.1974, 18.07.1976, 11.08.1976, 26.06.1977, 3.07.1977, 6.07.1977, 9.10.1977, 16.07.1978, 27.04. 1980, 24.07.1980; "Lepence-völgy", 26.06.1979, 7.07.1979, 28.08.1980, 27.09.1980; Dömös, 28.08.1980; Budakeszi, 16.04 1978, 2.07.1978, 18.07.1978, 24.08.1978, 16.05.1979, 22.05. 1979, 27.05.1979, 29.05.1979, 6.06.1979, 20.06.1979, 29.06.1979, 29.08.1979, 8.09.1979, 27.07.1980, 29.09.1980; Solymár, 3.09.1977; Budapest: Kén Street, 4.09.1979; Budapest:

Tahi Street, 11.10.1979; Csévharaszt, 18.05.1972; Pusztavacs, 12.05.1980, 13.09.1980; Isaszeg, 21.08.1966, 20.09.1966, 11.09.1980; Gödöllő-Incső, 26.09.1969, 11.09.1980, 22.10. 1980; Miskolc, 18.06.1979; Nyirmeggyes, 6.06.1980.

Pluteus pearsonii P.D.Orton –Szárliget, 16.07.1978, 24.07.1980.

Pluteus petasatus (Fr.) Gill.–"Vinye-major", 29.10.1974.

Pluteus romellii (Britz.) Sacc.–Csévharaszt, 18.05.1972.

Pluteus thomsonii (Berk.& Br.) Dennis –Szárliget, 11.08.1976, 16.07.1978, 24.07.1980.

Pluteus variabilicolor Babos,–Lenti, 14.09.1979; Zalahaláp, 21.10.1978, 16.09.1979, 31.07.1980; Franciavágás, 28.09.1979; "Vinye-major", 7.09.1980; Pusztavám, 24.07.1980, 7.09.1980; Szárliget, 19.08.1974, 5.10.1974, 18.07.1976, 26.06.1977, 3.07.1977, 6.07.1977, 16.08.1977, 9.10.1977, 16.07.1978; "Lepence-völgy", 26.06.1979, 7.07.1979, 28.08.1980, 27.09.1980; Dömös,23.07.1968; Solymár, 3.09.1977; Budakeszi, 28.05.1978, 2.07.1978, 18.07.1978, 24.08.1978, 10.10.1978, 1.04.1979, 6.05.1979,13.05.1979, 22.05.1979, 27.05.1979, 28.05. 1979, 29.05.1979,12.06.1979, 17.06.1979, 20.06.1979, 29.08.1979, 27.07.1980,26.09.1980; Gödöllő-Incső, 11.09.1980, 22.10.1980.

Psathyrella bipellis Quél.–Pusztavacs, 12.05.1980.

Psathyrella candolleana (Fr.) Mre.–Zalahaláp, 31.07.1980; "Vinye-major", 29.09.1979, 24.07. 1980; Szárliget, 24.07.1980.

Psathyrella cf. pseudogracilis (Romagn.) Moser –Pusztavacs, 13.09.1980.

Psathyrella spintrigera (Fr.) Konr. & Maubl.–Pusztavacs, 12.05.1980.

Psathyrella velutina (Pers. ex Fr.) Sing.–"Lepence-völgy", 27.09.1980; Budakeszi, 26.09.1980.

Tubaria furfuracea (Pers. ex Fr.) Gill.–Pusztavacs, 12.05.1980.

Tubaria hiemalis Rom. ex Bon –Budakeszi, 1.01.1979.

Volvariella bombycina (Schff. ex Fr.) Sing.–"Vinye-major", 24.07.1980, 7.09.1980; Szárliget, 16.07.1978, 20.08.1978; Budakeszi, 18.07.1978, 6.06.1979, 29.06.1979, 29.08.1979, 8.09. 1979, 27.07.1980.

Volvariella pubescentipes (Peck) Sing.–Szárliget, 11.08.1976.

Volvariella speciosa (Fr.) Sing.–Budakeszi, 13.05.1979, 16.05.1979.

Volvariella speciosa (Fr.) Sing. var. gloiocephala (DC. ex Fr.) Sing.–Szárliget, 20.06.1976; Budakeszi, 10.10.1978.

Volvariella taylori (Berk.) Sing.–Szárliget, 26.06.1977, 3.07.1977, 16.08.1978.

Volvariella volvacea (Bull. ex Fr.) Sing.–Franciavágás, 28.09.1979; "Vinye-major", 24.07.1980, 7.09.1980; Pusztavám, 7.09.1980; Szárliget, 20.06.1976, 11.08.1976, 25.10.1977, 16.07. 1978, 20.08.1978; "Lepence-völgy", 7.07.1979, 24.05,1980, 28.08.1980, 27.09,1980; Budakeszi, 30.05.1978, 18,07.1978, 24.08.1978, 20.05.1979, 22.05.1979, 27.05.1979, 29.05.1979, 6.06.1979, 12.06.1979, 17.06.1979, 20,06,1979, 29.06.1979, 8.09.1979, 24.07.1980, 26.09. 1980; Miskolc, 18.06.1979.

Gasteromycetidae

Crucibulum laeve (Huds. trans Rehl.) Kambly –Pusztavám, 24.07.1980, 7.09.1980.

Cyathus olla Batsch trans Pers.–Szárliget, 9.10.1977; Budakeszi, 26.09.1980.

Cyathus stercoreus (Schw.) de Toni –Franciavágás, 28.09.1979; "Vinye-major", 24.07.1980; Szárliget, 25.10.1977; Pusztavacs, 13.09.1980; Gödöllő-Incső, 11.09.1980, 22.10.1980.

Lycoperdon perlatum Pers. per Pers.–"Vinye-major", 7.09.1980; "Lepence-völgy", 27.09.1980.

Lycoperdon pyriforme Schaeff. per Pers.–Uzsa, 21.10.1978, 30.10.1978, 16.09.1979.

Myxomycetes

Fuligo septica (L.) Wiggers –Lenti, 14.09.1979; Uzsa, 16.09.1979; Zalahaláp, 16.09.1979; Franciavágás, 28.09.1979; "Vinye-major", 29.09.1979, 24.07.1980, 7.09,1980; Pusztavám, 24.07. 1980, 7.09.1980; Szárliget, 5.10.1974; "Lepence-völgy", 7.07.1979, 24.05.1980, 27.09.1980; Pusztavacs, 13.09.1980; Isaszeg, 11.09.1980; Gödöllő-Incső, 11.09.1980.

Lycogala epidendrum (L.) Fr.–Lenti, 14.09.1979; "Vinye-major", 24.07.1980, 7.09.1980; "Lepence-völgy", 26.06.1979, 7.07.1979.

Summary

Above all Agaricales species used for food play a significant role in the quick decomposition of sawdust and other wood wastes, on the other hand, Poriales and Polyporales species which take part in the decompositional processes of trunks have no importance in the utilization of sawdust.

On the basis of several years' observation made in sawdust depots of Hungary it can be stated that on the sawdust and wood waste of frondose trees (Quercus, Fagus, Robinia, Populus, etc.) mixed in a smaller part with coniferous trees (Pinus, Picea) - independently of the ratio of mixing of these species - a special mycocoenosis, fructificating regularly and often in mass, can be found (Table 1.). Of the warm up substrate stored in a thick layer the following Agaricales species are characteristic (according to the order of their frequency): Pluteus patricius, P. variabilicolor, Leucoagaricus bresadolae (incl. var.biornatus), L.meleagris, Volvariella volvacea, Leucocoprinus cepaestipes (incl. var.rorulentus), Hohenbuehelia geogenia, Pluteus atricapillus. On thin layered sawdust - where the heat of decomposition is not high - thermophilous species (Leucoagaricus meleagris, Volvariella volvacea) are missing. In forest environment, on flatly arranged bark-heaps, the mycocoenosis consists of other species: littercolous species and wood-decaying fungi appear in mass. On fresh bark waste (Fagus silvatica), ephemeral fungus communities of small species number (3) could be observed (Table 4). On sawdust with dung the wood-rot fungi appeared together with littercolous and coprophilic fungi.

Owing to their constantly and strongly disturbed conditions, the examined areas are not suitable for indication of sampling plots and for regular analyses of production, even thourgh these could have provided surprising results on the basis of the frequently found mass productions. It can be mentioned as a peculiarity of the characteristic species community that a considerable quantity of the character species could often be found even in a small area (1-3 m^2), and also that on several occasions no other fungi than the character species could be found on the depots. Fungus growth is much more regular on sawdust - probably because of the favourable water-holding capacity of the substrate - than in the neighbouring areas.

The main fruit producing period lasts from June till September (Table 2), but the warm up of the substrate made it possible for example for Volvariella volvacea to grow its fruit body even as early as May.

The measurement data related to the heat requirement and to the heat endurance of the most frequent species are given in Table 3. Concerning the quick growth of the mycelia of certain species, indirect data have been obtained, too. For example, Pluteus patricius and Volvariella volvacea on deeply-burnt through sawdust produced its fruit bodies as early as 2-4 weeks after burning.

A high degree of variability could be observed on certain fungi of the character species: Pluteus variabilicolor: (BABOS 1978); Leucoagaricus meleagris: (BABOS 1980); Pluteus patricius (to be published later) etc. Other species on the other hand always showed morphological identity (e.g. Volvariella volvacea, Volvariella bombycina).

Gigantism is also frequent, and growth in groups with such species that on other substrates are not characterized by it. For the clarification of certain taxonomical questions, sawdust proved to be good habitat.

Data on edibility of such fungi in relation of which edibility was not known or was doubtful were also obtained. Workers of sawmills and the inhabitants of the neighbouring villages regularly consume, in addition to the Pluteus and Volvariella species, Leucoagaricus meleagris, L.bresadolae and var.biornatus. In certain places, fungi are collected also for animal feeding. In certain experimental areas, the quick humification of sawdust could be experienced. If the depositing of the fresh sawdust was stopped, after 2-5 years the sawdust depots became covered with mostly weedy, nitrophilous plantage.

REFERENCES

BABOS, M. (1978): Pluteus Studies, I. (Basidiomycetes, Pluteaceae). - Ann.Hist.-nat.Mus.Nat. Hung., 70: 93-97, 7 figs.

BABOS, M. (1979): The species of the "Rubentes" group in the genus Leucocoprinus. - Sydowia, Ann.Mycol.Ser.2, Beiheft 8: 33-53, 6 figs.

BABOS, M. (1980): Studies on Hungarian Lepiota s.l. species, V. - Ann.Hist.-nat.Mus.Nat.Hung., 72: 81-90, 5 figs.

DENNIS, R.W.G., ORTON, P.D. & HORA, F.B. (1960): New check list of British Agarics and Boleti, I-II. - Suppl.Trans.Brit.mycol.Soc., 225 pp.

KREISEL, H. (1961): Die Entwicklung der Mykozönose an Fagus-Stubben auf norddeutschen Kahlschlagen. - Feddes Repertorium, Beiheft 139: 227-232.

MICHAEL, E., HENNIG, B. & KREISEL, H. (1977): Handbuch für Pilzfreunde, III. - Jena, 2. Aufl., 464 pp.

PONGÓ, L. (1979): Fahéj a Földnek. - Delta, (10): 11-13.

RUNGE, A. (1969): Pilzsukzession auf Eichenstümpfen. - Abhandlungen aus dem Landesmuseum für Naturkunde zu Münster in Westfalen, 31 (2): 3-10.

RUNGE, A. (1975): Pilzsukzession auf Laubholzstümpfen. - Zeitsch.f.Pilzkunde , 41: 31-38.

SZALAY, L., ORTUTAY, B. & OROSZ, J. (1975): Hulladékhasznositás, anyag- és energiatakarékosság. (Utilization of wooden waste, saving of materials and energy.) - Faipari Kutatások, 221-233.

TAKÁTS, T. (1978): A hulladék faanyag közvetlen felhasználása biomassza-termelésben. (Direct using of waste wood for producing biomass.) - Mikol.Közlem., (1-2): 71-75.

Author's address: M. BABOS
Botanical Department of the
Hungarian Natural History Museum
Budapest Pf: 222
H-1476
HUNGARY



Fig. 1. "Vinye-major" near Bakonyszentlászló, 1980. Photo: L. Babos



Fig. 2. "Lepence völgy" near Visegrád, 1980 Photo: L. Babos



Fig. 3. Budakeszi, 1980 Photo: L. Babos



Fig. 4. Pluteus patricius, farmstead Vinye Photo: L. Babos



Fig. 5. Pluteus variabilicolor, Budakeszi Photo: L. Babos



Fig. 6. Volvariella volvacea, Budakeszi. Photo: L. Babos



Fig. 7. Leucoagaricus bresadolae, Isaszeg Photo: E. Véssey



Fig. 8. Volvariella bombycina, farmstead Vinye Photo: L. Babos



Fig. 9. Hohenbuehelia geogenia, Isaszeg Photo: E. Véssey



Fig. 10 Bolbitius variicolor, Budakeszi Photo: L. Babos