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Original scientific paper

MACROFUNGI IN FOREST ASSOCIATIONS  
OF THE PLITVIČKA JEZERA NATIONAL  
PARK (CROATIA, YUGOSLAVIA)

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During mycological investigations in the first two weeks of September 1989, 120 species of macromycetes, mainly agarics, were identified. They are presented on a table against the background of substrates and forest associations.

Introduction

As a result of many years of investigations by the second author — M. T. — in the Plitvička Jezera National Park lignicolous fungi from the group *Aphyllophorales* were published in a number of smaller or larger contributions, the most important being the presentation of non-poroid species (TortiĆ 1985) and polypores (TortiĆ 1988) established up to now in various forest associations. However, agarics were also investigated, albeit sporadically, and a large number of species, both terricolous and lignicolous was found. They have not been published yet and no regular mycocoenological analysis has been made.

This paper presents an attempt to investigate agarics primarily, from the mycocoenological point of view in the main forest associations developed in the Plitvička Jezera National Park. The research was carried out from 28 Aug. to 10 Sept. 1989. Therefore only one seasonal aspect, that of late summer, is included.

## Main features of the investigated area

Position, morphology, climate etc. of the Plitvička Jezera National Park was described in a previous paper (Tortić 1988) and only the most important aspects are repeated here.

The National Park Plitvička Jezera is situated in the north-west part of Yugoslavia, in the republic of Croatia, at about 15°35' and 44°50' between the mountain ranges of Mala Kapela and Lička Plješevica, and comprises about 20000 ha, at altitudes from 483 m (River Korana) up to 1280 m (Seliški vrh). The relief displays many marked karstic characteristics in its geomorphology, hydrology, climate, vegetation. The primary natural phenomenon of the Park, which made it world famous, is a step-like series of larger and smaller lakes connected by many waterfalls, with markedly developed travertine biodynamics. The geologic substrate is Mesozoic limestones and dolomites on which the most frequent are rendzinas and brown soils. The climate according to Köppen is in lower, southeastern parts of the National Park C-warm-temperate rain climate whilst the higher tracts in the north-western part belong to D-boreal-subarctic type. Mean annual precipitation according to the observations from 1956—1965 on two localities was from 1453 mm to 1656 mm. The driest months were Jan.-March and July-Sept.

Most of the Park area (14500 ha) is covered by large autochthonous forests of deciduous trees and conifers forming several associations. The most important tree species are beech (*Fagus sylvatica*) and fir (*Abies alba*). Spruce (*Picea abies*) is also rather numerous. Less frequent are maples (*Acer obtusatum*, *A. pseudoplatanus*, *A. platanoides*), pine (*Pinus sylvestris*), hop-hornbeam (*Ostrya carpinifolia*) and some others.

## General data about the most important forest associations

The main climazonal types of forests are montane beech forest (*Fagetum illyricum montanum* Horv.) in the lower montane belt and beech and fir forest (*Abieti-Fagetum illyricum* Horv.) in the higher belt. In both, variants on limestones and dolomites are recognised, considered by some authors to represent separate associations. Several paraclimatic forest associations are also developed, the most important being spruce forest on dolomites (*Piceetum dolomiticum* Horv.) and pine forest with hellebore (*Helleboro-Pinetum* Horv.).

In the cited papers (Tortić 1985, 1988) variants on dolomites were included in those on limestones. Here, however, we treat them as separate associations (Collect auct. 1975) since we wanted to find out whether there was any difference in the mycoflora of similar forests on different geological substrates. The investigated forest communities are here described in short.

## Phytocoenoses on limestones

The *Faetum illyricum montanum* Horv. — Main tree species is *Fagus sylvatica*. Other trees, occurring rather rarely, are *Acer pseudoplatanus* and in some places also *Picea abies*. Among shrubs occur *Corylus avellana*, *Evonymus verrucosa*, *Daphne mezereum*, *Lonicera al-*

*pigena*, *Crataegus monogyna* etc., and in the herb layer *Galium odoratum* = *Asperula odorata*, *Asarum europaeum*, *Euphorbia amygdaloides*, *Sanicula europaea*, *Cyclamen europaeum*, *Dentaria bulbifera*, *Cardamine trifolia* and others.

The *Abieti-Fagetum illyricum* Horv. — *Fagus sylvatica* and *Abies alba* occur in about the same proportions, with *Picea abies* and *Acer pseudoplatanus* in smaller or larger quantities. In shrub layer are developed: *Lonicera alpigena*, *L. xylosteum*, *Corylus avellana*, *Daphne mezereum*, *D. laureola*, *Rhamnus fallax* etc. and in the herb layer *Anemone nemorosa*, *Oxalis acetosella*, *Senecio juchsii*, *Cyclamen europaeum*, *Polystichum lonchitis* etc., and many mosses.

The *Phegopteris-Piceetum* Pelcer. — In addition to *Picea abies* *Acer pseudoplatanus* and *Fagus sylvatica* occur singly. In the shrub layer there are *Sorbus aucuparia*, *Lonicera* spp., *Rhamnus fallax*, *Ribes alpina*, *Daphne mezereum* and others. and in the herb layer *Phegopteris dryopteris*, *Majanthemum bifolium*, *Oxalis acetosella*, *Melampyrum pratense* etc. and various mosses.

The *Seslerio-Ostryetum* Ht. et H-ić. — The most characteristic trees and shrubs are *Ostrya carpinifolia*, *Fraxinus ornus*, *Acer obtusatum*, *Cotinus coggygia*, and in the herb layer *Sesleria autumnalis*, *Teucrium chamaedrys* and others.

#### Phytocoenoses on Dolomites

The *Helleboro-Fagetum* Pelcer. — In addition to *Fagus sylvatica*, *Acer obtusatum* is rather frequent. Characteristic among shrubs is *Viburnum lantana* and in the herb layer primarily *Helleborus macranthus*, with *Hepatica nobilis*, *Hacquetia epipactis*, *Carex alba*, *Salvia glutinosa* and others. *Ostrya carpinifolia*, *Cornus mas*, *Crataegus monogyna*, *Erica carnea* and others are admixed in some places.

The *Abietetum dolomiticum* Pelcer. — Here, *Abies alba* is dominant, but *Picea abies* occurs occasionally. *Helleborus macranthus*, *Vaccinium myrtillus*, *Cardamine trifolia*, *Hepatica nobilis* etc are developed in the herb layer. Two subassociations are recognised: the described *typicum* and *fagetosum*, which is similar to beech and fir forest on limestones. In addition to *Fagus sylvatica* and *Abies alba* frequently occur here *Picea abies* and *Acer obtusatum*.

The *Piceetum dolomiticum* Horv. — *Picea abies* is the dominant tree species, the shrub layer is poorly developed and in the herb layer occur *Carex alba*, *Helleborus macranthus*, *Buphthalmum salicifolium* etc.

The *Helleboro-Pinetum* Horv. — In this association *Pinus sylvestris* predominates; *Picea abies* is also frequent. In some localities *Pinus nigra* also occurs. Among shrubs *Juniperus communis* is the most numerous, other species are *Viburnum lantana*, *Corylus avellana* etc. In the herb layer are developed: *Galium lucidum*, *Erica carnea*, *Helleborus macranthus* and others.

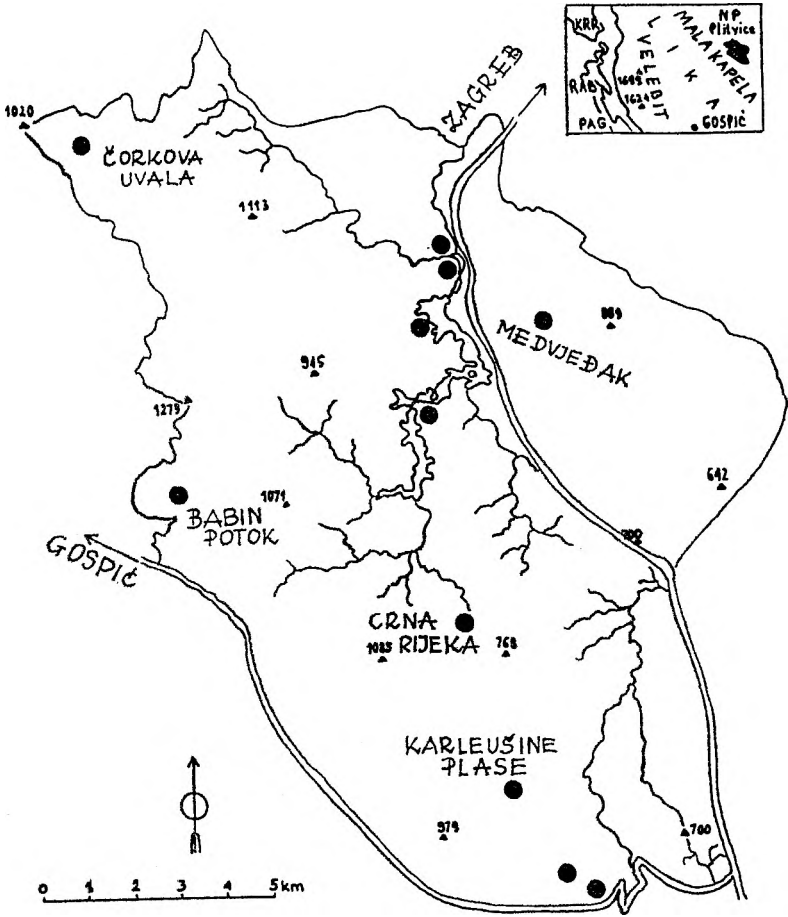


Fig 1. Investigated localities in the Plitvička Jezera National Park

## Materials and Methods

The fungi were studied in the following localities and forest associations (Fig. 1):

1. South-western slopes of Mt. Medvedak, alt. 600—650 m, the *Fagetum illyricum montanum*.
2. Čorkova uvala, alt. 850—900 m, virgin forest of the *Abieti-Fagetum illyricum*, with many 300—400 years old trees of *Abies alba*.
3. Karleušine Plase, alt. 850 m, the *Phegopteri-Piceetum* with *Fagus* and the *Fagetum montanum* with *Picea*.
4. Eastern steep slopes on the shore of Lake Kozjak, alt. about 550 m, the *Helleboro-Fagetum*.
5. Southern shore of Lake Batinovac, alt. 600 m, the *Helleboro-Fagetum*.
6. Pogledalo, in several places, 850—900 m, the *Piceetum dolomiticum*.
7. Source of the river Crna Rijeka, alt. 700 m. On north-western slopes *Piceetum dolomiticum* and above it, on a small plateau, the *Abietetum dolomiticum fagetosum*.
8. The *Helleboro-Pinetum* association near the village of Babin Potok, southern slopes, 800—850 m.
9. Steep slopes of the Lower Lakes, in two places: above the waterfalls Veliki Slap and Sastavci, alt. about 600 m, the *Fagetum illyricum montanum*, and at the western shore of Lake Kaluderovac, alt. about 500 m, the *Seslerio-Ostryetum* where only few species were found and they are not included in the Table.

The size of phytocoenoses investigated is various: some are developed in a narrow belt or in small patches distributed mosaically, others cover large areas, such as those in Medvedak, Čorkova Uvala and Babin Potok, where as large surfaces as possible were searched. In all localities there is a great abundance of rotten wood and not yet decomposed litter.

This study primarily considers agarics growing on soil, litter and wood, and also a small number of, mainly terrestrial, species from other groups of the class *Basidiomycetes*. The nomenclature is after Moser (1983) and Jülich (1984), corrected after some new literature (Kreisel 1987, Rauschert 1989).

The species are arranged in Table 1 according to the associations. In the first column substrate is indicated: s = soil, l = litter. Fungi growing on wood are marked as follows: F = on *Fagus*, P = on *Picea*, A = on *Abies*, Pin = on *Pinus*. The mycoflora from similar associations on limestones and dolomites is compared in other columns. Only one association on dolomites, the *Helleboro-Pinetum*, does not have its corresponding association on limestones.

The abundance of species is indicated after the scale of Jahn, Nespiak & Tüxen (1967) as: a = abundant, n = numerous, r = rare.

Abbreviations for the names of associations are: Fm = *Fagetum illyricum montanum*, A-F = *Abieti-Fagetum illyricum*, Ph-P = *Phegopteri-Piceetum*, H-F = *Helleboro-Fagetum*, Adf = *Abietetum dolomiticum fagetosum*, Pd = *Piceetum dolomiticum*, H-Pin = *Helleboro-Pinetum*.

Table 1. Macrofungi against the background of substrate and forest associations in the Plitvička Jezera National Park

Species	Substr	Fm/H-F	A-F/Adf	Ph-P/Pd	H-Pin
<i>Coprinus disseminatus</i> (Pers.: Fr.) S. F. Gray	F	a	.	.	.
<i>Calocera cornea</i> (Batsch.: Fr.) Fr.	F	n	.	.	.
<i>Clitocybe cerussata</i> (Fr.) Kummer	l	n	.	.	.
<i>Pholiota squarrosa</i> (Müll.: Fr.) Kummer	F	n	.	.	.
<i>Lactarius acris</i> (Bolt.: Fr.) S. F. Gray	s	r-n	.	.	.
<i>Marasmius rotula</i> (Scop.: Fr.) Fr.	l	r-n	.	.	.
<i>Mycena crocata</i> (Schrad.: Fr.) Kummer	F	r	.	.	.
<i>Russula xerampelina</i> (Schaeff.) Fr. var. <i>barlae</i> (Quél.) Mass.	s	r	.	.	.
<i>Lactarius vellereus</i> (Fr.) Fr.	s	r	.	.	.
<i>Mycena stylobates</i> (Pers.: Fr.) Kummer	l	r	.	.	.
<i>Tricholoma columbetta</i> (Fr.) Kummer	s	r	.	.	.
<i>Psathyrella piluliformis</i> (Bull.: Fr.) P. D. Orton	F	r	.	.	.
<i>Lepiota aspera</i> (Pers.) Quél.	s	r	.	.	.
<i>Lactarius volemus</i> (Fr.) Fr.	s	r	.	.	.
<i>Collybia butyracea</i> (Bull.: Fr.) Kummer	l	r	.	.	.
<i>Amanita phalloides</i> (Fr.) Link	s	r-n/r	.	.	.
<i>Psathyrella candolleana</i> (Fr.: Fr.) R. Maire	F	r/r	.	.	.
<i>Marasmius bulliardii</i> Quél.	l	r/r	.	.	.
<i>Mycena renati</i> Quél.	F	/n	.	.	.
<i>Crepidotus mollis</i> (Schaeff.: Fr.) Kummer	F	/r	.	.	.
<i>Russula solaris</i> Ferd. & Winge	s	/r	.	.	.
<i>Boletus luridus</i> Schaeff.: Fr.	s	/r	.	.	.
<i>Russula mairei</i> Sing.	s	/r	.	.	.
<i>Entoloma incanum</i> (Fr.) Hesler	s	/r	.	.	.
<i>Marasmius lupuletorum</i> (Weinm.) Bres.	l	n/n	r/n	.	.
<i>Megacollybia platyphylla</i> (Pers.: Fr.) Kotl. & Pouz.	F	n	r/n	.	.
<i>Panellus stypticus</i> (Bull.: Fr.) P. Karst.	F	n/n	n	.	.
<i>Pleurotus pulmonarius</i> (Fr.) Quél.	F	n/n	r	.	.
<i>Marasmius alliaceus</i> (Jacq.: Fr.) Fr.	F	r/r	r	.	.
<i>Oudemansiella radicata</i> (Rehl.: Fr.) Sing.	F	r/r	r	.	.
<i>Lactarius piperatus</i> (L.: Fr.) Pers	s	n	n	.	.
<i>Mycena pelianthina</i> (Fr.) Quél.	l	r	r	.	.
<i>Inocybe fastigiata</i> (Schaeff.) Quél.	s	r	r	.	.
<i>Mycena filopes</i> (Bull.: Fr.) Kummer	l	r	r	.	.
<i>Russula albogra</i> (Krombh.) Fr.	s	.	n	.	.
<i>Lactarius fuliginosus</i> (Fr.) Fr.	s	.	r	.	.
<i>Marasmius wynnii</i> Berk. & Br.	l	.	r	.	.
<i>Russula cyanoxantha</i> (Schaeff.) Fr.	s	.	r	.	.
<i>Russula velenovskyi</i> Melz. & Zv.	s	.	r	.	.
<i>Oudemansiella longipes</i> (Bull.) Moser	F	.	r	.	.
<i>Lepiota clypeolaria</i> (Bull.: Fr.) Kummer	l	.	r	.	r
<i>Agaricus arvensis</i> Schaeff.	s	.	r	.	.
<i>Amanita rubescens</i> (Pers.) Fr.	s	.	r	.	.
<i>Tricholomopsis rutilans</i> (Schaeff.: Fr.) Sing.	A	.	r	.	.
<i>Xeromphalina campanella</i> (Batsch.: Fr.) R. Maire	A	.	r	.	.
<i>Mycena atroalba</i> (Bolt.: Fr.) S. F. Gray	P	.	r	.	.
<i>Rickenella fibula</i> (Bull.: Fr.) Raith.	P	.	r	.	.

<i>Armillaria mellea</i> (Vahl.: Fr.) P. Karst.	P	.	r	.	.
s. l.					
<i>Tremiscus helvelloides</i> (DC: Fr.) Donk	A	.	n	.	/n
<i>Lactarius salmonicolor</i> Heim & Lecl.	s	.	n/r	.	/r
<i>Inocybe corydalina</i> Quél.	s	.	/r	.	.
<i>Mycena flavoalba</i> (Fr.) Quél.	l	.	n/n	/n	.
<i>Russula ochroleuca</i> Pers.	s	.	r	n/r-n	.
<i>Laccaria laccata</i> (Scop.: Fr.) Berk. & Br.	s	.	r	n/r	.
<i>Mycena galopus</i> (Pers.: Fr.) Kummer	l	.	r	/n	.
<i>Laccaria amethystea</i> (Bull.) Murr.	s	.	r	/r	.
<i>Mycena chlorinella</i> (Lange) Sing.	l	.	r	/r	.
<i>Marasmius scorodoni</i> (Fr.: Fr.) Fr.	l	.	/n	/r	.
<i>Pseudohydnum gelatinosum</i> (Scop.: Fr.) P. Karst.	P, Pin	.	n	/n	/n
<i>Hydnum rufescens</i> Fr.	s	.	n	/n	/n
<i>Lactarius scrobiculatus</i> (Scop.: Fr.) Fr.	s	.	r	n/n-a	/n
<i>Calocera viscosa</i> (Pers.: Fr.) Fr.	A, P	.	r	n/n	/n
<i>Clavulina coralloides</i> (L.) Schroet.	s	.	r	/n	/n
<i>Cortinarius variegatus</i> (Pers.: Fr.) Fr.	s	.	r/r	/n-a	/r
<i>Hypoloma fasciculare</i> (Huds.: Fr.) Kummer	A	.	/r	/r	/n
<i>Clitocybe odora</i> (Bull.: Fr.) Kummer	l	.	/r	/r	/n
<i>Russula laurocerasi</i> Melz.	s	.	.	r	.
<i>Amanita vaginata</i> (Bull.: Fr.) Vitt.	s	.	.	r/r	.
<i>Thelephora palmata</i> (Scop.) Fr.	s	.	.	/n-a	.
<i>Clavulina cinerea</i> (Bull.: Fr.) Schroet.	s	.	.	/n-a	.
<i>Albatrellus subrubescens</i> (Murr.) Pouz.	s	.	.	n/	.
<i>Cantharellus cibarius</i> Fr.: Fr. var. <i>amethysteus</i> Quél.	s	.	.	/n	.
<i>Boletopsis leucomelaena</i> (Pers.) Fayod	s	.	.	/n	.
<i>Hydnellum suaveolens</i> (Scop.: Fr.) P. Karst.	s	.	.	/n	.
<i>Lycoperdon umbrinum</i> Pers.: Pers.	s	.	.	/n	.
<i>Crucibulum crucibuliforme</i> (Scop.) White	l	.	.	/n	.
<i>Russula queletii</i> Fr. in Quél.	s	.	.	/r	.
<i>Mycena rubromarginata</i> (Fr.: Fr.) Kummer	P	.	.	/r	.
<i>Micromphale perforans</i> (Hoffm.: Fr.) S. F. Gray	l	.	.	/r	.
<i>Laccaria proxima</i> (Boud.) Pat.	s	.	.	/r	.
<i>Calvatia excipuliformis</i> (Scop.: Pers.) Perdeck	s	.	.	/r	.
<i>Russula lutea</i> (Huds.: Fr.) S. F. Gray	s	.	.	/r	.
<i>Inocybe praetervisa</i> Quél.	s	.	.	/r	.
<i>Collybia cookei</i> (Bres.) J. D. Arnold	l	.	.	/r	.
<i>Russula vesca</i> Fr.	s	.	.	/r	/r
<i>Tricholoma sulphureum</i> (Bull.: Fr.) Kummer	s	.	.	/n-a	/r
<i>Lactarius deterrimus</i> Gröger	s	.	.	/n	/n
<i>Sarcodon imbricatus</i> (L.: Fr.) P. Karst.	s	.	.	/r-n	/n
<i>Marasmius androsaceus</i> (L.: Fr.) Fr.	l	.	.	/r	/n
<i>Lycoperdon perlatum</i> Pers.: Pers.	s	.	.	/r	/n
<i>Clavulina rugosa</i> (Bull.: Fr.) Schroet.	s	.	.	n	/n
<i>Paxillus atrotomentosus</i> (Batsch.: Fr.) Fr.	P, Pin	.	.	.	/n
<i>Tricholomopsis decora</i> (Fr.) Sing.	P	.	.	.	/n
<i>Schizophyllum commune</i> Fr.: Fr.	A, Pin	.	.	.	/n
<i>Cortinarius russeus</i> R. Henry	s	.	.	.	/n
<i>Cantharellus tubaeformis</i> (Bull.) Fr.	s	.	.	.	/n
<i>Leucopaxillus lentus</i> (Post ap. Romell) Sing. & Smith	s	.	.	.	/n
<i>Hydropus marginellus</i> (Pers.: Fr.) Sing.	A	.	.	.	/r
<i>Pluteus tricuspidatus</i> Velen.	P	.	.	.	/r →

<i>Amanita mappa</i> (Batsch.) Quéf.	s	.	.	.	/r
<i>Tricholoma saponaceum</i> (Fr.) Kummer	s	.	.	.	/r
<i>Cortinarius glaucopus</i> (Schaeff.: Fr.) Fr.	s	.	.	.	/r
<i>Geastrum fimbriatum</i> Fr.	s	.	.	.	/r
<i>Lactarius glutinopallens</i> Moel. & Lange	s	.	.	.	/r
<i>Russula xerampelina</i> (Schaeff.) Fr. var. <i>xerampelina</i>	s	.	.	.	/r
<i>Russula emetica</i> (Schaeff.) Pers.: Fr.	s	.	.	.	/r
<i>Russula delica</i> Fr.	s	.	.	.	/r
<i>Cortinarius alboviolaceus</i> (Pers.: Fr.) Fr.	s	.	.	.	/r
<i>Cortinarius odorifer</i> Britz.	s	.	.	.	/r
<i>Suillus granulatus</i> (L.: Fr.) O. Kuntze	s	.	.	.	/r
<i>Suillus luteus</i> (L.: Fr.) S. F. Gray	s	.	.	.	/r
<i>Cantharellus cibarius</i> Fr.: Fr. var. <i>cibarius</i>	s	r/r	r	n	/r
<i>Hydnum repandum</i> L.: Fr.	s	r	n/n	.	/n
<i>Clitocybe hydrogramma</i> (Bull.: Fr.) Kummer	l	n	.	/r-n	/n
<i>Mycena pura</i> (Pers.: Fr.) Kummer	l	r	r	/r-n	/r
<i>Collybia peronata</i> (Bolt.: Fr.) Sing.	l	n-a/n	a	r	.
<i>Collybia confluens</i> (Pers.: Fr.) Kummer	l	n-a/n	n	r	.
<i>Clitocybe gibba</i> (Pers.: Fr.) Kummer	l	r	n/r	r	.
<i>Mycena sanguinolenta</i> (Alb. & Schw.: Fr.) Kummer	l	r	r	r/r	.
<i>Phallus impudicus</i> L.: Pers.	s	n/r	.	/r	.

Abbreviations: Substr = substrate, F = *Fagus*, A = *Abies*, P = *Picea*, Pin = *Pinus*, s = soil, l = litter

Fm = *Fagetum illyricum montanum* (3 localities), H-F = *Helleboro-Fagetum* (2 localities), A-F = *Abieti fagetum illyricum* (1 locality), Ad = *Abietetum dolomiticum* (1 locality), Ph-P = *Phegopteri-Piceetum* (1 locality), Pd = *Piceetum dolomiticum* (3 localities), H-P = *Helleboro-Pinetum* (1 locality)

a = abundant, n = numerous, r = rare



## Discussion and Conclusions

During a two week investigation in the first half of September in various parts of the Plitvička Jezera National Park, 120 species of macrofungi were identified — a rather large number for the time of the year owing to exceptionally rainy summer. The number of species in each type of the forest was nearly the same: in beech forest 43 species, in beech and fir 49, in spruce 48 and in pine forest 41. Most species, 66, grew on soil; 25 were found on litter and 29 on wood.

As shown in Table 1, each type of forest has a combination of species not occurring in other types, but, of course, some fungi grew in two or three types of forests, two species even in all four types.

Quite a number of species characteristic of beech forests were established, such as for instance: *Marasmius alliaceus*, *Mycena crocata*, *M. pelianthina*, *M. renati*, *Oudemansiella radicata*, *Megacollybia platyphylla*, *Russula mairei*, *R. solaris*, *R. xerampelina* var. *barlae* etc. (Lisiewska 1978); some of them were present also in forests of beech and fir. Although some were now found in a small number of specimens, as e.g. *Marasmius alliaceus*, *Oudemansiella radicata*, they are in fact frequent in this area and were found many times during earlier investigations there, both in beech forests and those of beech and fir. *Marasmius wynnei* is also frequent here in beech forest, but now only a single fruitbody was noted in beech and fir. On the other hand, some species found earlier only singly in the National Park developed now in large quantities, e.g. *Marasmius lupuletorum*. Frequent species *Collybia confluens* and *C. peronata* were this time particularly abundant and predominated in some patches.

Many species found here now in only one type of forest have a wider ecological range and were noted earlier in the National Park as well as in various other localities in Yugoslavia in several forest types; these include *Russula cyanoxantha*, *Lepiota clypeolaria*, *Armillaria mellea* s.l., *Tricholoma saponaceum* and others. Some, however, are bound to a particular tree genus, for instance *Lactarius glutinopallens*, *L. salmonicolor* to *Abies* under which they were found in the pine forest. Mycorrhizal species of *Picea* are *Russula queletii* and *Lactarius deterrimus*; some other species are cited in the literature (Nespiak 1975) as occurring particularly in spruce forests, e.g. *Cortinarius odorifer*, *C. russeus*, *C. varicolor* and others. Mycorrhizal species of *Pinus*, *Suillus granulatus* and *S. luteus* were noted only under young trees at the margin of the pine forest since, as is generally known, they do not occur under older ones.

Interesting was the mass occurrence of *Tricholoma sulphureum* particularly in spruce forest, where it had been noted in rather large quantities also earlier. It is not bound to conifers and was found here also in pure beech forests. In Yugoslavia it is not infrequent in lowland forests of *Quercus robur*.

Some common lignicolous species were noted only on conifers on which they were collected in the National Park earlier as well, but they grow preferably both here and elsewhere in Yugoslavia on deciduous trees, for instance on beech, e.g. *Hypholoma fasciculare*, *Schizophyllum commune*. *Tricholomopsis decora* was found on spruce this time, but in this area, as well as in other known localities in Yugoslavia, it mainly grows on *Abies*.

In Table 1 it is marked whether a fungal species grew on limestones or dolomites or on both. In many instances they were found only on one geological substrate. However, many collected here on dolomites occur in the National Park also on limestones or elsewhere even on silicates. It is not possible as yet to make any conclusions whether there is a pronounced difference between the mycoflora of parallel limestone and dolomite association (e.g. the *Fagetum montanum* and *Helleboro-Fagetum* etc.). Krieglsteiner (1977) mentions some calcephilous species, for instance: *Lepiota aspera*, *Inocybe corydalina*, *Cortinarius odorifer*, *Lactarius acris*, *Geastrum jimbriatum*; some of those grew here on limestones and some on dolomites.

*Entoloma incanum* was noted on dolomites in *Helleboro-Fagetum*, but this is a species which normally grows in meadows and was found there on limestones at the margin of *Phegopteri-Piceetum* in the National Park.

Some conspicuous fungi were now noted for the first time in the Park, such as *Inocybe corydalina* (one specimen in the *Abietetum dolomiticum fagetosum*), *Thelephora palmata* (abundant in the *Piceetum dolomiticum*), *Clitocybe hydrogramma* (in groups in the *Fagetum montanum*, *Piceetum dolomiticum* and in the *Helleboro-Pinetum*), a rare species, *Hydnellum suaveolens* (in groups in the *Piceetum dolomiticum*) and *Boletopsis leucomelaena* (a large group in the *Piceetum dolomiticum*). The last mentioned is also a rare species, known up to now in Yugoslavia from few localities but in pine forests.

\*

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## SAŽETAK

MAKROMICETI U ŠUMSKIM ASOCIJACIJAMA NACIONALNOG PARKA  
PLITVIČKA JEZERA (HRVATSKA, JUGOSLAVIJA)

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Tijekom dugogodišnjih mikoloških istraživanja druge autorice u Nacionalnom parku Plitvička jezera utvrđen je velik broj viših gljiva. O lignikolnim vrstama iz reda *Aphyllophorales* postoji nekoliko priloga, od kojih su najvažniji Tortić 1985, 1988, dok terikolne vrste iz reda *Agaricales* i nekih drugih grupa nisu dosad bile objavljivane.

Ovdje je pokušano da se prema mikocenološkim principima analiziraju u prvom redu *Agaricales* u glavnim šumskim asocijacijama parka. Istraživanja su provedena od 28. VIII. do 10. IX. 1989, pa je njima obuhvaćen kasno ljetni aspekt. Lokaliteti su ucrtani na crtežu (sl. 1), a u engleskom su tekstu ukratko opisani istraživani tipovi šuma: šuma bukve, bukve i jele, smreke, te bora. Prva tri tipa su razvijena i na vapnencima i na dolomitima, pa se prema podlozi razlikuju posebne asocijacije, a četvrti raste samo na dolomitima. Ukupno je determinirano 120 vrsta viših gljiva, uglavnom terikolnih i lignikolnih vrsta reda *Agaricales*, samo mali broj terikolnih iz ostalih grupa *Basidiomycetes*. Veliki dio njih nije dosad opažen na ovom području. U tabeli su prikazane i uspoređene prema navedenim tipovima šuma, a označeno je koje dolaze na kojoj geološkoj podlozi.

U engleskom su tekstu istaknute vrste karakteristične za bukove šume, dani su primjeri za nađene mikorizne gljive jele, smreke, bora. Niz vrsta sada ustanovljenih u samo jednom tipu šume ima širi ekološki spektar pa dolazi i u drugim tipovima i u ovom parku i drugdje u Jugoslaviji. Neke su gljive nađene u malom broju primjeraka iako su inače češće, dok se nekoliko vrsta razvijalo u masama. Navedeno je nekoliko gljiva koje rastu pretežno na listačama na ovom terenu i drugdje, a ovaj su put ustanovljene samo na četinjačama. Vrste koje su poznate kao kalcifilne dolazile su ovdje bilo na vapnencima bilo na dolomitima. Neke prilično upadljive vrste ustanovljene su prvi put u parku, pa se prema tome vjerojatno rjeđe pojavljuju, kao *Inocybe corydalina*, *Thelephora palmata*, *Clitocybe hydrogramma*, te općenito rijetki *Hydnelium suaveolens* i *Boletopsis leucomelaena*.

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