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LIGNICOLOUS *APHYLLOPHORALES* IN HUMID AND SEMIHUMID LOWLAND FORESTS OF PEDUNCULATE OAK (*QUERCUS ROBUR*) IN YUGOSLAVIA

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Lignicolous *Aphyllophorales* were investigated in five localities in lowland forests of *Quercus robur*, mostly not far from Zagreb. In all, 171 species were identified, the majority of which not yet noted from those biotopes in Yugoslavia. Their occurrence and importance in investigated forests are discussed.

Introduction

Lowland forests of *Quercus robur* are in Yugoslavia spread in the regions along the rivers Sava and Drava and some of their larger tributaries. They lie on alluvial soils at altitudes of about 100—150 m and are yearly inundated for longer or shorter periods. Only in few places stands of very old, large oaks are now left as nature reserves. Elsewhere young managed forests are developed or the forests are completely cleared.

The mycoflora in those forests was investigated in two localities (Jelić & Tortić 1973, Hočevar & Tortić 1975, 1976, Tortić & Hočevar 1977, Hočevar & al. 1980). Macromycetes from all groups were studied, terricolous as well as lignicolous.

The present author continued the investigations in those and in three more localities, but concentrated on lignicolous *Aphyllophorales* s.l., i.e. polypores and corticia. Here are presented the species belonging to this group (a few *Heterobasidiomycetes* are also included), identified up to now in all five localities.

Short description of forests and localities

The principal tree species in lowland oak forests is *Quercus robur*, reaching in some reserves the age of 300 years and a diameter of 200 cm. *Ulmus minor* and *U. laevis* were also important constituents but have almost disappeared owing to fungal diseases. In drier sites *Carpinus betulus* appears abundantly and in very humid *Alnus glutinosa*. Other trees are *Fraxinus angustifolia, Tilia* spp., in some places also *Fagus sylvatica*, etc. Among shrubs, the most important are *Genista elata, Crataegus oxyacantha, C. monogyna, Cornus sanguinea, C. mas, Corylus avellana, Evonymus europaea, Pyrus pyraster* and others.

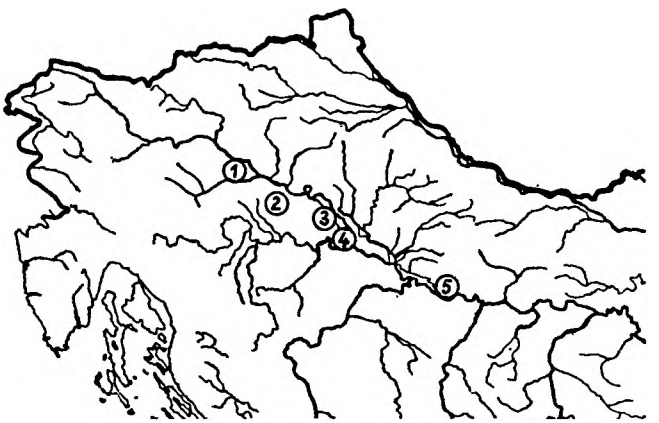

Fig. 1 Localities investigated: 1 Krakovo, 2 Stupnički Lug, 3 Turopolje, 4 Kotar, Prašnik

Two forest associations were described: *Genisto elatae-Quercetum roboris* Horv. on more humid sites and *Carpino betuli-Quercetum roboris* Rauš in drier places, where *Carpinus betulus*, almost absent in the first association, is present in large numbers (Matić & al. 1979). In places inundated for longer periods during the year occur associations of *Alnus glutinosa* as well as those of *Salix* spp. and *Populus* spp.

The localities investigated are situated mostly within a radius of 60 km from Zagreb, only one is at about 120 km (Fig. 1).

The westernmost one, the Krakovo forest (Krakovski gozd) in the Republic of Slovenia — others belong to the Republic of Croatia — lies along the river Krka, near the town of Kostanjevica. Nearly 40 ha are set apart as nature reserve, with oaks up to 180 years old. Fungi in this forest, from all groups, were studied by Hočevar & Tortić (1975, 1976), Tortić & Hočevar (1977) and the vegetation and flora of the nature reserve, including mosses, lichens and fungi by Hočevar & al. (1980) In addition to the nature reserve various parts of the forest were visited. In some places exotic oaks (*Quercus rubra, Q. palustris*) and even conifers were planted.

Table 1. Lignicolous macromycetes in humid and semihumid lowland forests of *Quercus robur*

Species	Krakovo	Prašnik	Turopolje	Stupnički lug	Kotar
Schizopora carneolutea (Rodw. & Clel.) Kotl. & Pouz.	vc (**Q, C,** Cy, A, Pic)	vc (**Q,** C, F)	vc (**Q, C**)	vc (**Q, C,** A?)	vc (**Q,** Cy)
Hyphoderma setigerum (Fr.) Donk	vc (**Q, A,** Cy)	c (**Q,** C)	vc (**Q,** C, Cy, Pr)	vc (**Q, C,** A)	vc (**Q,** C)
Stereum hirsutum (Willd.: Fr.) S. F. Gray	vc (**Q, Cy,** C, A, B, P, Ro, Cr)	c (**Q,** C)	vc (**Q,** Cy)	c (**Q,** C, F, A, Rh)	vc (**C,** Q, Cy)
Peniophora quercina (Pers.: Fr.) Cooke	vc (Q)	fc (Q)	c (Q)	c (Q)	vc (Q)
Hyphodontia quercina (Pers.: Fr.) John Erikss.	vc (**C, Cy,** A, Q, U)	r (C)	c (C)	vc (**C,** Q)	c (**C,** Q)
Schizopora paradoxa (Schrad.: Fr.) Donk s. lato	c (**C,** Q, A, Cy)	fc (Q, C, S)	c (**Q, C,** A, Cy)	c (**Q,** C)	vc (**Q,** C)
Trametes versicolor (L.: Fr.) Pil.	vc (**Q, Cy,** C, A, B, P, Pr, Pic)	c (**Q, C,** U, S, P)	c (**Q,** C)	c (**Q,** C, A)	c (**Q,** C)
Skeletocutis nivea (Jungh.) Keller	vc (**Cy,** Q, A, Cr, Pr, C)	c (**Q,** C, Cy, S, F, P)	fc (**Q, Cy,** C, Cr)	r (C)	c (**Q,** Cy, Cr)
Hymenochaete rubiginosa (Dicks.: Fr.) Lév.	vc (Q)	c (Q)	c (Q)	vr (Q)	fc (Q)
Bjerkandera adusta (Willd.: Fr.) P. Karst.	vc (**Q,** C, A, Pr)	fc (Q, C, U?)	c (**Q,** A, C, Cy, Cr?)	r (C, Rh)	r (C, Q)
Stereum rameale (Pers.: Fr.) Burt	vc (**Q,** Cy, C)	r (Q)	c (Q)	r (Q)	vr (Q)
Stereum subtomentosum Pouz.	vc (**A,** Q, S, Pr)	vr (S, C)	c (**Q,** A)	r (A)	r (Q)
Vuilleminia comedens (Nees: Fr.) R. Maire	c (**Q,** S)	vr (Q)	fc (**Q,** A)	r (Q)	c (**Q,** Cy)
Lenzites betulina (L.: Fr.) Fr.	c (**Q,** Cy, B)	r (**Q,** C)	r (Q, A)	vr (Q)	fc (Q)
Phlebia rufa (Pers.: Fr.) M. P. Christ.	c (Q, Cy, A, C, Rh, Pic)	vr (Q)	r (Q)	r (Q)	r (Q, C)
Hyphoderma praetermissum (P. Karst.) John Erikss. & Strid	fc (**Cy,** Q)	r (Q, C?)	r (**Q,** C)	r (Q, F)	fc (**Q,** C)
Schizophyllum commune Fr.	fc (Q, P, C, Rh, Pic)	r (Q, P)	fc (**Q,** Cy)	vr (?)	vr (C)
Steccherinum bourdotii Saliba & David	fc (**C,** Cy)	vr (Q)	r (Q)	r (Q, C)	vr (Q)
Scopuloides hydnoides (Cooke & Massee) Hjortst. & Ryv.	r (Q)	fc (Q)	c (**Q,** C)	r (Q, C)	fc (Q)
Hyphodontia barba-jovis (Bull.: Fr.) John Erikss.	r (Cy)	vr (Q)	r (Q)	vr (C)	fc (Q)
Merulius tremellosus Fr.	r (S, Q, C, Cy)	fc (C, Q)	vr (C?)	r (C, Q)	r (Q)
Trametes gibbosa (Pers.: Fr.) Fr.	r (C, Q, B)	r (C)	vr (Q)	r (C)	r (C)
Trechispora farinacea (Pers.: Fr.) Liberta	vr (Py?)	fc (Q, Gan)	r (Q)	r (Q, A?)	r (Q, C, Cy)
Phlebia radiata Fr.	r (**Q,** P)	r (Q)	vr (Q)	vr (Q)	r (Q)
Hapalopilus rutilans (Pers.: Fr.) P. Karst.	r (Q, C, Cy)	vr (Q)	r (Q)	vr (Q)	vr (Q)
Radulomyces confluens (Fr.: Fr.) M. P. Christ.	vr (Q)	vr (Q)	vr (Q)	vr (Sm)	vr (C)
Daedaleopsis confragosa (Bolt.: Fr.) Schroet.	vc (**A, Cy,** P, Py, S, Co, Q)	r (A, S, Cy)	r (**A,** S)	r (A, Q)	—
Inonotus radiatus (Sow.: Fr.) P. Karst.	c (A, Cy)	vr (A?)	vr (A)	r (A)	—
Phellinus ferruginosus (Schrad.: Fr.) Pat.	r (Q, Cy, C, P)	r (Q, C)	r (Q)	fc (Q)	—
Fomes fomentarius (L.: Fr.) Fr.	r (P, C, Q)	r (**Q,** U)	vr (Q)	vr (F)	—
Chondrostereum purpureum (Pers.: Fr.) Pouz.	r (Q)	vr (P)	r (A)	vr (P, A)	—
Phlebiella tulasnelloidea (Höhn. & Litsch.) Oberw.	vr (Q)	vr (Q)	r (Q, Cy, A?)	vr (Q)	—
Byssomerulius corium (Fr.) Parm.	fc (Q, C, Cy)	vr (C, Cy)	fc (**Q,** C, S)	—	r (Q)
Hyphoderma puberum (Fr.) Wallr.	vr (Q)	—	r (C, Q)	vr (C)	fc (Q)
Phanerochaete sordida (P. Karst.) John Erikss. & Ryv.	r (Q)	—	r (**Q,** Py?)	vr (Q)	vr (Q)
Exidia truncata Fr.	r (Q, Cy)	—	vr (Q)	vr (Q)	vr (Q)
Peniophora cinerea (Pers.: Fr.) Cooke	vr (Cy)	—	r (Q, A, Cr)	vr (Rh?)	vr (C?)
Steccherinum ochraceum (Pers.: Fr.) S. F. Gray	—	fc (C, Q)	fc (Q, A?)	vr (Q)	r (Q)
Auricularia mesenterica Dicks.: Fr.	fc (P, A, U, Q)	fc (Q, U, S?)	fc (Q, U, A)	—	—
Radulomyces molaris (Chaill.: Fr.) M. P. Christ.	vr (Q)	fc (Q)	r (Q)	—	—
Ganoderma lipsiense (Batsch) Atk.	r (Q)	r (Q)	vr (Q)	—	—
Mycoacia uda (Fr.) Donk	vr (Q)	vr (Q)	r (Q)	—	—
Laetiporus sulphureus (Fr.) Murr.	r (Q)	vr (Q)	vr (Q)	—	—
Phellinus robustus (P. Karst.) Bourd. & Galz.	fc (**Q,** Cy, U)	r (Q)	—	vr (Q)	—
Hyphodontia crustosa (Pers.: Fr.) John Erikss.	r (**Cy,** A, C)	r (Py, C)	—	fc (**Q,** C)	—
Gloeocystidiellum porosum (Berk. & Curt.) Donk	r (Cy, C)	vr (C?)	—	vr (C)	—
Ganoderma lucidum (Fr.) P. Karst.	r (Q)	vr (Q)	—	vr (C)	—
Sistotremastrum niveocremeum (Höhn. & Litsch.) John Erikss.	vr (Q)	vr (C)	—	vr (Q)	—
Inonotus dryadeus (Pers.: Fr.) Murr.	vr (Q)	vr (Q)	—	vr (Q)	—
Fistulina hepatica Schaeff.: Fr.	vr (Q)	r (Q)	—	—	vr (Q)
Tremella mesenterica Retz.: Hook.	r (C, Q)	—	r (Q)	vr (C)	—
Botryobasidium conspersum John Erikss.	r (A)	—	vr (?)	vr (Q)	—
Phellinus igniarius (L.: Fr.) Quél. s. lato	fc (Q, A, S)	—	vr (S)	—	vr (S)
Exidia glandulosa Bull.: Fr.	r (Q, C, Cy, Pr, S, A)	—	r (C, Q)	—	r (Q)
Phanerochaete tuberculata (P. Karst.) Parm.	vr (C)	—	r (Q, C?)	—	r (Q, C)
Polyporus tuberaster (Pers.: Fr.) Fr.	r (Q)	—	vr (?)	—	vr (Q)
Phellinus ribis (Schum.: Fr.) P. Karst.	vr (E)	—	vr (E)	—	vr (E)
Stereum rugosum (Pers.: Fr.) Fr.	r (Q, Cy)	—	—	vr (C)	vr (Q)
Tyromyces chioneus (Fr.: Fr.) P. Karst.	r (C?)	—	—	vr (A?)	vr (?)
Mycoacia aurea (Fr.) John Erikss. & Ryv.	vr (Q)	—	—	vr (Q)	vr (Q, C)
Hyphoderma radula (Fr.) Donk	—	—	r (Q)	vr (Q)	vr (Q)
Funalia trogii (Berk.) Bond. & Sing.	fc (P)	r (P)	—	—	—
Stereum gausapatum Fr.: Fr.	fc (Q)	vr (Q)	—	—	—
Hypochnicium analogum (Bourd. & Galz.) John Erikss.	vr (Q)	fc (U, C, Q, A?)	—	—	—
Athelia epiphylla Pers.	r (A)	r (Q)	—	—	—
Trametes zonata (Nees: Fr.) Pil.	r (P)	vr (P)	—	—	—
Antrodia albida (Fr.: Fr.) Donk	r (Cy, C)	vr (Py)	—	—	—
Antrodiella fragrans (David & Tortić) David & Tortić	fc (**Cy,** C, A)	—	vr (Q, A)	—	—
Trametes hirsuta (Wulf.: Fr.) Pil.	r (Q, C, A)	—	r (Q)	—	—
Abortiporus biennis (Bull.: Fr.) Sing.	r (Q)	—	vr (Q)	—	—
Polyporus ciliatus Fr.	r (U, Q, A)	—	vr (?)	—	—
Trametes pubescens (Schum.: Fr.) Pil.	r (**Cy,** Q)	—	vr (Q)	—	—
Cerrena unicolor (Bull.: Fr.) Murr.	vr (A)	—	vr (C)	—	—
Ganoderma resinaceum Boud. in Pat.	vr (Q rubra)	—	vr (Q)	—	—
Hyphodontia nespori (Bres.) John Erikss. & Hjortst.	vr (Cy)	—	—	vr (C, F)	—
Phellinus punctatus (Fr.) Pil.	fc (**Cy, S,** P, U)	—	—	—	r (Cy, Ac)
Postia subcaesia (David) Jül.	r (**Cy,** Q, C)	—	—	—	r (Q, Ac)
Sebacina incrustans (Fr.) Tul.	r (?)	—	—	—	r (Q)
Daedalea quercina L.: Fr.	r (Q)	—	—	—	vr (Q)
Cylindrobasidium evolvens (Fr.: Fr.) Jül.	r (Co, C, Q)	—	—	—	vr (C)
Sistotrema brinkmannii (Bres.) John Erikss.	r (C, Q)	—	—	—	vr (Q)
Cristinia helvetica (Pers.) Parm.	vr (Q)	—	—	—	r (Q, C)
Peniophora incarnata (Pers.: Fr.) P. Karst.	vr (Co, Q)	—	—	—	vr (Q)
Hypochnicium polonense (Bres.) Strid	—	r (F, U)	vr (Q)	—	—
Hyphodontia arguta (Fr.) John Erikss.	—	vr (A?)	r (Q, ?)	—	—
Hyphodontia sambuci (Pers.) John Erikss.	—	vr (U)	vr (E)	—	—
Xylobolus frustulatus (Pers.: Fr.) Boid.	—	r (Q)	—	vr (Q)	—
Botryobasidium aureum Parm.	—	vr (F, Ust)	—	vr (Q)	—
Ganoderma adspersum (S. Schulz.) Donk	—	fc (U, Q)	—	—	vr (Q)
Junghuhnia nitida (Pers.: Fr.) Ryv.	—	vr (C, S)	—	—	r (Q)
Botryobasidium laeve (John Erikss.) Parm.	—	vr (Q)	—	—	vr (Q, S)
Trechispora mollusca (Pers.: Fr.) Liberta	—	—	vr (Q)	—	vr (Q)
Inonotus rheades (Pers.) P. Karst.	—	—	vr (P)	—	vr (P)
Botryobasidium botryosum (Bres.) John Erikss.	—	—	—	vr (Q)	fc (Q)
Peniophora laeta (Fr.) Donk	—	—	—	vr (C)	vr (C)

A = *Alnus glutinosa* Ac = *Acer tataricum*, B = *Betula pendula*, C = *Carpinus betulus*, Co = *Cornus sanguinea*, Cr = *Crataegus* spp., Cy = *Corylus avellana*, E = *Evonymus europaea*, F = *Fagus sylvatica*, P = *Populus* sp., Pic = *Picea abies*, Pr = *Prunus padus*, *P. avium*, Py = *Pyrus pyraster*, Q = *Quercus robur*, Rh = *Rhamnus* sp., R = *Rosa* sp., S = *Salix* sp., Sm = *Sambucus nigra*, U = *Ulmus* sp., Gan = *Ganoderma* sp., Ust = *Ustulina deusta*

vc = very common — vrlo često, c = common — često, fc = fairly common — prilično često, r = rare — rijetko, vr = very rare — vrlo rijetko

South of Zagreb in the Turopolje plain, many oak forests still exist although old trees are extremely rare. Investigations were made mostly in the area between the village of Pešćenica and the river Odra (cited in Tortić 1988a as Pešćenica); a small number of finds are from near the villages of Turopolje and Lekenik.

In the following three localities permanent experimental plots of 1 ha were delimited by the Ecological Society of Croatia for ecological investigations, as part of the project »Man and Biosphere.«

In Stupnički Lug near Stupnik, a little west of Zagreb, there is a nature reserve of the association *Carpino betuli-Quercetum roboris fagetosum,* with large old oaks and old beeches. The fungi were studied in the permanent plot and other parts of this reserve, as well as in the surrounding younger managed forest.

The Kotar forest lies between the towns of Sisak and Petrinja, south of Zagreb, in the valley of the river Kupa. The permanent plot in *Carpino betuli-Quercetum roboris* was mainly investigated.

The farthest locality from Zagreb, Prašnik, lies to the southeast, near the village of Okučani along the river Sava. A little more than 53 ha is set apart as a nature reserve, with oaks up to 300 years old. Both oak associations mentioned are developed and in each a permanent plot is delimited. Fungi were collected also in the surrounding younger forest, and a preliminary account of the mycoflora was published by Jelić & Tortić (1973).

Materials and Methods

The localities were visited six to ten times each, except Krakovo where investigations were carried out for years and almost 40 visits, although some very brief, were made. Different seasonal aspects were studied, as possible, but mostly the autumnal, when the majority of fungal species fructifies.

It was not possible at this stage to relate particular species to particular associations. The associations are often intermixed occupying sometimes small plots according to changing ecological conditions and are difficult or impossible to recognise in the field at sight. They are therefore not mentioned at all for some localities. Moreover, even in the case when fungi were collected in clearly defined permanent plots, no particular difference in mycoflora of both oak associations could be observed. Lignicolous species follow their hosts in the first place. Only after thorough inventory of both terricolous and lignicolous fungi in those forests — and years of investigations with several investigators are needed for that — serious mycocenological studies may be started. For the moment, it was only possible to compare the fungi in several localities and make an attempt to establish which species may be most typical of lowland oak forests as a whole.

The species found in five to two localities are presented in Table 1 and those observed in only one locality are listed for each separately in alphabetical order in Table 2. Hosts are specified for each fungus (for abbreviations see Table 1); in some cases only genus could be identified If the host was not certain or was unknown a question mark is added.

Many species occurred on several hosts; if one or two of them were predominant, they are underlined. In some parts of the Krakovo forest, as stated above, the conifers: fir, spruce and pine were introduced and a number of species typical of conifers was noted. Some fungi which occur regularly on hardwoods were found also on spruce (Table 1).

The frequency was assessed as: very common (vc) — species found regularly and abundantly; common (c) — noted often in large quantities; fairly common (fc) — found often in small numbers or not many times but rather abundantly; rare (r) — observed few times singly or in small groups or once abundantly; very rare (vr) — found only once singly or several specimens or small groups (Table 1, 2).

Herbarium specimens are preserved at the Department of Botany, Faculty of Science, University of Zagreb (ZA). They were identified mainly by the present author; some critical corticia were determined by K. Hjortstam (Göteborg) and *Tomentella* spp. by M. Svrček (Prague), to both of whom most sincere thanks are expressed.

Table 2. Lists of species found in only one locality

Krakovo

Aleurodiscus amorphus (Pers.: Fr.) Schroet. and its parasite *Tremella simplex* Jacks. & Martin	vr (Abies)
Amylostereum areolatum (Fr.) Boid.	vr (Pic)
Antrodia malicola (Berk. & Curt.) Donk	vr (Pic)
A. ramentacea (Berk. & Br.) Donk	vr (Pinus)
A. serialis (Fr.) Donk	r (Pic)
Calocera viscosa (Pers.: Fr.) Fr.	vr (Pic)
Gloeophyllum abietinum (Bull.: Fr.) P. Karst.	vr (Pic)
G. odoratum (Wulf.: Fr.) Imaz.	vr (Pic)
Heterobasidion annosum (Fr.) Bref.	vr (Pic)
Hyphodontia spathulata (Schrad.: Fr.) Parm.	vr (Pic)
Onnia tomentosa (Fr.) P. Karst.	vr (Pic)
Postia stiptica (Pers.: Fr.) Jül.	r (Pic)
Pseudomerulius aureus (Fr.) Jül.	vr (Pinus)
Stereum sanguinolentum (Alb. & Schw.: Fr.) Fr.	r (Pic)
Antrodiella hoehnelii (Bres. in Höhn.) Niemelä	r (C, A)
A. semisupina (Berk. & Curt.) Ryv. & Johansen	r (A, Cy, Q)
Creolophus cirrhatus (Pers.: Fr.) P. Karst.	vr (Q)
Dacrymyces stillatus Nees: Fr.	r (Q, Pr)
Datronia mollis (Sommerf.: Fr.) Donk	r (C, P, Cy)
Femsjonia pezizaeformis (Lév.) P. Karst.	vr (Q, Cy)
Guepiniopsis buccina (Pers.: Fr.) Kennedy	r (Cy)
Hirneola auricula judae (Bull.: Fr.) Berk.	vr (Q?)
Hymenochaete corrugata Fr.: Fr.	r (Cy)
H. tabacina (Sow.: Fr.) Lév.	r (S)
Hyphoderma litschaueri (Burt) John Erikss.	r (Q, P?)
H. transiens (Bres.) Parm.	r (P, Cy, Q)
Hypochnicium vellereum (Ell. & Crag.) Parm.	vr (Q)
Laeticorticium roseum (Pers.: Fr.) Donk	r (P)
Pachykytospora tuberculosa (Fr.) Kotl. & Pouz.	vr (Q)
Perenniporia medulla-panis (Fr.) Donk	vr (Q)
Phleogena faginea (Fr.) Link	r (C, Cy)
Piptoporus betulinus (Bull.: Fr.) P. Karst.	r (B)
Plicaturopsis crispa (Pers.: Fr.) Reid	c (Cy, C?, Q?)
Polyporus arcularius Batsch: Fr.	vr (Q)
P. badius (S. F. Gray) Schw.	r (C, P?, Q?)
P. umbellatus Pers.: Fr.	vr (?)

P. varius Pers.: Fr.	vr (Rh)
Postia simanii (Pil.) Jül	r (Cy)
Rigidoporus latemarginatus (Dur. & Mont. in Mont.) Pouz.	r (Q)
Sistotrema confluens Pers.: Fr.	r
Spongipellis fractipes (Berk. & Curt.) Kotl. & Pouz.	r (A)
Stromatoscypha fimbriata (Pers.: Fr.) Donk	r (C, Q)
Tomentella fuscella (Sacc.) Lundell	vr (Cy)
Trametes suaveolens (L.: Fr.) Fr.	fc (P)
Tremella globospora Reid	r (Q)
T. steidleri (Bres.) Bourd. & Galz.	vr (Q)
Tulasnella violea (Quél.) Bourd. & Galz.	vr (A)
Tyromyces kmetii (Bres.) Bond. & Sing.	vr (Cy)

Prašnik

Bjerkandera fumosa (Pers.: Fr.) P. Karst.	vr (Q)
Bulbillomyces farinosus (Bres.) Jül.	vr (?)
Calocera cornea (Batsch: Fr.) Fr.	vr (Q)
Ceraceomyces serpens (Tode: Fr.) Ginns	vr (Q)
Ceriporiopsis subrufa (Ellis & Dearn.) Ginns	vr (U)
Fomitopsis cytisina (Berk.) Bond. & Sing.	vr (Q)
Hirschioporus pargamenus (Fr.) Bond. & Sing.	vr (Q)
Phlebia albida Post in Fr.	vr (Q)
Phlebiopsis roumeguerii (Bres.) Jül. & Stalpers	vr (Q)
Piloderma byssinum (P. Karst.) Jül.	vr (Q)
Resinicium furfuraceum (Bres.) Parm.	vr (Q)
Spongipellis pachyodon (Pers.) Kotl. & Pouz.	vr (Q)
Tomentella epiphylla (Schw.) Litsch. sensu Svrček	vr (Q)
Trechispora confinis (Bourd. & Galz.) Liberta	vr (Q)
T. vaga (Fr.) Liberta	vr (Q)

Turopolje

Cristinia gallica (Pil.) Jül.	vr (Q, S?)
Hyphoderma argillaceum (Bres.) Donk	vr (Q)
Phellinus contiguus (Fr.) Pat.	vr (Q)
Rigidoporus populinus (Schum.: Fr.) Pouz.	vr (A)
Subulicystidium longisporum (Pat.) Parm.	r (Q, A)

Stupnički lug

Botryobasidium candicans John Erikss.	r (Q)
Henningsomyces puber (Rom. ex W. B. Cooke) Reid	vr (Q)
Tubulicrinis accedens (Bourd. & Galz.) Donk	vr (Q)

Kotar

Byssocorticium atrovirens (Fr.) Bond. & Sing. in Sing.	r (Q)
Dendrothele acerina (Pers.: Fr.) Lemke	r (Ac)
Gloeoporus dichrous (Fr.) Bres.	vr (C?)
Steccherinum fimbriatum (Pers.: Fr.) John Erikss.	c (C)

Discussion

Altogether 171 species are presented here, mostly belonging to *Aphyllophorales*, and a few to *Heterobasidiomycetes*. About half of them (86) were published from Krakovo and Prašnik together (from Krakovo 83, Prašnik 25). In all the five localities 26 species were found, 12 in four, 23 in three and 34 in two. A considerable number was noted in only one locality: Krakovo 49 (15 solely on conifers), Prašnik 15, Turopolje 5, Stupnički lug 3 and Kotar 4. The largest number of species, 130, was recorded from Krakovo, which is probably due to the great number of visits and

also the area investigated was bigger than in other localities. In Prašnik 75 species were found, Turopolje 68, Stupnički lug 57 and Kotar 61.

The majority of species, 117, were collected on wood of *Quercus*. Some are bound exclusively or preferably to oak wood, but others were noted also on various other hosts. On *Carpinus* grew 54, on *Corylus* 48, on *Alnus* 32. Uncertain identification of hosts was not counted. On other trees and shrubs only a small number of fungi were observed.

It is, of course, not possible or necessary to discuss all the species. The interesting and rare ones are pointed out here, and an attempt has been made to establish which fungi could be considered as typical of humid forests of *Quercus robur* in general. In order to evaluate their importance in such forests in would be necessary to compare *Aphyllophorales* in other types of forests. There are only single mostly unpublished data by the author from forests of other oak species (*Quercus petraea, Q. pubescens* etc.) which can be used for comparison. Intensive investigations of fungi from this group were made mainly in beech forests and those of beech and fir (Tortić 1985, 1988), where a number of species found in lowland oak forests also occurs.

Many species found in all the five localities were also the most abundant. Some belong to generally common fungi and occur frequently also in beech forests, such as *Stereum hirsutum, Hyphoderma setigerum, Bjerkandera adusta, Trametes versicolor, Schizopora paradoxa* s. lato *Skeletocutis nivea* (Tortić 1985, 1988). Several species, however, have up to now been noted predominantly in forests of *Quercus robur*, such as *Schizopora carneolutea, Stereum rameale, S. subtomentosum, Steccherinum bourdotii.* According to Kotlaba & Pouzar (1979), who published part of the localities in Yugoslavia, too, *Sch. carneolutea* occurs in Czechoslovakia mainly in lowland and colline belts and is particularly common in riverside forests. In Yugoslavia it was collected up to 700 m altitude, on *Fagus* and *Acer*, only few times and in small quantities, whilst it is one of the most common species in the forests discussed here. Similarly, *S. rameale* and *S. subtomentosum* are most abundant in those forests although they were found also at higher altitudes (Tortić 1988a). Several years ago Dr. Z. Pouzar (Prague), later also Dr. A. David (Lyon) drew the attention of the author to *Steccherinum dichroum* sensu Bourdot & Galzin as differing from *S. ochraceum* with which it was usually considered as synonymous. Grosse-Brauckmann (1986) published a description, photo and microscopical drawing of this taxon. Saliba & David (1988) showed that it is incompatible with *S. ochraceum* and described it (for nomenclatural reasons) as a new species, *S. bourdotii.* It differs from *S. ochraceum* already macroscopically, but in cases of doubt its subglobose spores are distinctive. It was found in Yugoslavia up to now only in lowland forests. *S. ochraceum* was collected there too, but also in beech forests.

Some species bound more or less to the wood of oak occur on other species of oaks, of course, but for the moment they were noted most often in forests of *Q. robur*, occurring abundantly, as, for instance, *Hymenochaete rubiginosa* and *Peniophora quercina.* Very frequent there is also *Hypodontia quercina*, in spite of its name growing preferably on wood of *Carpinus.*

Among the more or less frequent species, although not occurring in all localities, one may mention *Daedaleopsis confragosa*, growing preferably on wood of *Alnus.* It was very common in Krakovo where dead *Alnus* wood was abundant in some places. However, it is also common at Plitvice in stands of *Alnus* along some brooks (Tortić 1988). *Auricularia me-*

senterica was sometimes rather abundant on fallen trunks of several tree genera. In Yugoslavia it often occurs on beech, even on live injured trees. *Plicaturopsis crispa* was noted only in Krakovo, growing in large numbers mainly on dead standing trunks of *Corylus;* this shrub is particularly plentiful there. At Plitvice it is very frequent on dead wood of *Fagus* and *Corylus* (Tortić 1988).

Most fungi studied are saprophytes, but several parasites were also noted, mainly on oak. In Krakovo (Hočevar & al. 1980) the most important parasites on oak were *Phellinus robustus* and *Ph. igniarius.* As shown by Fischer (1987) *Ph. igniarius* s. stricto grows only on *Salix* spp., and the species on oak and alder in Krakovo is probably the newly described *Ph. ossatus* Fischer. *Fistulina hepatica, Inonotus dryadeus* and *Laetiporus sulphureus* were observed rarely, probably because their fruitbodies are not long lasting and may not develop often even if the mycelium has lived in the trunk for years. *Ganoderma resinaceum* was observed in Krakovo on planted *Quercus rubra. G. adspersum* also occurs on live trees, but preferably near human habitations (synanthropic occurrence was stated for both species e.g. for Czechoslovakia — see Kotlaba 1984). *Piptoporus betulinus,* bound to *Betula* spp., was collected only in Krakovo since the host was not present in other investigated sites. Fruitbodies of *Daedalea quercina* were rarely noted; this species can also develop as a saprophyte (e.g. on oak-wood sculptures in »Forma viva« in Kostanjevica). *Fomes fomentarius,* rare in oak forests, is very common in beech forests on *Fagus* (Tortić 1988) and it grew on this host in Stupnički lug.

Many species were observed rarely and it is difficult, in most cases impossible, to judge whether they are really rare or only overlooked — for instance inconspicuous corticia which, moreover, grow mainly on the underside of prostrate branches or logs — particularly if they are known from few other localities or from nowhere else. A species found in only one of the investigated localities may be found much later, after years, in other ones; this happens all the time. Some rarities are discussed here.

Spongipellis fractipes was collected several times at Krakovo, usually only few specimens (Tortić & Hočevar 1977). According to Jahn (1972/73), as well as Kotlaba & Pouzar (1976), it is distributed in wet forests in river valleys on wood of *Alnus,* and this agrees perfectly with our find. It has not been refound yet in Yugoslavia although its occurrence in similar localities can be expected. *Antrodiella fragrans* was described from Krakovo (David & Tortić 1979 as *Trametes fragrans*) and some localities in Czechoslovakia published at the same time (see also Kotlaba 1984): one along a river, three on somewhat drier sites; the altitudes were from 130 to 250 m. Recently it has also been collected in Turopolje; *Quercus* is a new host. It is probably typical of lowland forests, which *Postia subcaesia* also seems to prefer (cf. also Kotlaba 1984).

The finds in Yugoslavia of *Postia simanii* as well as of *P. hibernica* have been published recently (Tortić 1988). They are two distinct species according to Jülich (1984); on the other hand these names are considered as synonymous by Gilbertson & Ryvarden (1986, 1987 as *Oligoporus hibernicus*). Specimens collected by the present author showed some differences, particularly in the size of spores and she therefore prefers to treat them, at present, as belonging to two species. Further investigations, including studies of cultures in the first place, are needed to clear this problem.

A number of species presented here are known from only one or very few, mostly unpublished, localities in Yugoslavia. Some examples are given. Among the first may be mentioned, for instance, *Bulbillomyces farinosus, Resinicium furfuraceum, Tremella steidleri* (recorded already by Hočevar & Tortić 1975 but not yet refound at the same locality), *Tubulicrinis accedens,* and among the second e. g. *Femsjonia pezizaeformis, Fibrodontia gossypina, Hypoderma transiens,* each found in only one locality besides that or those mentioned here. *Hyphoderma litschaueri* was published recently from Plitvice (Tortić 1988).

The list from Krakovo contains 15 species found only on planted *Abies, Picea* and *Pinus.* With the exception of one, they are all bound to conifers. The exception is *Antrodia malicola* which regularly grows on hardwoods, for instance at Plitvice (Tortić 1988); it was found once elsewhere on fir. The other 14 species are mostly common or at least not particularly rare in coniferous forests, very rare is *Pseudomerulius aureus* and only few localities in Yugoslavia are known, some recorded by Tortić & Sylejmani (1982).

Conclusions

The frequency of species presented here was in some cases probably not estimated accurately, since less conspicuous fungi or those producing fruitbodies which rapidly deteriorate, or not producing them every year, e.g. in living trees, may be more frequent than indicated here. Some species were absent in one or more localities simply because of the lack or small quantity of appropriate hosts. Still, according to the data collected, and comparing the occurrence of those species with their presence or absence in other types of forests studied by the author, the following lignicolous *Aphyllophorales* may be considered as typical of humid lowland forests with *Quercus robur: Schizopora carneolutea, Stereum rameale, S. subtomentosum, Steccherinum bourdotii* and very probably *Antrodiella fragrans: Spongipellis fractipes* occurs in very wet sites in alder stands. *Hymenochaete rubiginosa, Peniophora quercina,* growing predominantly on oak wood, and *Hyphodontia quercina,* in spite of its name mainly occurring on *Carpinus,* distributed in various other oak forests, seem to be most frequent just in forests discussed. *Hyphoderma setigerum, Skeletocutis nivea, Stereum hirsutum,* common in beech forests (Tortić 1988) are apparently still more abundant in forests of *Q. robur.*

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SAŽETAK

LIGNIKOLNI *APHYLLOPHORALES* U VLAŽNIM I POLUVLAŽNIM NIZINSKIM ŠUMAMA HRASTA LUŽNJAKA (*QUERCUS ROBUR*) U JUGOSLAVIJI

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Nizinske šume hrasta lužnjaka rasprostranjene su u nas duž Save, Drave i nekih njihovih većih pritoka, na nadmorskim visinama od oko 100—150 m i periodično su poplavljivane kroz dulje ili kraće vrijeme tijekom godine. Njihova je mikoflora istraživana na dva lokaliteta i do tada ustanovljene vrste objavljene (vidi literaturu). Autorica je nastavila istraživanja proširivši ih na još tri lokaliteta, a koncentrirala se sada uglavnom na lignikolne *Aphyllophorales*.

Proučavane šume leže većinom unutar radiusa od oko 60 km od Zagreba, samo je jedna (Prašnik) udaljena oko 120 km. U nekima se nalaze rezervati s hrastovima starim ponegdje i do 300 godina, a u nekoliko je Hrvatsko ekološko društvo postavilo trajne pokusne plohe od po 1 ha, pa je takvim površinama posvećena osobita pozornost.

Iako su unutar nizinskih šuma opisane različite šumske asocijacije, nije još bilo moguće da se provedu podrobnije mikocenološke studije, nego je ovdje izneseno koje su vrste proučavane grupe gljiva dosad utvrđene u takvim šumama općenito, i koje bi mogle biti za njih tipične.

U tablici 1 prikazane su gljive nađene u dva do pet lokaliteta, a one sabrane samo na po jednom lokalitetu nanizane su abecednim redom za svaki posebno u tablici 2. Za svaku su navedeni domaćini, a označena je i njihova učestalost. U Krakovskoj su šumi na pojedinim mjestima sađeni bor, jela i smreka, pa je tamo nađeno i 14 vrsta vezanih za drvo četinjača.

Ukupno je determinirana 171 vrsta, od kojih je 86 objavljeno iz Krakovske šume i Prašnika. U engleskom su tekstu dani podaci o broju vrsta u pojedinim šumama te koliko je nađeno na četiri najčešća domaćina (hrast, grab, lijeska, joha). Istaknuto je koje su vrste česte i obilne u ovim ali i drugim šumama (u prvom redu bukovim), te koje su pronađene dosad samo u nizinskim šumama. Raspravlja se i o pojedinim zanimljivijim češćim i rijetkim vrstama.

Prema dosadašnjim istraživanjima pretpostavlja se da bi za vlažne nizinske šume mogle biti najtipičnije: *Schizopora carneolutea*, *Steccherinum bourdotii*, *Stereum rameale*, *S. subtomentosum*, a vjerojatno i *Antrodiella fragrans*. *Spongipellis fractipes* dolazi na osobito vlažnim mjestima u sastojinama johe.

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