

# A new morphological arrangement of the Polyporales. I. Phanerochaetineae

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**SUMMARY:** A new taxonomic division of the suborder Phanerochaetinae of the order Polyporales is presented. The suborder covers five families, i.e. Faerberiaceae Pouzar, Fistulinaceae Lotsy (including Jülich's Bjerkanderaceae, Grifolaceae, Hapalopilaceae, and Meripilaceae), Laetiporaceae Jülich (=Phaeolaceae Jülich), and Phanerochaetaceae Jülich. As a basis of the suggested subdivision, features of basidioma micromorphology are regarded, with special attention to hypha/epibasidium ratio. Some generic concepts are changed. New genera *Radulporus* Spirin & Zmitr. (type *Polyporus aneirinus* Sommerf. : Fr.), *Emmia* Zmitr., Spirin & V. Malysheva (type *Polyporus latemarginatus* Dur. & Mont.), and *Leptochaete* Zmitr. & Spirin (type *Thelephora sanguinea* Fr. : Fr.) are described. The genus *Byssomerulius* Parmasto is proposed to be conserved versus *Dictyonema* C. Ag. The genera *Abortiporus* Murrill and *Bjerkandera* P. Karst. are reduced to *Grifola* Gray. In total, 69 new combinations are proposed. The species *Emmia metamorphosa* (Fuckel) Spirin, Zmitr. & Malysheva (commonly known as *Ceriporia metamorphosa* (Fuckel) Ryvarden & Gilb.) is reported as new to Russia.

**Key words:** aphylloroid fungi, corticioid fungi, *Dictyonema*, Fistulinaceae, homobasidiomycetes, Laetiporaceae, merulioid fungi, Phanerochaetaceae, phylogeny, systematics

## I. INTRODUCTORY NOTES

There is no general agreement how to outline the limits of the forms which should be called phanerochaetoid fungi. The main intention of this paper is to clarify taxonomic position and concept of this group which is, in our opinion, morphologically distinct union of corticioid and some polyporoid homobasidiomycetes, characterized by hyphae and basidia similar to those of the genus *Phanerochaete* P. Karst. In current taxonomic literature this group is incorporated within polyporoid clade and reveals close relationships with phlebioid and 'core polyporoid' clades (Parmasto, Hallenberg, 2000; De Koker *et al.*, 2003; Binder *et al.*, 2005).

Historically, a group in question was established by John Eriksson (1958) as subfamily Phanerochaetoideae of the Corticiaceae Herter, although it was validly published only 30 years later (Parmasto, 1986). Originally, the group of phanerochaetoid fungi was limited to *Phanerochaete* P. Karst. with several closely related corticioid genera. In "Conspectus systematis Corticiacearum" (Parmasto, 1968), this group was considered as tribe Byssomerulieae of subfamily Athelioideae. Hence, the phylogenetic relationships of *Phanerochaete* with some merulioid fungi (as *Byssomerulius* Parmasto) were widely discussed for the first time. However, in this work *Phanerochaete* genus complex was opposed to the "subfamily" Phlebioideae; therefore, a kind of stereotype was created for further approaches.

Jülich (1982) raised Eriksson's Phanerochaetoideae to the family level and placed it in the order Phanerochaetales Jülich, where Phanerochaetaceae Jülich appeared side by side with

completely alien (at least for the first sight) polyporoid and hydroid elements as *Amylosporus* Ryvarden, *Pyroformos* Kotl. & Pouzar, and *Climacodon* P. Karst.

Thus, the term “phanerochaetoid fungi” is now interpreted in two ways: “corticiocentric” one, when “Phanerochaetoideae” remains restricted to a group of pellicular clampless athelioid (or even *Botryobasidium*-like) fungi (Parmasto, 1986, 1995; Wu, 1990, 2000), and opposite one, directed on broad scope of aphylloroid fungi having similar “phanerochaetoid” microstructure (Hansen, Knudsen, 1997). There is necessary to mention that numerous molecular evidences currently support the line by Hansen and Knudsen (Hibbett, Donoghue, 1994; Hibbett *et al.*, 1997; Hibbett, Thorn, 2001). More complicated problem is the boundaries between “phanerochaetoid” and “merulioid” as well as polyporoid fungi, because an existence of many intermediate taxa within gilled and polyporoid representatives obscures clear division among Polyporaceae and Meruliaceae. Therefore, we consider “phanerochaetoid fungi” as Phanerochaetinae, an indistinctly allocated (at least in its certain aspects) suborder of the Polyporales.

To avoid any subjective interpretations, it is essential that all the taxa are precisely outlined. Therefore the basic task of our paper is to give rather detailed diagnoses for all the subdivisions of Phanerochaetinae.

## II. BASIC STRUCTURES, TERMINOLOGY, DIAGNOSTICAL TECHNIQS

### 1. Hyphal structure

#### a. Main hyphae types

The basic type of hyphal differentiation is **generative hyphae** — totipotent septate hyphae with functioning protoplast; usually thin-walled, clamped, in some groups without clamps. In some cases, also **gloeoplerous hyphae** are present together with generative ones, i.e. living hyphae with oily (light-refracting) contents; usually they bear clamps and inflations.

In some species **supporting hyphae** can be differentiated too — more or less thick-walled septate ones, clearly differing from generative hyphae by its thickened walls, pigmentation, or diameter ( $L > 2w$ ),<sup>1</sup> and also **pseudoskeletal hyphae** (the same as **skeletal hyphae**, but  $L \leq 2w$ )

While the protoplast and septa collapse, sclerified fibre-like hyphae develop, called also **skeletal hyphae**, i.e. thick-walled, non-septate linear filaments.

Supporting hyphae as well as precursors of skeletal hyphae can be furnished by peculiar protuberances, or **binding hyphae**, i.e. sclerified hyphae branched to the state when the main axis is undistinguishable.

#### b. Diagnostically important hyphal attributes

Generative hyphae of many species bear small lateral anastomoses between connected cells — so-called **clamp connections, or clamps**. According to Cléménçon (2004), three main forms of clamp connections can be distinguished: (i) **closed clamp**, leaving no space between the hypha and anastomose body; (ii) **ring clamp** (= *medallion clamp*), leaving a hole or space between the hypha and anastomose body; and (iii) **verticillate clamps**, forming a cluster of two or more clamp connections around the same septum. There are also **pseudoclamps**, occurring sometimes in presomatogamic as well as postsomatogamic mycelium, when lateral anastomose initials did not reach the following cell body.

Branching pattern of hyphae is a good diagnostical feature. In phanerochaetoid fungi four types of hyphal branching can be detected: 1) normal (or **athelioid**) branching pattern, when

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<sup>1</sup> L — width of hyphal lumen, w — width of hyphal wall.

hyphae are ramified at sharp angles, 2) **candelabriform branching** — the same, but finally branches are parallel (usually such branching pattern occurs in subhymenial layer), 3) **rectangular branching** (occurring in medullar tissue of *Phanerochaete*, *Grandiniella*, *Climacodon*, *Laetiporus*, and some other species), and 4) **parallel branching**, when verticillate pseudo-clamp affiliations expand parallel to mother hypha (this type occurs as a rule in subiculum of *Grandiniella*, *Byssomerulius*, *Efibula* etc.).

In mycelial cultures of some species (*Sarcodontia spumea*, *Climacodon setentrionalis*) so-called **allocysts** can be observed — the fragments or ends of generative hyphae consisting of glycogen-bearing inflated cells staining red-brown in Melzer's solution.

**Gloeosphexes** are the structures evolving in the aerial mycelium of some *Hohenbuehelia* species — laterally branched elongate cells secreting a drop of sticky liquid and frequently showing a median constriction. Nematodes, coming into contact with the sticky drop of a mycelial gloeosphex, will be firmly glued to the cell. Then hyphae will penetrate into the worm, dissolve its organs and take up the nutrients (Cléménçon, 2004). In old literature such fungal form was considered as deuteromycete genus *Nematoctonus* (Drechsler, 1949).

### c. Hyphal system of basidiocarp

The presence and combination of certain types of hyphae determine the hyphal construction of basidiocarp. The following types of hyphal systems can be distinguished:

**monomitic** — basidiocarp consists of generative hyphae only;

**dimitic** — skeletal hyphae present too;

**trimitic** — generative, skeletal, and binding hyphae present;

**submonomitic** — without true skeletals, but with supporting hyphae;

**pseudodimitic** — without true skeletals, but with pseudoskeletal hyphae;

**sarcodimitic** — several supporting hyphae are strongly inflated;

**sarcotrimitic** — the same, but inflate hyphae bear binding-like protuberances with narrow lumen;

**subdimitic** — pseudodimitic or sarcodi(tri)mitic construction, when many thick-walled hyphae are rarely septate.

### d. Textura types

**Textura** is determined as the mode of hyphal arrangement in certain parts of basidiocarp. This term is usually applied to the **context** (sterile tissue<sup>2</sup> of basidiocarp) or **trama** (sterile tissue of hymenophore bearing euhymenium). Context (subicular) texture is as a rule loose (wadded, arachnoid, spongy), i.e. hyphae and hyphal cords are arranged freely, having  $\pm$ radial growth. Tramal (subhymenial) texture is more compact.

According to Burdsall (1985), the following main types of texture can be distinguished in phanerochaetoid fungi:

**textura oblita** — hyphae more or less parallel, with strongly thickened and cohering walls;

**textura intricata** — hyphae interwoven, with interhyphal spaces, or spaces lacking in compact *textura intricata*, walls thin to thickened;

**textura intricata-porrecta** — hyphae interwoven but with definite parallel tendency, walls thin to thickened;

**textura porrecta** — hyphae basically parallel with little interweaving, walls thin to firm.

## 2. Generative sphere

### a. Hymenium and its elements

**Hymenium** is the fertile surface of basidiocarp. The basic element of hymenium is an exogenously sporulating cells called **basidia**. Before spore producing, these bodies are usually considered as **basidioles**. In phanerochaetoid fungi the hymenium is **euhymenium** (i.e. hy-

<sup>2</sup> The term 'tissue' is used here in traditional mycological sense, i.e. concerning *plectenchyma*.

menium composed of basidial clusters — see Cléménçon, 2004) in its two variants: (i) **leptohymenium** (non-thickening hymenium: basidial clusters converge which leads to the development of thin pellicular layer, e.g. *Leptochaete*), and (ii) **auxohymenium** (having thickened subhymenium and in some cases developed trama, e.g. *Climacodon*).

Also various types of **cystidia** can be observed in the hymenium of phanerochaetoid fungi. This term is applied to heterogeneous assemblage of storage, excretory, and supporting 'organs' (for detailed review of cystidial theme see Donk, 1964, Eriksson *et al.*, 1987, Zmitrovich, 2001, Cléménçon, 2004, Zmitrovich, 2006a). For the group in question, the following types of cystidia are usually reported.

#### Cystidial organs of hymenial/subhymenial origin

**Leptocystidia** — thin-walled, as a rule non-encrusted cystidia:

**cystidioles** — hymenial leptocystidia, emerging at the same level as basidia;

**hydroplerous gloeocystidia** — leptocystidia with oily (light-refracting) contents.

**Lamprocystidia** — thick-walled, heavily encrusted cystidia.

**Metuloids** — thick-walled, non-encrusted or apically-encrusted cystidia.

#### Cystidial organs of tramal origin

**Pseudocystidia (skeletocystidia)** — thick-walled sterile elements, penetrating the hymenium as endings of skeletal (pseudoskeletal, thick-walled generative) hyphae.

**Gloeocystidia** — thin-walled elements, protruding the hymenium as endings of gleoplerous hyphae.

#### b. Basidial morphology and terminology

**Basidium** is a main organ of sexual reproduction of basidiomycetes being simultaneously a distinct stage of their life cycle — progametophyte or protogamont (Zmitrovich, 2006b). This is quite evolved kind of tetrasporangium with high degree of its elements coordination (Zmitrovich, 2006a). The most detailed explanation of basidial terminology was given by Kirk *et al.* (2001), Cléménçon (2004), Zmitrovich and Wasser (2004). Only taxonomically important aspects of the question are considered in this paper.

The basidium of phanerochaetoid fungi is chastic homobasidium. This basidium type (in contrast to heterobasidium) is characterized by weak differentiation into hypo- and epibasidium and into pro/metabasidium in its ontogenesis. In our opinion, the ratio between hypobasidial and epibasidial segments in the basidium has an essential taxonomic value.

**Epibasidial segment** — the part of basidium above the medial constriction.

**Hypobasidial segment** — the part of basidium below the median constriction.

**Clavate basidium** — basidium with epibasidial segment longer than hypobasidial segment, and weakly developed or absent medial constriction; if epibasidial segment is abruptly extended, the basidium is regarded as inflated [according to Oberwinkler's (1982) terminology].

**Cylindrical basidium** — basidium with hypo- and epibasidial segments approximately equal in width, without evident medial constriction.

**Podobasidium (pedunculate, sinuose basidium)** — basidium with epibasidial segment wider than flexuose hypobasidial segment; medial constriction is well visible.

**Urniform basidium** — basidium with hypobasidial segment wider than epibasidial segment.

**Utriform (utriculate, meruloid) basidium** — basidium with hypo- and epibasidial segments approximately equal in width, with well-expressed medial constriction and often flexuose epibasidial segment.

#### c. Basidiospores, mitosporoes, and some staining technics

**Basidiospore** initials start to develop within basidia during post-meiotic mitoses mainly by holoblastic way. The components of basidial cytoplasm migrate into the sporoid bodies, and when the process of maturing develops, dissimilative processes in cytoplasm slow down. Taxo-

onomic importance has the form of dormant basidiospores (ellipsoid, cylindrical, allantoid, sigmoid, amygdaloid, subglobose) and sporoderm features (see Spirin *et al.*, 2005). Both LM and TEM research show clear heterogeneity of sporoderm, i.e. its multilayered nature (Tab. 1). Among these structures exine (mostly tectocorium) has main diagnostic value. It can be smooth, perforated, or ornamented (e.g. *Granulobasidium*). When developed, perine covers outer tectonic structures of exine only.

Table 1

**Stratification of the basidiomycetes sporoderm according to transmission electron microscopy (Oláh *et al.*, 1977) and light microscopy (Locquin, 1984)**

TEM strates	LM reconstruction		
Parietal subcytoplasmic structure 'C'	Intine:	endocorium mesocorium	
Core spore wall 'B-A'	Exine:	epicorium:	sclerosporium scutellosporium episporium leptosporium
		tectocorium:	tectosporium parasporium ixosporium
Sterigmatic wall remnants 'b-a'	Perine:	myxocorium:	perisporium ectosporium

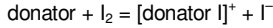
Some kinds of asexual propagules (**mitospores**) may develop on mycelium in culture or within vegetative tissue of wild basidiocarps. There are two kinds of mitospores in phanerochaetoid fungi: (i) **aleuria**, i.e. terminal or lateral swollen hyphal outgrowths, and (ii) **chlamydospores** in strict sense (Clémenton, 2004), i.e. specialized cells in hyphal filament having more or less thickened mantle and dormant protoplast. These peculiar sporulations were united in some artificial genera as *Confistulina*, *Ptychogaster*, *Sporotrichum*, *Sporotrichopsis*, *Spiniger* (see Stalpers, 1974, 1984, 2000; Stalpers, Vlug, 1983).

Fine structure of basidiospore and mitospore surface as well as vegetative hyphal filaments has evident taxonomical meaning. Minimization of optical artifacts is possible due to use of various chemical reagents, from which Melzer's reagent and Toluidin (or Cresyl) Blue are especially interesting for us.

Colour reaction with Melzer's reagent (i.e. iodine-starch reaction) becomes apparent if amorphous glucan matrix of spore wall absorbs iodine. However, depending on the wall structure, reaction can be varying.

For a long time iodine-starch reaction remained a riddle for chemists. They contented with supposition of "iodine-starch complex" formation, and only recently the convincing explanations were given. Here we briefly summarize them. The "iodine-starch complex" belongs to the substance class named *acclusion compounds* and placed between two other classes — solid intrusion solutions and true chemical compounds. The inclusion compound appears when one chemical substance (in our case — iodine) penetrates into the cavities of the other (for example, between "axes" and "branches" of glucan components). The iodine molecules fasten to glucan structure due to electrostatic powers. Unlike true chemical compounds, iodine atoms not fix strictly within glucan structure, but form a long chain in which every iodine atom is combined with the neighbour by one electron. The colour of iodine chain is conditioned by length of cavity, and varying from bluish (cavity long) to brownish (cavity short).

Iodine forms analogous compounds together with barbiturates, coumarins, and flavons. The electron transfer provides iodine-organic complex with stability:



Therefore iodine is commonly used in reactions, being a component of an organic-inorganic complex — Melzer's reagent. Intensity of reaction descends after heating, and increases when preparation is cooled and nitrites of alkaline metals are added.

Colour variation depends on glucan concentration in a hyphal/spore wall, and has taxonomic significance. At the same time, oftenly the evaluation of colour reactions is rather subjective. In our opinion (Spirin *et al.*, 2005), a cell wall staining in Melzer's reagent can be well characterized by: 1) reaction with predominant glucan fragments; 2) degree of colour intensity (ranged according to three-pointed scale); and 3) colour designation according to colour scale (the colour scale of J. H. Petersen, 1996 — see Tab. 2).

Table 2

**A scale of reactions of basidiomycete cell wall with Melzer's reagent**  
(colours designated according to J. H. Petersen, 1996)

Widespread term	Gradation proposed	Reference to colour plate
seemingly amyloid	'amylose'(+)	pale mouse grey (P 53) to light vinaceous grey (P 59)
weakly amyloid	'amylose'+	ash-grey (P 55)
amyloid	'amylose'++	bluish grey (P 57) to dark bluish grey (P 56)
strongly amyloid, =amylodextrinoid	'amylopectin'+++	vinaceous-grey (P 58) to greyish violet (P 44)
weakly dextrinoid	amyloextrins+	cinnamon-buff (P 14) to olivaceous buff (P 16)
dextrinoid	amyloextrins++	yellowish-brown (P 9)
strongly dextrinoid	amyloextrins+++	orange-brown (P 7)

Thus, Melzer's reagent allows to show the peculiarities of fibrillar-crystalline wall matrix, and precludes to some degree the artifacts caused by minute structure of core wall. However, this stuff does not detect the shape of thin ectal sculpture because it has no affinity with denser hydrophobic matter.

Toluidin blue (TB) aids to detect granular matter and reconstruct the shape of wall surface (Locquin, 1945; R. H. Petersen, 1968, 1988). Due to its free  $\text{NH}_2^-$  group, this medium easily reacts with "acide" fragments of many lipid and protein substances. In many cases, TB is very effective dye: it stains other matters, retaining its own colour. It is useful to morphological studies, since it colours superficial chondroproteins. The absorption of TB by any surface structure is usually termed as its **cyanophily**.

When reacting with simpler stuffs, TB causes red or rosy colouration — the structure is termed **metachromatic**. Usually, this is the reaction with lipid inclusions in cytoplasm, or with surfaces of small organelles. For example, metachromatic reaction is highly characteristic for the spores and basidia in the genus *Granulobasidium*, etc.

### 3. Basidiocarp morphology

The fungal mycelium is a peculiar variant of colony with quasi-centralized regulation of morphogenetic events. It has presumably radial growth — both into the substratum and outside

of it. Aerial mycelium is capable to form hyphal mats, cordons, rhizomorphs,<sup>3</sup> and a range of sexual and asexual fruiting bodies.

#### a. Basidiocarp growth forms

The peculiarities of basidiomata growth forms are determined by the arrangement and quantitative ratio of orthotropic and plagiotropic filaments (axial hyphae). Four main growth forms occur within the fungi under consideration.

1. **Orthotropic** basidiomata — axial filaments have fountain growth; appendage filaments (**pleuridia**) are parageotropic or positively geotropic; e.g. *Faerberia*.

2. **Parageotropic** basidiomata — laterally attached; axial filaments have fan-tracery growth; pleuridia are positively geotropic; e.g. *Climacodon*, *Climacocystis*, *Hohenbuehelia*, *Laetiporus*, *Phaeolus*, *Pycnoporellus*.

3. **Plagiotropic** basidiomata — prostrate: axial filaments have plagiotropic growth. Depending on the density of pleuridia, these basidiomata have (i) **hypochnoid** (pleuridia loosely arranged — some *Sporotrichum* species), or (ii) **crustose** (pleuridia densely packed — *Efibula*) appearance.

4. **Resupinate ortho-plagiotropic** basidiomata — prostrate, but some filaments are taken out with development of complicated hymenophoral structure. Depending on growth dimension and the way of substratum rooting, the following variants of resupinate basidiomata can be distinguished:

(i) **resupinate** s. str. — dorsally attached (turned down) pilei with prostrate (in some cases inrolled) margin;

(ii) **rhizomoid** — non-pileated basidiocarp; initially arachnoid and cordonic, then continuous due to an integration by dense hymenophoral structure;

(iii) **orbicular** — non-pileated basidiocarp; totally prostrate, radially fibrillose; this structure can be monocentric (i.e. based on a single prostrate cladothallus) or polycentric (based on a confluent cladothalli integrated by common hymenophore).

#### b. Basidiocarp morphotypes

Growth form of the fruitbody, its textura, proportions, and hymenophore configuration, can be generalized as certain morphotype. Within phanerochaetoid fungi the following basidiocarp morphotypes can be distinguished:

**cantharelloid** — annual orthotropic infundibuliform basidiocarp of fleshy-ceraceous consistence, with folded to venose or almost smooth hymenophore and more or less expressed stipe;

**pleurotoid** — annual parageotropic or even orthotropic basidiocarp of fleshy consistence, with gilled hymenophore and more or less reduced stipe;

**tyromycetoid** — annual parageotropic basidiocarp of fleshy consistence, with tubular (rarely toothed) hymenophore;

**meruloid** — annual resupinate to orbicular basidiocarp of fleshy to corneous consistence, with folded hymenophore;

**stereoid** — usually perennial parageotropic to resupinate basidiocarp of hard consistence with smooth or almost so hymenophore;

**porioid** — annual to perennial resupinate or orbicular basidiocarp of various consistence, with tubular hymenophore;

**corticoid**<sup>4</sup> — annual orbicular or rhizomoid basidiocarp of dense consistency, with smooth hymenophore;

<sup>3</sup> They differ from hyphal cordons in having well-developed cortical structure.

<sup>4</sup> The term “corticoid fungi” is not strictly synonymous, because has an additional ‘pragmatic historical’ aspect: “corticoid fungi — ...those species which generally are collected by corticologists” (Hjortstam 1998).

**athelioid** — the same as corticioid, but basidioma is differentiated into loose subiculum and pellicular leptohymenium;

**grandinioid** — the same as corticioid, but with papillose hymenophore;

**odontioid** — the same as corticioid, but with toothed hymenophore.

### III. SPECIAL PART

Order **POLYPORALES** Gäum., Vergl. Morphol. Pilze: 503, 1926.

Suborder **PHANEROCHAETINEAE** (Jülich) Zmitr., V. Malysheva et Spirin subord. nov. — order *Phanerochaetales* Jülich, Bibl. Mycol. **85**: 351–352, 1982. — *Albatrellales* Nuss, 1980 pr. p. — *Fistulinales* Jülich, 1982. — *Grifolales* Jülich, 1982. — *Phaeolales* Jülich, 1982. — *Scutigerales* Zmitr., 2001 nom. descript.

BASIDIOCARPS annual, rarely perennial, orthotropic to resupinate, in many cases tyromycetoid, merulioid, corticioid, or porioid; HYMENOPHORE bearing auxo- or leptohymenium: lamellate to even, commonly folded, tuberculate, spinose, tubular; TEXTURA: in context rather loose to wadded, spongy, firm, fleshy to fleshy-coriaceous; tramal one ceraceous in various degree — oblita, intricata, porrecta, intricata-porrecta; HYPHAL SYSTEM monomitic, submonomitic, sarcodi(tri)mitic, pseudodimitic, or subdi(tri)mitic; GENERATIVE HYPHAE clamless or clamped, branched at sharp to right angles, rather wide (diameter of subhymenial hyphae is approximately equal or no more than in 1.5–2 times less than those of epibasidial segment), thin- to thick-walled, in some cases with narrow lumen or bearing an intercalar skeletal; inamyloid to weakly amyloid (amylose+), indextrinoid but in many cases cyanophilous; CYSTIDIA present in many species, naked (lepto- and gloeocystidia) to heavily encrusted (lamprocystidia); BASIDIA clavate, distinctly constricted, with widened epibasidial segment, 2–4-spored, organized in regular palisade, but gelatinous matrix not developing; BASIDIOSPORES thin- to thick-walled, neither amyloid nor dextrinoid but in many cases cyanophilous; ellipsoid, amygdaliform, cylindrical, less typically subglobose or allantoid; hyaline or in some species yellowish; CONIDIA sometimes present, of *Ptychogaster* or *Sporotrichopsis* type; SUBSTRATUM: wood in various forms and conditions; sometimes in association with algae; TYPE OF ROT: white or brown rot fungi.

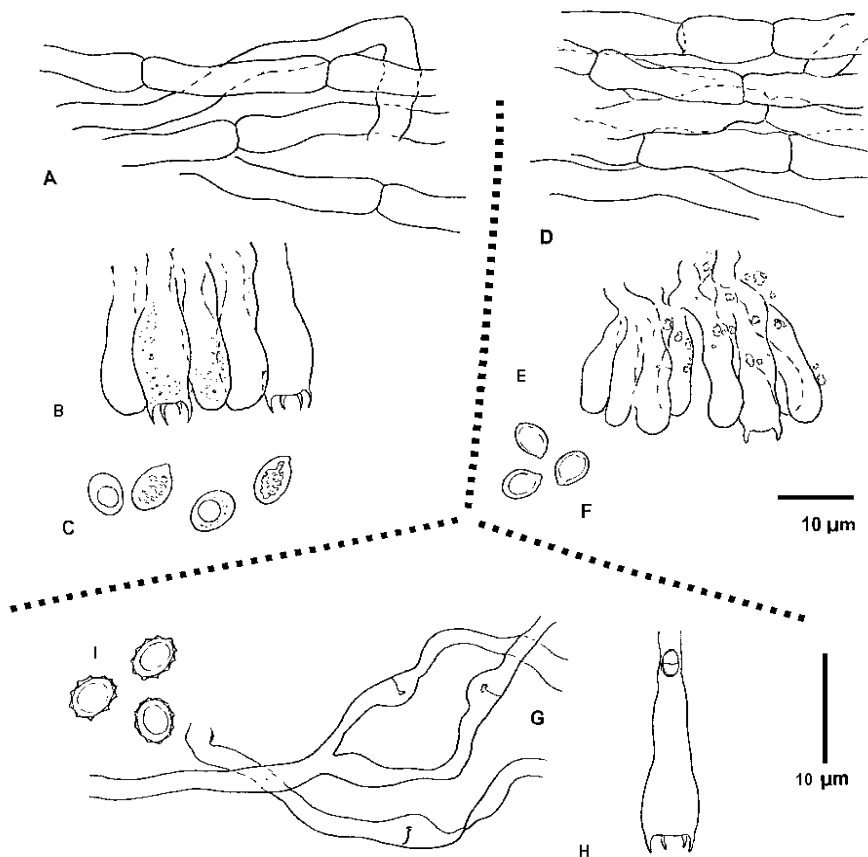
Within the chaotic mass of Polyporales, this group can be allocated by quite characteristic hypha/epibasidium ratio,<sup>5</sup> presence of rectangular hyphal branching, neither amyloid nor dextrinoid, mostly “inflated” spores ( $Q \leq 3$ ), and constricted basidia with more widened epibasidial segment, organized within ceraceous (not dissolving) euhymenium. The context is rather loose due to widened hyphae and absence of true skeletal. The adjoining Boletales differ by Melzer’s-positive (dextrinoid or amyloid) or, at least, more pigmented basidiospores; Hyphodermatales have more inflated hypobasidial segment and basidia are utriform to pseudouniform, not clavate. The border with Russulales can be marked by presence in them oil-rich gloeocystidia and amyloid/rough basidiospores, whereas Polyporales/Meruliineae can be separated by narrower hyphae and spore length/width ratio. The Polyporineae, behind other hypha/epibasidium ratio, differs by the presence of true skeletal, and clearly thin-walled, mostly acyanophilous spores, although there is intermediate group of polypores related to *Osteina* Donk, *Royoporus* A.B. De, and *Piptoporus* P. Karst., as well as some pleurotoid taxa (as *Pleurotus* (Fr.) P. Kumm., *Panus* Fr.) with some phanerochaetoid characteristics.

In respect of decay pattern the order is heterogeneous. However, recently the taxonomical weight of the rot type character has undergone a reassessment. After the discovery of laccase

<sup>5</sup> This character is evolutionary quite conservative, i.e. it remains constant within major groups of the Basidiomycetes.



gene-specific sequences in genome of brown-rotters (D'Souza *et al.*, 1996) and oxidase-dependent (not hydrolytic!) mechanism of cellulose degradation (Hyde, Wood, 1997), it has become obvious that brown-rot fungi is a heterogeneous assemblage of the most advanced wood-rotters (Ander, Marzullo, 1997). Phylogenetically it means that brown-rot fungi are probably independent terminal branches of the phylum of Homobasidiomycetes (Gilbertson, 1980; Zmitrovich, 2001), but certainly are not a domain of its basal radiation (Nobles, 1971).



**Fig. 1.** Leucopaxilloideae. A–C — *Melanoleuca brevipes* (LE 201383): A — tramal hyphae, B — basidia, C — spores; D–F — *Pseudoclitocybe cyathiformis* (LE 6626): D — tramal hyphae, E — basidia, F — spores; G–I — *Leucopaxillus albissimus* (LE 18282): G — medullar hyphae, H — basidium, I — spores.

Certainly, phanerochaetoid fungi take roots in a basal domain of agaric-bolete-russuloid “triangle”. Here it is necessary to mention the family Leucopaxillaceae (Singer) Jülich attributed by us to the order Russulales together with Albatrellaceae–Amylosporaceae owing to its strongly amyloid or dextrinoid spore walls and inflated hyphae with characteristic branching pattern (Fig. 1). But in residual features of basidiocarp morphology Leucopaxillaceae are com-

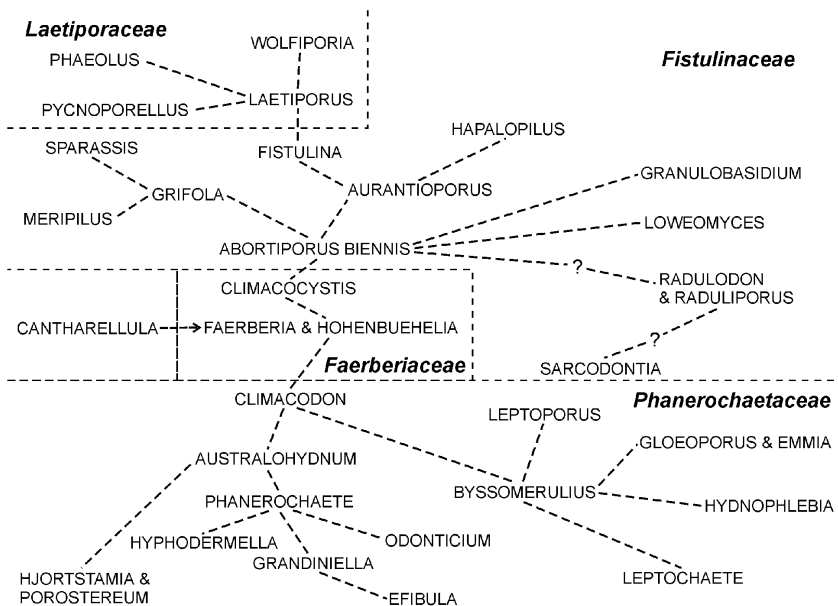
parable with Phanerochaetaceae. The system of this family in our survey does not differ essentially from the system proposed by Singer (1975, 1986) and can be described as following:

**Fam. Leucopaxillaceae** (Singer) Jülich, *Bibl. Mycol.* **85**: 376, 1982.

Typus: *Leucopaxillus* Bours., 1939.

Genera alia: *Melanoleuca* Pat., 1897, *Cantharellula* Singer, 1936, *Pseudoarmillariella* (Singer) Singer, 1956, *Pseudoomphalina* (Singer) Singer, 1956, *Pseudoclitocybe* (Singer) Singer, 1956, *Clitocybula* (Singer) Métrod, 1952, *Porpoloma* Singer, 1952.

The Albatrellaceae (Pouzar) Nuss demonstrate many parallelisms with Phanerochaetaceae (especially in such taxa as *Amylosporus* Ryvar den, *Wrightoporia* Pouzar). An interesting example is *Albatrellus syringae* (Parmasto) Pouzar, the construction of which is very similar to that of *Loweomyces fractipes* (Berk. & M.A. Curtis) Jülich — its basidia have prolonged hypobasial segment and arranged within loose hymenial palisade; the shape as well as arrangement of their subhymenial hyphae are identical, and gloeopleroid elements are present both in subhymenium and trama. Sterile tissue of carpophores is sarcotrimitic in both species. These similarities can be interpreted to a certain degree as a result of their wood-inhabiting life mode (according to Niemelä, 1970, *A. syringae* is a white-rot fungus), therefore contextual binding hyphae are less inflated than in other albatrellae. However, similar basidial morphology testifies about rather the case of common basal area for phanerochaetoid-albatrelloid radiation. If *Albatrellus pes-caprae* (Fr.) Pouzar and *A. syringae* would be separated from efibulate amyloid-spored albatrellae into an independent genus (having restored *Scutigera* Paul. — see Pieri, Rivoire, 2002; Ryman *et al.*, 2003), then the better place for them should be within the Phanerochaetaceae (Scutigerales sensu Zmitrovich, 2001).



**Fig. 2.** Topology showing possible phylogenetic relationships between the genera of the Phanerochaetaceae (demarcations between four families are bordered by dashed lines).

Another sister group is Polyporales/Meruliineae. The genus *Cantharellula* (Leucopaxillaceae) is probably the taxon closest to the archetype. Possibly, two lines were separated at the earliest stages of evolution of Meruliineae: (i) *Cantharellula*–Mycenaceae–Peniophoraceae (Stereaceae), and (ii) *Cantharellula*–*Sarcomyxa*–Cylindrobasiidiaceae & Meruliaceae. The core Polyporales is also rooted in the phylogenetic zone of Leucopaxillaceae–Tricholomataceae and closely connects with Phanerochaetinaeae. In these groups there are many parallelisms with Albatrellaceae, but spores of Phanerochaetinaeae are neither amyloid nor dextrinoid, the hyphae/epibasidium ratio does not exceed 2, and there are the hyphae of strikingly rectangular branching.

The family Faerberiaceae Pouzar, connected with *Cantharellula*, can be considered as an immediate link between the Phanerochaetinaeae and Leucopaxillaceae. All the other series of the suborder are deduced very well from here (Fig. 2). As seen, the basic pool of corticioid phanerochaetaeous fungi was generated due to simplification of resupinate pleurotoid fungi (like *Hohenbuehelia*), which have lost ability to form stipe and radial agaricoid lamellae (the problem of the origin of resupinate growth form was more detailed discussed in our recent work — see Zmitrovich, 2001).

The family Rigidoporaceae is excluded from our synopsis, because its representatives have unperforated parenthosomata (Keller, 1997), which seems to be a conservative evolutionary feature. Probably the Rigidoporaceae is closely related to Phellinaceae and other Hymenochaetales, deviated from cantharelloid (not russuloid) stock (for example, among *Clavariachaete* Corner). However, its distant position in relation to Polyporales can be an artifact as well. Nowadays some molecular (e.g. LSU rDNA) data can be interpreted as evidences of the large clitocyboid-omphalioid area of basal radiation of homobasidiomycetes, where hymenochaetoid clade is nested too (Moncalvo *et al.*, 2003).

Thus, four families of the Phanerochaetinaeae can be stated according to the characteristics outlined below.

#### KEY TO THE FAMILIES OF PHANEROCHAETINEAE

##### A. Hyphae with simple clamp connections.

**B.** Basidiospores thick-walled in various degree,  $\pm$ cyanophilous. Lamprocystidia none, gloeoplerous hyphae and/or gloeocystidia usually present. Basidiocarps mostly tyromycetoid, fleshy with sarcodi(tri)mitic or pseudodi(tri)mitic context, rarely hydroid to corticioid and monomitic.

Fam. **Fistulinaceae**

**B.** Basidiospores thin-walled, acyanophilous in most cases. Lamprocystidia present, gloeoplerous elements absent.

**C.** Basidiocarps cantharelloid, pleurotoid, meruloid, or tyromycetoid, fleshy with monomitic or sarcodimitic context.

Fam. **Faerberiaceae**

**C.** Basidiocarps stereoid, often dull-coloured; hyphae sometimes without clamps. Hyphal system pseudodimitic.

Order **Hyphodermatales** (*Veluticeps* etc. — not treated)

##### A. Hyphae as a rule without clamps in subhymenium, in some cases with scattered verticillate clamp connections in context.

**D.** Basidiospores thick-walled in various degree,  $\pm$ cyanophilous, if thin-walled, then context reddish in alkalis. Lamprocystidia none. Basidiocarps tyromycetoid, fleshy, or robustly porioid with sarcodimitic to pseudodimitic context.

Fam. **Laetiporaceae**

**D.** Basidiospores thin-walled, acyanophilous. Lamprocystidia present or not. Basidiocarps meruloid, corticioid, delicately porioid, rarely sessile, fleshy with monomitic context.

Fam. **Phanerochaetaceae**

**Fam. 1. Faerberiaceae** Pouzar, Česká Mykol. **37**: 184, 1983.

BASIDIOCARPS orthotropic — cantharelloid, or parageotropic to resupinate — pleurotoid, tyromycetoid, merulioïd; fleshy; HYMENOPHORE bearing auxohymenium: lamellate, folded, or poroid, of subgelatinous-ceraceous consistency; TRAMA consisted of parallel arranged hyphae to irregular; CONTEXT fleshy, usually with gelatinized strata; HYPHAL SYSTEM monomitic or sarcodimitic; HYPHAE with clamp connections; CYSTIDIA expressed as metuloids: cheilo- cylindrical to subulate, pleuro- of tramatic or hymenial origin, fusoid, thick-walled, naked or more often with robustly encrusted upper third; BASIDIA long-clavate, constricted, (2)4-spored; BASIDIOSPORES ellipsoid to amygdaliform, obscurely thin-walled,<sup>6</sup> neither amyloid nor dextrinoid, acyanophilous. TYPE OF ROT: white.

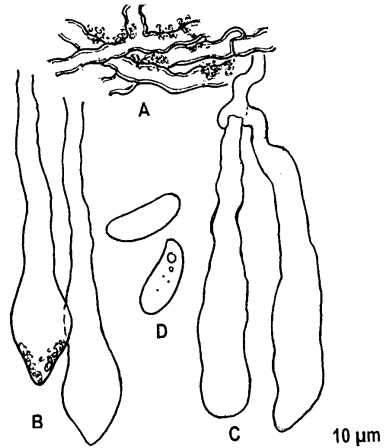
Type: *Faerberia* Pouzar, 1983.

This family morphologically looks to be accessory to the Leucopaxillaceae (e.g. *Cantharelula*). All the other series of the Phanerochaetinae are very well deduced from it (along the lines *Hohenbuehelia*–*Climacocystis*–Fistulinaceae and *Hohenbuehelia*–Phanerochaetaceae).

The case for a clitocyboid (leucopaxilloïd) ancestor of the group does not exclude close relationships of the Faerberiaceae with lentinoid Polyporaceae. This case in details was considered by Corner (1966, 1981) and later also by the authors (Zmitrovich *et al.*, 2004: 67). The reason can be that three groups mentioned before can be parallel developed from common clitocyboid stock.

Some superficial agreements with the Hyphodermatales also can be allocated here. A good example is corticioid genus *Mutatoderma*, having similarly encrusted cystidia and *Hohenbuehelia*-like basidiospores (Fig. 3). The genus, however, has longer utriculate basidia, another hypha/epibasidium ratio, therefore should not be regarded inside of Phanerochaetinae.

The suborder Meruliineae appears to be related with this family. As a link can be considered the genus *Sarcomyxa* P. Karst., which is comparable with *Panellus*, *Merulius* (incl. *Auriculariopsis*, *Schizophyllum*), *Scopuloides*<sup>7</sup> and other Meruliineae (see Spirin, Zmitrovich, 2004).



**Fig. 3.** *Mutatoderma mutatum* (LE 202146): A — subicular hyphae, B — cystidia, C — basidioles, D — spores.

<sup>6</sup> So thick-walled that this can hardly be seen.

<sup>7</sup> **Scopuloides cana** (Burt) Zmitr. & Spirin comb. nov. — B.: *Peniophora cana* Burt, Ann. Mo. Bot. Gard. **12**: 227, 1926.

**Scopuloides gigantea** (Fr. : Fr.) Spirin & Zmitr., Nov. Syst. Pl. non Vasc. **37**: 184, 2004. — *Thelephora gigantea* Fr. : Fr., 1821. — *Phlebia gigantea* (Fr. : Fr.) Donk, 1957. — *Phlebiopsis gigantea* (Fr. : Fr.) Jülich, 1978.

**Scopuloides hiulca** (Burt) Zmitr. & Spirin comb. nov. — B.: *Peniophora hiulca* Burt, Ann. Mo. Bot. Gard. **12**: 272, 1926.

**Scopuloides ravenelii** (Cooke) Boidin, Lanquetin et Gilles, Cryptogamie-Mycologie **14**: 205, 1993; Zmitr. & Spirin, Nov. Syst. Pl. non Vasc. **37**: 184, 2004 nom. superfl. — *Peniophora ravenelii* Cooke, 1879; *P. molleriana* Bres. in Sacc., 1893; *Corticium roumeguerii* Bres., 1898.

Besides, monotypic tropical genus *Amauromyces* Jülich, *Persoonia* 9: 456, 1978 (type *A. pallidus* Jülich, op. cit.) is closely connected with this family. It is characterized by obligately fibulate hyphae and naked (but thick-walled) septate cystidia. In the original description of the genus Jülich noted, that it is "characterized by very broad and thick-walled hyphae, which remind one of *Phanerochaete*". In our opinion, the shape of basidia, which have thick walls at basal part, belongs also to the similarities with some Phanerochaetaceae, e.g. *Candelabrochaete* and *Odonticum*, however, obligately fibulate hyphae and thick-walled cystidia are the characteristic attribute of the Faerberiaceae, that gives intermediate character to the genus.

If to exclude *Amauromyces* temporarily from the consideration, three genera only can be attributed herein.

A. Basidiocarps cantharelloid, hymenophore radiately folded.

2. **Faerberia**

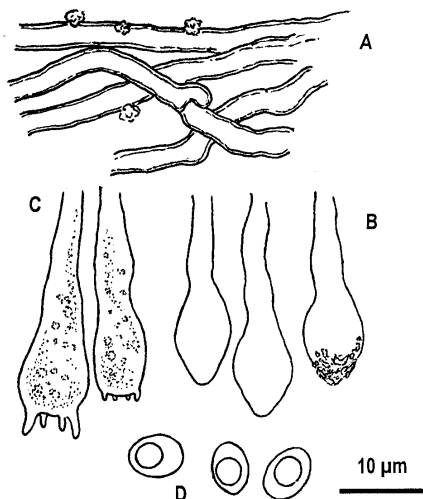
B. Basidiocarps pleurotoid to resupinate, hymenophore lamellate to meruloid.

3. **Hohenbuehelia**

C. Basidiocarps sessile, fleshy, hymenophore poroid.

1. **Climacocystis**

1. **CLIMACOCYSTIS** Kotl. & Pouzar, *Česká Mykol.* 12: 103, 1958.



**BASIDIOCARPS** annual, tyromycetoid, fleshy (hard ceraceous when dry); **HYMENOPHORE** poroid; **TRAMA** irregular to subregular; **CONTEXT** sap-fleshy to coriaceous-fibrillose; **HYPHAL SYSTEM** sarcodimitic; **HYPHAE** clamped; **CYSTIDIA**: lepto- or lamprocystidia, inamyloid; **BASIDIA** clavate-pedunculate, 2–4-spored; **BASIDIOSPORES** broadly ellipsoid, obscurely thin-walled, inamyloid, cyanophilous; **TYPE OF ROT**: white.

Monotypic: ***Climacocystis borealis*** (Fr.) Kotl. & Pouzar, *Česká Mykol.* 12: 103, 1958. — *Polyporus borealis* Fr., 1821. — Fig. 4.

**Fig. 4.** *Climacocystis borealis* (LE 202146-bis): A — tramal hyphae, B — cystidia, C — basidia, D — spores.

2. **FAERBERIA** Pouzar, *Česká Mykol.* 35(4): 187, 1981.

**BASIDIOCARPS** annual, cantharelloid, fleshy (hard ceraceous when dry); **HYMENOPHORE** radiately folded; **TRAMA** consisted of parallel arranged hyphae; **CONTEXT** fleshy to ceraceous; **HYPHAL SYSTEM** sarcodimitic; **HYPHAE** clamped; **CYSTIDIA**: lamprocystidia, inamyloid; **BASIDIA** cylindrical, 4-spored; **BASIDIOSPORES** ellipsoid, obscurely thin-walled, inamyloid, cyanophilous. Soil-inhabiting fungus.

Monotypic: ***Faerberia carbonaria*** (Alb. & Schwein.) Pouzar, *Česká Mykol.* 35(4): 187, 1981. — *Merulius carbonarius* Alb. & Schwein., 1805; *M. leucophaeus* Pers., 1825; *Cantharelus anthracophilus* Lév., 1841; *C. radicosus* Berk. & Broome, 1866.

**3. HOHENBUEHELIA** Schulz. in Schulz., Kanitz & Knapp, Verhandl. Zool.-Bot. Ges. Wien **16**: 45, 1866.

BASIDIOCARPS annual, pleurotoid — stipitate to petaloid or cyphelliform, fleshy with gelatinous layer; HYMENOPHORE lamellate to folded; TRAMA subregular; CONTEXT fleshy-gelatinous, bistratose; HYPHAL SYSTEM monomitic; HYPHAE clamped, thin- to thick-walled; CHEILOCYSTIDIA ampullate, thin-walled; PLEUROCYSTIDIA: lampro-, metuloids, inamyloid; BASIDIA clavate, constricted, 2–4-spored; BASIDIOSPORES ellipsoid to amygdaliform, obscurely thin-walled, inamyloid; TYPE OF ROT: white.

Type: *Agaricus petaloides* Bull. : Fr., 1821.

In our opinion *Phlebia lindtneri* (Pilát) Parmasto, having gelatinized cupulate basidiomata, radiately folded hymenophore, characteristic metuloids, and wide spores, quite satisfies the concept of *Hohenbuehelia* (see Spirin, Zmitrovich, 2004, Zmitrovich *et al.*, 2004).

In presented synopsis the genus includes smooth-spored species only, i.e. the subgenus *Reidia* Singer is excluded. The last one may be transferred provisionally to the genus *Crepidotus* (Crepidotaceae, Agaricales). Some less known American species are also excluded from discussion here.

**Hohenbuehelia atrocaerulea** (Fr.)

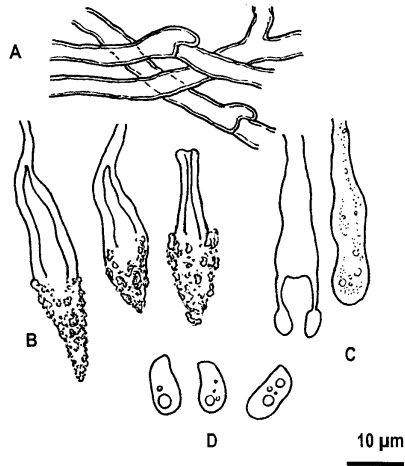
Singer, Lilloa **22**: 255, 1951.<sup>8</sup> — *Agaricus atrocaeruleus* Fr., 1821.

~ **culmicola** Bon, Doc. Mycol. **37–38**: 89, 1984.

~ **fluxilis** (Fr.) P.D. Orton, Not. Roy. Bot. Gard. Edinburgh **26**: 50, 1964. — *Agaricus fluxilis* Fr., 1821. — Fig. 5.

~ **geogenia** (DC. : Fr.) Gill., Hym. France: 339, 1874. — *Pleurotus petaloides* var. *geogenius* (DC. : Fr.) Pilát, 1935.

~ **leightonii** (Berk.) Watl., British Fungus Fl. **6**: 47, 1989. — *Pleurotus leightonii* (Berk.) Sacc., 1887.



**Fig. 5.** *Hohenbuehelia fluxilis* (LE 216183): A — tramal hyphae, B — lamprocystidia, C — 2-spored basidia, D — spores.

~ **lindtneri** (Pilát) Spirin in Zmitr. *et al.*, Folia Cryptogamica Petropolitana **1**: 71, 2004. — *Peniophora lindtneri* Pilát, Bull. Soc. Mycol. France **53**: 97, 1937. — *Phlebia lindtneri* (Pilát) Parmasto in Å. Strid, 1975; *Phlebia meruloidea* Parmasto, 1962.

~ **longipes** (Boud.) Moser in Gams, Kl. Krypt.-Fl. Mitteleur. IIB **2**: 108, 1967. — *Pleurotus longipes* Boud., 1905.

~ **mastrucata** (Fr.) Singer, Lilloa **22**: 255, 1951. — *Agaricus mastrucatus* Fr., 1821.

~ **petaloides** (Bull. : Fr.) Schulz. in Schulz., Kanitz & Knapp, Verhandl. Zool.-Bot. Ges. Wien **16**: 45, 1866. — *Agaricus petaloides* Bull. : Fr., 1821.

~ **reniformis** (Meyer : Fr.) Singer, Lilloa **22**: 255, 1951. — *Agaricus reniformis* Meyer : Fr., 1821.

~ **rickenii** (Kühner) P.D. Orton, Trans. British Myc. Soc. **43**: 176, 1960. — *Geopetalum rickenii* Kühner, 1954.

<sup>8</sup> Only widespread and palearctic species are listed. For the rest *Hohenbuehelia* species see Thorn & Barron (1986).

~ **silvana** (Sacc.) O.K. Miller, Centr. Stud. Fl. Mediterranea: 131, 1986. — *Pleurotus sylvanus* (Sacc.) Sacc., 1887.

**Hohenbuehelia spodoleuca** (Berk. & Broome) Zmitr. & Spirin comb. nov. — Bas.: *Marasmius spodoleucus* Berk. & Broome, Ann. Mag. Nat. Hist. **3**: 3, 1859; *Pleurotus cyphelliformis* (Berk.) Sacc., 1887.

~ **ungicularis** (Fr.) O.K. Miller, Centr. Stud. Fl. Mediterranea: 132, 1986. — *Agaricus unguicularis* Fr., 1821.

**Fam. 2. Fistulinaceae** Lotsy, Vortr. Bot. Stammesgesch. **1**: 695, 704, 1907. — *Sparassidaceae* Herter, 1910. — *Bjerkanderaceae* Jülich, 1982. — *Grifolaceae* Jülich, 1982. — *Hapalopilaceae* Jülich, 1982. — *Meripilaceae* Jülich, 1982.

BASIDIOCARPS wood-inhabiting, tyromycetoid or multipileate cantharelloid, rarely nodulose or corticioid; HYMENOPHORE bearing auxohymenium: tubular (sometimes polycyphelloid), spinose, tuberculate, or even, of waxy-fibrous consistency; TRAMA consisted of parallel arranged hyphae to irregular; CONTEXT film-like or fleshy-spongious to fleshy-coriaceous; HYPHAL SYSTEM submonomitic, sarcodi(tri)mitic, or subdi(tri)mitic; HYPHAE with regular to irregular clamp connections, with rectangular or candelabriform branching, often inflated; gloeopleroid elements (gliophores) present in many species; CYSTIDIA: lepto- or gloeo-, sometimes absent. BASIDIA clavate, pedunculate, or meruloid, 4-spored; BASIDIOSPORES ellipsoid to subglobose, mostly thick-walled, neither amyloid, nor dextrinoid, in most cases cyanophilous. TYPE OF ROT: brown, rarely white.

Type: *Fistulina* Bull. : Fr., 1821.

The family is very well determined by elongated hypobasidia, commonly clamped hyphae, producing peculiar binding-like elements into pileate basidiocarps, and obligately cyanophilous spores. Presence of gloeoplerous elements and occurrence of conidiogenesis in some species are peculiar too. Two genera are interesting in this respect — *Abortiporus* and *Granulobasidium*. The first one shows many characters similar with *Grifola* (we are inclined to reduce it to subgenus of *Grifola*) and *Loweomyces*, but differs by its longer, regularly narrowed basidia and presence of conidial state. This feature brings *Abortiporus* and *Granulobasidium* together. These genera share similar type of basidia and hyphal structure with simple-septate thick-walled hyphae in subiculum. In our opinion *Cymatoderma*, characterized by an analogous conidial state (Stalpers, 2000), should be compared with some genera of the Tricholomatales (*Xerulaceae*).

In presented synopsis, 16 genera are included into the family.

**A.** Hymenophore smooth or irregularly tuberculate. Basidiocarps corticioid or cantharelloid multilobed.

**B.** Basidiocarps corticioid, hymenophore tuberculate to smooth.

**C.** Basidia granulate. In context obligate conidial state of *Sporotrichopsis* type.  
Basidiospores angular-rugulose.

### 3. *Granulobasidium*

**C.** Basidia guttulate. Conidia in context absent. Basidiospores smooth or rugulose.

*Hypochnicium* (Hyphodermatales — not treated)

**B.** Basidiocarps cantharelloid multilobed, hymenophore smooth.

### 11. *Sparassis*

**A.** Hymenophore poroid or hydroid (with intermediates). Basidiocarps generally sessile, fleshy.

**D.** Hymenophoral tubes separated one from another, so hymenophore has polycyphelloid appearance.

### 2. *Fistulina*

**D.** Hymenophore of normal polyporoid appearance, or hydroid.

E. Basidia without a basal clamp. Mature basidiocarp enormously giant.

## 7. *Meripilus*

E. Basidia fibulate at base. Mature basidiocarp large to small, not giant.

F. Flesh reddish-violet and spores faintly brownish in KOH.

## 5. *Hapalopilus*

F. Flesh unchanging or purplish-red and spores unchanging in KOH. Size of fruitbodies varying.

G. Spores elongated, walls thickening comes to light in CB-medium only.

H. True intercalar skeletal present in context.

*Piptoporus* (Polyporineae)

H. Hyphal system sarco(di)trimitic.

I. Basidiocarps fomitoid. Inflated gloeopleroid hyphae present.

*Laricifomes* (Polyporineae)

I. Basidiocarps sessile, of tough-fleshy consistency.

*Osteina* (Polyporineae)

G. Spores broadly ellipsoid to subglobose, walls mostly expressively thickened.

J. Asexual sporulation as a rule present in situ.

K. Oblong hymenial gloecystidia occurring. Basidia more than 25  $\mu\text{m}$  long, stalked.

## 4. *Grifola* (*biennis*)

K. Basidia less than 20  $\mu\text{m}$  long, centrally constricted. Cystidia sometimes present as fusoid leptocystidia of hymenial origin.

*Oligoporus* (Polyporineae)

J. Asexual sporulation not seen and conspicuous gloecystidia absent.

L. Basidia up to 20  $\mu\text{m}$  in longest dimension; basidiocarps not changing in colour when brushed; spores moderately thick-walled and fairly cyanophilous; hyphae clear cyanophilous.

## 6. *Loweomyces*

L. Basidia longer than 20  $\mu\text{m}$  or basidiocarps reddish-brown when brushed.

M. Basidiocarps robustly sessile, fleshy, flesh often changing in colour in KOH, or reddish-brown when bruised.

## 1. *Aurantioporus*

M. Flesh not changing in colour in KOH or when bruised.

N. Spores thick-walled, strongly cyanophilous.

## 10. *Sarcodontia*

N. Spores with slightly thickened walls, reaction in CB vari-  
ous.

O. Basidiocarps mostly multipileate; when resupinate on underside of logs, then with black zone above tube layer.

## 4. *Grifola*

O. Basidiocarps normally resupinate, hymenophore hyd-  
noid or poroid; black zone absent.

P. Gloecystidia often present. Hymenophore hyd-  
noid.

## 9. *Radulodon*

P. Cystidial elements absent. Hymenophore poroid.

## 8. *Raduliporus*



### 1. **AURANTIOPORUS** Murrill, Bull. Torrey Bot. Club **32**: 487, 1905.

BASIDIOCARPS annual, tyromycetoid, robust, orange or reddish; HYMENOPHORE poroid; TRAMA irregular; CONTEXT sappy or fleshy, dried hard; HYPHAL SYSTEM sarcodimitic; HYPHAE thin- to thick-walled, with clamps, often encrusted by large crystalline concretions, context consisting of sclerified generative hyphae with scattered irregular clamps, gloeopleroid hyphae present; CYSTIDIA sometimes present as hymenial leptocystidia; BASIDIA pedunculate or meruloid; BASIDIOSPORES broadly ellipsoid to ovoid, with slightly thickened walls, cyanophilous. MITOSPORES present in context of *Aurantioporus fissilis*. TYPE OF ROT: white.

Type: *Polyporus pilotae* Schwein., 1832 = *Polyporus croceus* Pers. : Fr., 1821.

**Aurantioporus alborubescens** (Bourdot & Galzin) H. Jahn, Westf. Pilzbr. **9**: 99, 1973. — *Phaeolus albosordescens* Romell ssp. *alborubescens* Bourdot & Galzin, 1925; *Phaeolus alborubescens* (Bourdot & Galzin) Bourdot & Galzin, 1928.

~ **croceus** (Pers. : Fr.) Murrill, Mem. Am. Fl. **9**: 72, 1907. — *Polyporus croceus* Pers. : Fr., 1821; *Hapalopilus croceus* (Pers. : Fr.) Donk, 1933; *Aurantioporus pilotae* (Berk. & M.A. Curtis) Murrill, 1907.

~ **fissilis** (Berk. & M.A. Curtis) H. Jahn, Westf. Pilzbr. **9**: 99, 1973; *Polyporus fissilis* Berk. & M.A. Curtis, 1849; *Tyromyces fissilis* (Berk. & M.A. Curtis) Donk, 1933.

**Aurantioporus transformatus** (Núñez & Ryvar den) Spirin & Zmitr. comb. nov. — Bas.: *Tyromyces transformatus* Núñez & Ryvar den, Fungal Diversity **3**: 117, 1999.

### 2. **FISTULINA** Bull. : Fr., Syst. Mycol. **1**: 396, 1821.

BASIDIOCARPS wood inhabiting, sessile, fleshy; HYMENOPHORE tubular polycyphelloid, waxy; TRAMA irregular; CONTEXT fleshy-spongious; HYPHAL SYSTEM monomitic with gloeoplerous elements; HYPHAE fibulate, in context inflated and having rectangular branching; CYSTIDIA: gloeo-, of hyphoid appearance. BASIDIA clavate, constricted, 4-spored; BASIDIOSPORES broadly ellipsoid to subglobose, obscurely thick-walled, neither amyloid, nor dextrinoid, cyanophilous. MITOSPORIC STATE known as *Confistulina* (Stalpers, Vlug, 1983) occurring in flesh tissue of basidiomata as well as in superficial cap-like structures, as binucleate aleuria and chlamydospores of *Ptychogaster* type. TYPE OF ROT: brown-rotters.

Type: *Fistulina hepatica* Schaeff. : Fr., 1821.

**Fistulina hepatica** Schaeff. : Fr., Syst. Mycol. **1**: 396, 1821.

~ **radicata** Schwein., Schr. Nat. Geo. Leipz. **1**: 100, 1822; *F. pallida* Berk. & Ravenel, 1872.

### 3. **GRANULOBASIDIUM** Jülich, Persoonia **10**: 328, 1979.

BASIDIOCARPS annual, resupinate, membranaceous; HYMENOPHORE smooth, ceraceous-pellicular; TRAMA irregular; CONTEXT loose, soft-fibrous; HYPHAL SYSTEM sub-dimitic; HYPHAE clamped, thin-walled or with thickened walls, long fragments of sclerified simple-septate hyphae present in subiculum (like those of *Abortiporus biennis*); CYSTIDIA none; BASIDIA regularly clavate with very long basal part; BASIDIOSPORES thick-walled, warted, subglobose, cyanophilous. MITOSPORIC STATE present, of *Sporotrichopsis* type (Stalpers, 2000). TYPE OF ROT: white.

Monotypic: **Granulobasidium vellereum** (Ellis & Crag.) Jülich, Persoonia **10**: 328, 1979. — *Corticium vellereum* Ell. & Crag., 1885.

4. **GRIFOLA** Gray, Nat. Arr. British Pl. **1**: 643, 1821 emend. — *Bjerkandera* P. Karst., 1879. — *Myriadoporus* Peck, 1884. — *Polypilus* P. Karst., 1881. — *Abortiporus* Murrill, 1904. — *Irpicium* Bref., 1912. — *Heteroporus* Laz., 1916. — *Cladodendron* Laz., 1916. — *Cautinia* Maas Geest., 1967. — *Ryvar denia* Rajchenb., 1994.

BASIDIOCARPS sessile, tyromycetoid — multipileate to resupinate, of fleshy-fibrous consistency; HYMENOPHORE tubular, of cartilaginous, later subceraceous consistency; TRAMA irregular to regular; CONTEXT loose, soft-fibrous, often with dense zone above tube layer; HYPHAL SYSTEM sarcodi(tri)mitic; HYPHAE clamped, thin- to thickwalled, in context

HYPHAL SYSTEM sarcodi(tri)mitic; HYPHAE clamped, thin- to thickwalled, in context often inflated and producing strongly branched fibulate fragments with narrow lumen; CYSTIDIA present in one species as gloeocystidia; BASIDIA pedunculate, 4-spored; BASIDIOSPORES obscurely thick-walled, smooth, ellipsoid to subglobose, cyanophilous; MITOSPORIC STATE of *Sporotrichopsis* or *Ptychogaster* types present in some cases; TYPE OF ROT: white.

Type: *Polyporus frondosus* Dicks. : Fr., 1821.

In our opinion, *Bjerkandera* P. Karst. is congeneric with *Grifola* s. str. As seen in fig. 6–7, all anatomical structures of *Grifola frondosa* and *Bjerkandera fumosa* have similar shape and size. They have prolonged basidia, slightly thick-walled, guttulate, broad-ellipsoid, cyanophilous spores, and similar type of hyphal system.

In this connection, we emphasize specially the higher similarities between two genera in hyphal structure of context, in particular, the presence of strongly inflated thick-walled hyphae, producing thin protuberances with narrow lumen. The presence of these hyphae conditions loose, rather hard basidiocarps consistency. This hyphal structure completely corresponds to Corner's term "sarcodi(tri)mitic". As marked by Corner (1966: 176), "many generative hyphae soon became very thick-walled with linear lumen, and they interweave between the inflated skeletal cells, rendering the tissue so much tougher", and "these narrow, thick-walled hyphae simulate binding hyphae of the trimitic polypores, but they are septate as the generative hyphae".

Another similarities between two genera are rather large multipileate basidiocarps, which are stipitate in *Grifola frondosa*, but sessile to resupinate in *bjerkanderas*, the cartilaginous consistency of hymenophore which is well differentiated from flesh, etc.

In our opinion, it is possible to reduce *Abortiporus* sensu typi to *Grifola*, especially after detailed study of conidial state of *G. cretacea*, *G. campyla* (Rajchenberg, 1994), and *G. fumosa* (our observations). We consider *Abortiporus fractipes* belonging to *Loweomyces* (see Spirin, 2001), whereas *Heteroporus zonatus* Corner [= *Abortiporus zonatus* (Corner) Hattori, 2001a] can be more successfully united into separate genus of lentinoid affinity together with *Irpex foliaceodentatus* Nikol. (Irpicaceae Spirin & Zmitr., Polyporales — see Spirin, 2003).

**Grifola adusta** (Willd. : Fr.) Zmitr. & V. Malysheva comb. nov. — Bas.: *Polyporus adustus* Willd. : Fr., Syst. Mycol. 1: 363, 1821. — *Bjerkandera adusta* (Willd. : Fr.) P. Karst., 1879; *Boletus concentricus* Schumach., 1803; *Polyporus tristis* Pers., 1825; *P. subcinereus* Berk., 1839; *P. fumosogriseus* Cooke & Ellis, 1881; *P. cinerascens* Velen., 1922; *Gloeoporus nigrescens* Corner, 1989; *G. ubmrinus* Corner, 1989.

**Grifola biennis** (Bull. : Fr.) Zmitr. & V. Malysheva comb. nov. — Bas.: *Daedalea biennis* Bull. : Fr., Syst. Mycol. 1: 332, 1821; *Poria terrestris* Pers., 1801; *Sistotrema rufescens* Pers., 1801; *Polyporus distortus* Schwein. : Fr., 1821; *Irpex radicans* Fuckel, 1898; *I. hydriiformes* Velen., 1922.

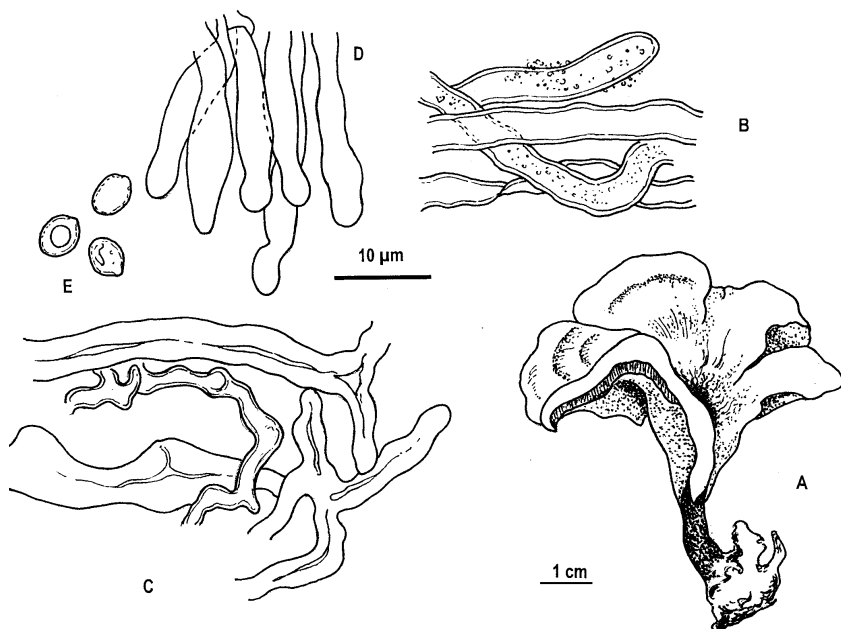
~ **campyla** (Berk.) G. Cunn., Bull. New Zeal. Dept. Sci. Industr. Res. 164: 92, 1965. — *Polyporus campylus* Berk., 1860; *P. rosularis* G. Cunn., 1948; *Tyromyces falcatus* G. Cunn., 1965.

**Grifola cretacea** (Lloyd) Zmitr. & V. Malysheva comb. nov. — Bas.: *Polyporus cretaceus* Lloyd, Mycol. Writ. 4: 302, 1915.

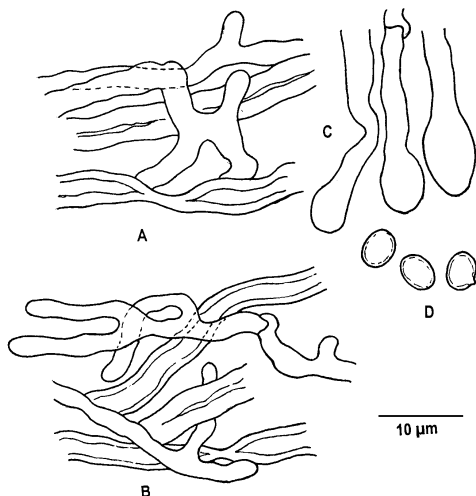
~ **frondosa** (Dicks. : Fr.) Gray, Nat. Arrang. British Pl. 1: 643, 1821. — *Polyporus frondosus* Dicks. : Fr., 1821. — Fig. 6.

**Grifola fumosa** (Pers. : Fr.) Zmitr. & V. Malysheva comb. nov. — Bas.: *Polyporus fumosus* Pers. : Fr., Syst. Mycol. 1: 367, 1821. — *Bjerkandera fumosa* (Pers. : Fr.) P. Karst., 1879; *Boletus salicinus* Bull., 1789; *Daedalea saligna* Fr., 1818; *Polyporus alligatus* Fr., 1828. — Fig. 7.

~ **sordulenta** (Mont.) Singer, Sydowia 15: 53, 1962. — *Polyporus sordulentus* Mont., 1842.



**Fig. 6.** *Grifola frondosa* (LE 30676): A — single pileus of multipileate basidiocarp, B — hyphal structure of pileal surface, C — hyphal structure of medullar tissue, D — hymenium, E — spores.



**Fig. 7.** *Grifola fumosa* (LE 26317): A — hyphal structure of pileus surface, B — hyphal structure of medullar tissue, C — hymenium, D — spores.

**5. HAPALOPILUS** P. Karst., Rev. Mycol. **3**: 18, 1881.

BASIDIOCARPS annual, tyromyces-toid — sessile to subresupinate, with superficial cuticle; HYMENOPHORE tubular, of fleshy-ceraceous consistency; TRAMA irregular; CONTEXT loose, soft-fibrous, hygrophanous; tissue brightly coloured, reddish to violet in alkalis; HYPHAL SYSTEM sarcodimitic; HYPHAE clamped, thin- to thick-walled; CYSTIDIA: lepto-, weakly differentiated; BASIDIA short clavate,  $\pm$ constricted, 4-spored; BASIDIOSPORES obscurely thick-walled, with yellowish contents, smooth, ellipsoid, faintly cyanophilous; TYPE OF ROT: white.

Type: *Polyporus nidulans* Fr., 1821 = *P. rutilans* Pers. : Fr., 1821.

**Hapalopilus aurantiacus** (Rostk.) Bondartsev & Singer, Ann. Mycol. **39**: 53, 1941. — *Polyporus aurantiacus* Rostk. in Sturm, D. Fl. **3** (17): 119, 1838.

~ **mutans** (Peck) Gilb. & Ryvardeen, N. Am. Polypores **1**: 337, 1986. — *Polyporus mutans* Peck, 1880.

~ **ochraceolateritius** (Bondartsev) Bondartsev & Singer, Ann. Mycol. **39**: 53, 1941. — *Poria ochraceolateritia* Bondartsev, 1940.

~ **olivascens** Corner, Beih. Nova Hedwigia **96**: 69, 1989.

~ **rubescens** Corner, Beih. Nova Hedwigia **96**: 70, 1989.

~ **rutilans** (Pers. : Fr.) Murrill, Bull. Torrey Bot. Club **31**: 416, 1904. — *Polyporus rutilans* Pers. : Fr., 1821; *P. nidulans* Fr., 1821.

~ **sibiricus** Núñez, Parmasto & Ryvardeen, Fungal Diversity **6**: 108, 2001.

For recent changes of the species concepts within this genus see Niemelä *et al.* (2005).

**6. LOWEOMYCES** (Kotl. & Pouzar) Jülich, Persoonia **11**: 424, 1982. — *Spongipellis* subgen. *Loweomyces* Kotl. & Pouzar, 1976.

BASIDIOCARPS annual, tyromycetoid, effused-reflexed, or subresupinate, solitary or imbricate, relatively thin, fleshy, upper surface of pileate species hispid or glabrous; HYMENOPHORE tubular, of ceraceous-fibrous consistency; TRAMA consisted of parallel arranged hyphae or irregular; CONTEXT unclearly duplex, has looser consistency than tubes; HYPHAL SYSTEM sarcodi(tri)mitic; HYPHAE with clamps, the walls are coloured in cotton-blue; quasi-binding hyphae sometimes present in context, gloeopleroid hyphae present or absent; CYSTIDIA present, thin-walled, inconspicuous; BASIDIA broadly-clavate, with abruptly narrowed base, 15–25 µm long; BASIDIOSPORES broadly ellipsoid to subglobose, with slightly thickened walls, cyanophilous. TYPE OF ROT: white.

Type: *Polyporus fractipes* Berk. & M.A. Curtis, 1872.

Two rare species of polypores also fit to Jülich's (1982) generic concept accepted in this paper. *Spongipellis sibiricus*, which was described as *Tyromyces sibiricus*, is characterized by subglobose cyanophilous spores and presence of leptocystidia (Kotiranta, Penzina, 2001), but has more shorter basidia than those of *Spongipellis* (= *Sarcodontia* in present synopsis). According to description by Kotiranta and Penzina (2001), this species is very similar to *Polyporus fractipes* Berk. & M.A. Curtis, the type of *Loweomyces*. The same morphological and anatomical characteristics of *Tyromyces subgiganteus* allow to include this species in the discussed genus.

**Loweomyces fractipes** (Berk. & M.A. Curtis) Jülich, Persoonia **11**: 424, 1982. — *Polyporus fractipes* Berk. & M.A. Curtis, 1872.

**Loweomyces sibiricus** (Penzina & Ryvardeen) Spirin comb. nov. — Bas.: *Tyromyces sibiricus* Penzina & Ryvardeen, Folia Crypt. Estonica **33**: 109, 1998. — *Spongipellis sibiricus* (Penzina & Ryvardeen) Kotiranta & Penzina, 2001.

**Loweomyces subgiganteus** (Berk. & M.A. Curtis) Spirin comb. nov. — Bas.: *Polyporus subgiganteus* Berk. & M.A. Curtis, Grevillea **1**: 49, 1872.

**7. MERIPILUS** P. Karst., Bidr. Känned. Finl. Nat. Folk **37**: 33, 1882.

BASIDIOCARPS annual, multipileate tyromycetoid, robust, fleshy, stipitate to sessile on a common base, of fleshy-fibrous consistency; HYMENOPHORE tubular, of cartilaginous, later subceraceous consistency; TRAMA irregular; CONTEXT loose, soft-fibrous; HYPHAL SYSTEM sarcodi(tri)mitic; HYPHAE irregularly clamped, thin- to thickwalled, in context often inflated and producing strongly branched fibulate fragments with very narrow lumen; CYSTIDIA: lepto-, of fusoid appearance; BASIDIA regularly clavate with prolonged hypobasidial segment, 4-spored, simple-septate at base; BASIDIOSPORES obscurely thick-walled, smooth, broadly ellipsoid to subglobose, cyanophilous; TYPE OF ROT: white.

Monotypic: **Meripilus giganteus** (Pers. : Fr.) P. Karst., Bidr. Känned. Finl. Nat. Folk **37**: 33, 1882. — *Polyporus giganteus* Pers. : Fr., 1821.

### 8. **RADULIPORUS** Spirin & Zmitr., gen. nov.

Fungi lignicoli, resupinati, porioidei. Hymenophorum tubulosum ad raduloideum, leniter coriaceum ad ceraceo-gelatinosum. Trama irregularis. Systema hypharum submonomiticum. Hyphae fibulatae et fibulis duplicatis praeditae, in subhymenio tenuitunicatae, in subiculo crassitunicatae. Leptocystidia desunt. Basidia longiclavata, constricta, cum 4 sterigmatibus. Sporae late ellipsoideae, tenuitunicatae, inamyloideae. Putredinem albidae provocant.

Typus: *Polyporus aneirinus* Sommerf. : Fr., 1828.

BASIDIOCARPS annual or persistent, porioid; HYMENOPHORE poroid, with wide shallow pores, sometimes splitting and becoming irpicoid, soft-corky to membranaceous or ceraceous; TRAMA irregular; CONTEXT relatively soft, fleshy-ceraceous or membranaceous; HYPHAL SYSTEM monomitic; HYPHAE clamped, thin- to moderately thick-walled, sometimes with verticillate clamps and crystalline encrustation; CYSTIDIA absent; BASIDIA clavate-pedunculate, constricted, often long (more than 25 µm); BASIDIOSPORES comma-shaped to broadly ellipsoid, sometimes with medial constriction, faintly cyanophilous. TYPE OF ROT: white.

This new genus is established to clarify taxonomic position of *Polyporus aneirinus* Sommerf. : Fr., commonly attributed to *Ceriporiopsis* Domański. In peculiar work on fungi of Poste-de-la-Baleine, Niemelä (1985b) noted that 'the taxonomy of the genus [*Ceriporiopsis*] is difficult and the species variable'. The combination of *P. aneirinus* by Spirin (2001) into *Radulodon* Ryvar den (see below) was based mainly on pedunculate shape of basidia and similarity in spore shape and size. *P. aneirinus* is close to some species of both *Radulodon* (albeit most species of the latter are resupinate hydroid and have gloeocystidia) and *Grifola* (this genus includes pileate species with cartilaginous hymenophore); thus, a new generic name for *P. aneirinus* is needed. Isolated position of this species is confirmed by molecular data (De Koker *et al.*, 2003). Type species of *Ceriporiopsis* — *C. gilvescens* (Bres.) Domański — differs from *P. aneirinus* by narrow suballantoid spores, relatively small basidia, and rod-shaped reddish crystals on basal hyphae.

Monotypic: **Raduliporus aneirinus** (Sommerf. : Fr.) Spirin & Zmitr. comb. nov. — *Polyporus aneirinus* Sommerf. : Fr., Elench. Fung. **1**: 123, 1828; *Antrodia serena* P. Karst., 1881; *Poria wasjuganica* Pilát, 1936. — Fig. 8.

9. **RADULODON** Ryvar den, Can. J. Bot. **50**: 2073, 1972 emend. Stalpers, 1998. — *Pseudogagarobasidium* J.C. Jang & Chen, 1985.

BASIDIOCARPS annual or persistent, odontoid; HYMENOPHORE hydroid, moderately ceraceous or membranaceous; TRAMA consisted of parallel arranged hyphae; CONTEXT relatively soft, fleshy-ceraceous or membranaceous, hard when dry; HYPHAL SYSTEM sarcodimitic; HYPHAE with clamps (clampless in *Radulodon casearius*), quasi-binding hyphae sometimes present in context, gloeopleroid hyphae present or absent; CYSTIDIA as gloeocystidia present in some species; BASIDIA clavate-pedunculate, often with constrictions, of variable sizes (15–40 × 5–10 µm); BASIDIOSPORES broadly ellipsoid to subglobose, with slightly thickened wall, cyanophilous. TYPE OF ROT: white.

Type: *Radulodon americanus* Ryvar den, 1972.

Primary differences of this genus from *Loweomyces* is basidia shape and size. Basidia of *Loweomyces* are short clavate, abruptly narrowed to the base, while they are pedunculate, with one or some constrictions in the species of *Radulodon*. Another distinction appears in cystidial elements. Species of *Loweomyces* have "true" (however, sometimes very difficult to observe) hymenial cystidia, while these ones of *Radulodon* arise from overgrown basidia (as cystidia of *Hypochnicium erikssonii*). Several additional similarities between *Radulodon* and *Loweomyces*

is in spore shape and size (broadly-ellipsoid to subglobose, cyanophilous in many species) and presence of quasi-binding hyphae (Stalpers, 1998; Spirin, 2001).

**Radulodon americanus** Ryvarden, Can. J. Bot. **50**: 2073, 1972.

~ **calcareus** (Cooke & Massee) Jülich, Persoonia **9**: 466, 1978. — *Hydnum calcareum* Cooke & Massee, 1892.

~ **casearius** (Morgan) Ryvarden, Can. J. Bot. **50**: 2075, 1972.

~ **copelandii** (Pat.) N. Maekawa, Rep. Tottori Mycol. Inst. **31**: 93, 1993. — *Hydnum cope-landii* Pat., 1914; *Acia licentii* Pilát, 1940.

~ **erikssonii** Ryvarden, Can. J. Bot. **50**: 2075, 1972.

~ **pseudomucidus** (Petch) Stalpers, Folia Crypt. Estonica **33**: 137, 1998. — *Hydnum pseudomucidum* Petch, 1916.

~ **subvinosus** (Berk. & Broome) Stalpers, Folia Crypt. Estonica **33**: 137, 1998. — *Hydnum subvinosum* Berk. & Broome, 1875; *Pseudolagarobasidium leguminicola* J.C. Jang & Chen, 1985.

10. **SARCODONTIA** Schulz. in Schulz., Kanitz & Knapp, Verhandl. Zool.-Bot. Ges. Wien **16**: 41, 1866 emend. Spirin, 2001. — *Spongipellis* Pat., 1887. — *Irpiciporus* Murrill, 1904.

BASIDIOCARPS annual or persistent, tyromycetoid to poroid-odontoid, pileal surface tomentose to glabrous; HYMENOPHORE poroid or hydroid fleshy-fibrous to fleshy-ceraceous; CONTEXT duplex, with harder lower part and looser upper layer; HYPHAL SYSTEM sarcodi(tri)mitic; hyphae fibulate, in context bear inflations up to 15 µm in diam, gloeopleroid hyphae present or absent; CYSTIDIA as fusoid leptocystidia present or absent; BASIDIA clavate, often with elongated base, of variable sizes (20–50 × 6–10 µm); BASIDIOSPORES thick-walled, hyaline, smooth, often with central oil-drop, broadly-ellipsoid to subglobose, strongly cyanophilous. TYPE OF ROT: white.

Type: *Sarcodontia mali* Schulz., 1866 = *Hydnum croceum* Schwein. : Fr., 1828.

**Sarcodontia delectans** (Peck) Spirin, Mycena **1**: 68, 2001. — *Polyporus delectans* Peck, 1884; *Leptoporus bredecelensis* Pilát, 1938; *Spongipellis litschaueri* Lohweg, 1931.

~ **pachyodon** (Pers.) Spirin, Mycena **1**: 68, 2001. — *Hydnum pachyodon* Pers., 1825; *H. schestunowii* Nikol., 1950.

~ **setosa** (Pers.) Donk, Mycologia **44**: 262, 1952. — *Hydnum setosum* Pers., 1825; *H. croceum* Schwein. : Fr., 1828; *H. luteocarneum* Secr., 1833; *Sarcodontia mali* S. Schulz., 1866; *Hydnum schiedermayri* Heufler, 1870; *H. amplissimum* Berk. & M.A. Curtis in Berk., 1873; *H. subvelutinum* Berk. & M.A. Curtis in Berk., 1873; *H. earleanum* Sumstine, 1904; *H. foetidum* Velen., 1922.

~ **spumea** (Sowerby : Fr.) Spirin, Mycena **1**: 68, 2001. — *Polyporus spumeus* Sowerby : Fr., 1821.

**Sarcodontia unicolor** (Schwein.) Zmitr. & Spirin comb. nov. — Bas.: *Boletus unicolor* Schwein., Schr. Nat. Ges. Leipz. **1**: 97, 1822.

11. **SPARASSIS** Fr., Syst. Mycol. **1**: 464, 1821.

BASIDIOCARPS annual, multilobed cantharelloid, with robust stipe-like base, of fleshy-ceraceous consistency; HYMENOPHORE even, as thick ceraceous layer underside of the lobes; TRAMA irregular; CONTEXT fleshy; HYPHAL SYSTEM monomitic with gloeoplerous hyphae; HYPHAE regularly (in subhymenium) to irregularly (in context) clamped, thin- to thick-walled, in context inflated up to 18 µm in diam; CYSTIDIA: gloeo-, of hyphoid appearance; BASIDIA clavate, with prolonged hypobasidial segment, 4-spored, fibulate at base; BASIDIOSPORES obscurely thick-walled (“with distinct wall” according to Yurchenko, 2002), smooth, broadly ellipsoid to subglobose, cyanophilous. TYPE OF ROT: brown.

Type: *Sparassis crispa* Wulfen : Fr., 1821.

Some other species, besides the type, were described on the base of deviating basidiocarp macromorphology (*S. laminosa* Fr., *S. spathulata* Schwein. : Fr., etc.), or specific substrata (*S. nemecii* Pilát & Veselsky). Their nuclear and mitochondrial ribosomal DNA and RNA polymerase sequences were intensively studied (Wang *et al.*, 2004). In their anatomy, however, they seem to be rather a continuum. Therefore, the *species concept* in higher fungi should be specially debated (see Zmitrovich, Spirin, 2005).

**Sparassis brevipes** Krombh., Nat. Abb. Beschr.: 22, 1834; ?*S. laminosa* Fr., 1836.

~ **crispa** Wulfen : Fr., Syst. Mycol. 1: 465, 1821; *S. herbstii* Peck, 1895; *S. radicata* Weir, 1917; *S. nemecii* Pilát & Veselsky, 1932; ?*S. spathulata* Schwein. : Fr., 1828.

~ **cystidiosa** Desjardin & Wang in Desjardin, Wang, Binder & Hibbett, Index of Fungi 7: 655, 2004.

**Fam. 3. Laetiporaceae** Jülich, Bibl. Mycol. 85: 375, 1982. — *Phaeolaceae* Jülich, 1982.

BASIDIOCARPS wood inhabiting, tyromycetoid to poroid; HYMENOPHORE tubular, of waxy-fibrous consistency; TRAMA irregular; CONTEXT fleshy-spongious to fleshy-coriaceous; HYPHAL SYSTEM sarcodi(tri)mitic or subdi(tri)mitic; HYPHAE clampless, in context regularly inflated, robustly thick-walled; CYSTIDIA: lepto-, sometimes absent; BASIDIA clavate, weakly constricted, 4-spored; BASIDIOSPORES ellipsoid to subglobose, obscurely thin-walled or with thickened walls, neither amyloid, nor dextrinoid, cyanophilous reaction varying. TYPE OF ROT: brown, active.

Type: *Laetiporus* Murrill, 1904.

The family consists of the species with robust sessile fleshy basidiocarps, simple septate hyphae, roughly thick-walled in context, and characteristic rot pattern. Four genera can be included in the presented synopsis.

**A. Basidiocarps sessile, fleshy.**

**B. Flesh xanthochroic or reddish in KOH.**

**C. Flesh xanthochroic, basidiocarps large in mature state.**

**2. Phaeolus**

**C. Flesh reddish in KOH, basidiocarps medium-sized.**

**3. Pycnoporellus**

**B. Flesh unchanged under KOH.**

**1. Laetiporus**

**A. Basidiocarps resupinate, robustly poroid.**

**4. Wolfiporia**

**1. LAETIPORUS** Murrill, Bull. Torrey Bot. Club 31: 607, 1904. — *Pseudophaeolus* Ryvarden, 1975.

BASIDIOCARPS annual, robustly tyromycetoid, as a rule multipileate, fleshy; HYMENOPHORE tubular, of waxy-fibrous consistency; TRAMA irregular; CONTEXT fleshy-spongious, homogeneous; HYPHAL SYSTEM sarcodi(tri)mitic; HYPHAE clampless, in context regularly inflated and robustly thick-walled; CYSTIDIA: lepto-, sometimes absent. BASIDIA clavate, weakly constricted, 4-spored; BASIDIOSPORES ellipsoid to subglobose, obscurely thin-walled or with thickened walls, neither amyloid, nor dextrinoid, cyanophilous reaction varying. MITOSPORIC STATE of two types: 1) *Sporotrichum versisporum* (Lloyd) Stalpers (chlamydospores produced by aerial mycelium), and 2) *Ptychogaster aurantiacus* Pat. (chlamydospores produced in closed sporocarps). TYPE OF ROT: brown.

Type: *Polyporus sulphureus* Bull. : Fr., 1821.

The closest relative of this genus is *Phaeolus* Pat. *Laetiporus baudonii* (Pat.) Ryvarden, the member of the genus *Pseudophaeolus* Ryvarden (1991), can be considered here as intermediate species.

**Laetiporus baudonii** (Pat.) Ryvarden, Syn. Fung. **5**: 215, 1991. — *Polyporus baudonii* Pat., 1914.

~ **cincinnatus** (Morgan) Burds., Banik & Volk in Banik *et al.*, Folia Cryptog. Estonica **33**: 13, 1998. — *Polyporus cincinnatus* Morgan, 1885.

~ **persicinus** (Berk. & M.A. Curtis) Gilb., Mycotaxon **12**: 385, 1982. — *Polyporus persicinus* Berk. & M.A. Curtis, 1872.

~ **portentosus** (Berk.) Rajchenb., Nord. J. Bot. **15**: 114, 1995. — *Polyporus portentosus* Berk., 1844.

~ **sulphureus** (Bull. : Fr.) Murrill, Mycologia **12**: 11, 1920. — *Polyporus sulphureus* Bull. : Fr., 1821; *Agaricus speciosus* Batt., 1755.

## 2. PHAEOLUS Pat., Essai Tax. Hymen.: 86, 1900.

BASIDIOCARPS tyromycetoid, as a rule multipileate, fleshy; HYMENOPHORE tubular, of waxy-fibrous consistency; TRAMA irregular; CONTEXT fleshy-spongious, hygrophanous in fresh, lacunose, with xanthochroic reaction; HYPHAL SYSTEM subdi(tri)mitic with gloeoplerous hyphae; HYPHAE clampless, in context robustly thick-walled and melanized; CYSTIDIA: gloeo-, hyphoid. BASIDIA clavate to utriform, constricted, 4-spored; BASIDIOSPORES broadly ellipsoid, thick-walled, with yellowish contents and central oildrop, neither amyloid, nor dextrinoid, weakly cyanophilous. TYPE OF ROT: brown.

Monotypic: **Phaeolus schweinitzii** (Fr.) Pat., Essai Tax. Hymen.: 86, 1900. — *Polyporus schweinitzii* Fr., 1821.

**3. PYCNOPORELLUS** Murrill, Bull. Torrey Bot. Club **32**: 489, 1905. — *Aurantioporellus* Murrill, 1905.

BASIDIOCARPS annual, medium-sized, tyromycetoid to poriid; HYMENOPHORE tubular, of soft ceraceous consistency; TRAMA irregular; CONTEXT fleshy-spongious, hygrophanous in fresh, reddening in alkalis; HYPHAL SYSTEM subdimitic; HYPHAE clampless, in context robustly thick-walled and yellowish; CYSTIDIA: lepto-, fusoid to cylindrical. BASIDIA long clavate, constricted, 4-spored; BASIDIOSPORES narrowly ellipsoid, rather thin-walled, hyaline to slightly yellowish in KOH, neither amyloid, nor dextrinoid; cyanophilous reaction varying. TYPE OF ROT: brown.

Type: *Polyporus fibrillosus* P. Karst., 1859 = *Hydnum fulgens* Fr., 1852.

**Pycnoporellus alboluteus** (Ellis & Everh.) Kotl. & Pouzar, Česká Mykol. **17**: 174, 1963. — *Fomes alboluteus* Ellis & Everh., 1895.

~ **fulgens** (Fr.) Donk, Persoonia **6**: 216, 1971. — *Hydnum fulgens* Fr., 1852; *Polyporus fibrillosus* P. Karst., 1859.

## 4. WOLFIPORIA Ryvarden & Gilb., Mycotaxon **19**: 141, 1984.

BASIDIOCARPS perennial, poriid with free margin; HYMENOPHORE tubular, of waxy-coriaceous consistency; TRAMA irregular; CONTEXT fleshy-coriaceous, not changing in alkalis; HYPHAL SYSTEM subdimitic; HYPHAE clampless, in context peculiarly inflated and robustly thick-walled, melanized; CYSTIDIA none; BASIDIA clavate, obscurely constricted, 4-spored; BASIDIOSPORES ellipsoid, obscurely thin-walled, yellowish in KOH, neither amyloid, nor dextrinoid; cyanophilous reaction varies. TYPE OF ROT: brown.

Type: *Poria cocos* (Schwein.) Wolf., 1922.

**Wolfiporia cocos** (Schwein.) Ryvarden & Gilb., Mycotaxon **19**: 141, 1984. — *Poria cocos* (Schwein.) Wolf., 1922.

~ **curvispora** Y.-C. Dai, Ann. Bot. Fennici **35**: 151, 1998.



~ **dilatohypha** Ryvarden & Gilb., Mycotaxon **19**: 141, 1984.

**Fam. 4. Phanerochaetaceae** (J. Erikss.) Jülich, Bibl. Mycol. **85**: 384, 1982. — *Corticaceae* subfam. *Phanerochaetoideae* (J. Erikss. per Jülich) Parmasto, 1986. — *Climacodontaceae* Jülich, 1982.

BASIDIOCARPS wood inhabiting or lichenized, tyromycetoid, stereoid, merulioid, poroid, odontoid, corticioid (often rhizomoid); HYMENOPHORE bearing auxo- or leptohymenium: folded, tubular, spinose, tuberculate to even, of ceraceous consistency; TRAMA consisted of parallel arranged hyphae to irregular; CONTEXT film-like, waxy or fleshy without gelatinized strata; HYPHAL SYSTEM monomitic, submonomitic, pseudodimitic; HYPHAE simple septate or with verticillate clamp connections (except of *Porostereum* and some *Climacodon* species with irregularly clamped hymenial hyphae), with athelioid, rectangular, or candelabriform branching, often inflated towards the septa; CYSTIDIA: lepto- or lampro-, sometimes absent. BASIDIA clavate to long-clavate or merulioid, 4-spored; BASIDIOSPORES ellipsoid, cylindrical, amygdaliform, or suballantoid, rather thin-walled, neither amyloid, nor dextrinoid, cyanophilous reaction varies. TYPE OF ROT: white, as exception brown (*Leptoporus mollis*, *Ceraceomerulius albotramineus*).

Type: *Phanerochaete* P. Karst., 1889.

The family is connected with Faerberiaceae via the genera *Australohydnum*, *Phanerochaete*, or *Climacodon*.

We differ the terms leptocystidia and pseudocystidia according to anatomical structures in this family. The first ones originate from thin-walled subhymenial hyphae, while the latter ones are born by supporting hyphae of tramatic origin. In presented synopsis, 13 genera can be included.

**A.** Subhymenial hyphae regularly or irregularly clamped.

**B.** Basidiocarps tyromycetoid with toothed hymenophore, sessile or imbricate.

**3. Climacodon**

**B.** Basidiocarps stereoid.

**15. Porostereum**

**A.** Subhymenial hyphae without clamps; basidiocarps varying in shape and sizes, but hymenial surface not hydroid.

**C.** Lamprocystidia present.

**D.** Hyphae with narrow lumen; basidiocarps merulioid to corticioid.

**1. Australohydnum**

**D.** Hyphae with normal lumen; basidiocarps corticioid.

**14. Phanerochaete**

**D'.** Genetartive hyphae with normal lumen, pseudoskeletal hyphae with narrow lumen; basidiocarps stereoid.

**8. Hjortstamia**

**C.** With pseudo- or leptocystidia, or without them.

**E.** Hymenophore truly poroid.

**F.** Basidiocarps sessile, fleshy, hyphae thick-walled, always without clamps.

**12. Leptoporus**

**F.** Basidiocarps poroid (one species merulioid infundibuliform), only basal hyphae with thickened walls, sometimes clamped. Spores allantoid to cylindrical; chlamydospores and leptocystidia absent.

**6. Gloeoporus**

**F'.** Basidiocarps with large, often irregular pores. Leptocystidia present. Spores ellipsoid or cylindrical (if so, chlamydospores present).

**5. Emmia**

E. Hymenophore smooth to odontoid. Basidiocarps resupinate.

G. Basidia up to 20  $\mu\text{m}$  long.

H. Basidia thick-walled at base, with pseudocystidia.

13. **Odonticium**

H. Basidia thin-walled at base, with leptocystidia.

9. **Hydnothlebia**

G. Basidia longer than 20  $\mu\text{m}$ .

I. Hymenophore grandinioid, aculei tips with crystalline encrustation; true cystidia absent.

10. **Hyphodermella**

I. Hymenophore grandinioid in some species, aculei tips without encrustation. Cystidia present or absent.

J. With pseudocystidia; basal hyphae grossly thick-walled and candelabrum-like in subiculum.

7. **Grandiniella**

J. Cystidia lacking or present as leptocystidia; basal hyphae thin- to moderately thick-walled, branched at acute to right angles.

K. Hymenium pellicular (leptohymenium); tissue loose, leptocystidia usually present.

11. **Leptochaete**

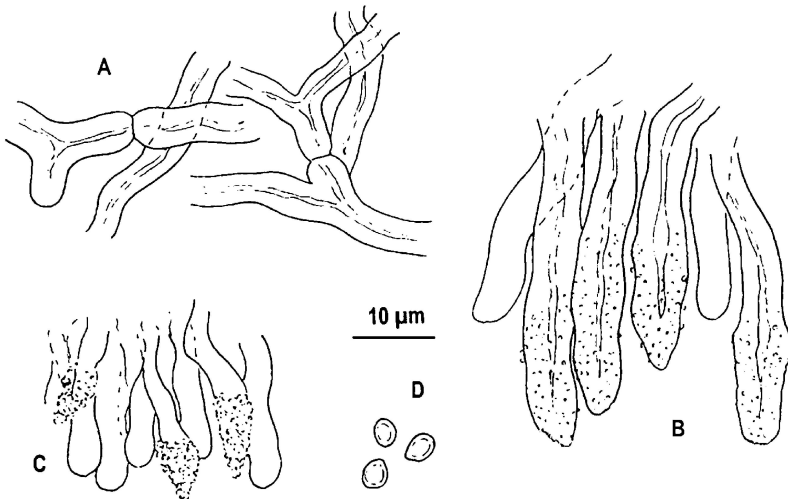
K. Hymenium firm waxy (auxohymenium); leptocystidia absent or indistinct.

L. Spores cylindrical to amygdaliform; contextual hyphae not wider than epibasidial segment.

2. **Byssomerulius**

L. Spores ellipsoid; contextual hyphae wider than epibasidial segment.

4. **Efibula**



**Fig. 8.** *Australohydnum dregeanum* (LE 169071): A — subicular hyphae, B — fascicle of macrocystidia, C — hymenium with enclosed lamprocystidia, D — spores.

1. **AUSTRALOHYDNUM** Jülich, *Persoonia* **10**: 137–138, 1978 emend. — *Castanoporos* Ryvarden, 1991.

BASIDIOCARPS annual, wood inhabiting, merulioid or corticioid; HYMENOPHORE bearing auxohymenium: folded or tuberculate, of ceraceous consistency; TRAMA irregular to  $\pm$ regular; CONTEXT film, rather dense; HYPHAL SYSTEM submonomitic; HYPHAE simple septate, thick-walled, with very narrow lumen; CYSTIDIA: lampro-, both of tramatic and hymenial origin. BASIDIA long-clavate, constricted, 4-spored; BASIDIOSPORES ellipsoid to subballantoid, with distinct walls, neither amyloid, nor dextrinoid, obscurely cyanophilous. TYPE OF ROT: white.

Type: *Hydnum griseofuscescens* Reichardt., 1866 = *Corticium dregeanum* Berk., 1846.

**Australohydnum castaneum** (Lloyd) Zmitr., V. Malysheva & Spirin comb. nov. — Bas.: *Merulius castaneus* Lloyd, *Mycol. Writ.* **4**: 555, 1916.

~ **dregeanum** (Berk.) Hjortstam & Spooner, *Kew Bull.* **45**: 312, 1990. — *Corticium dregeanum* Berk., 1846; *Hydnum griseofuscescens* Reichardt, 1866. — Fig. 8.

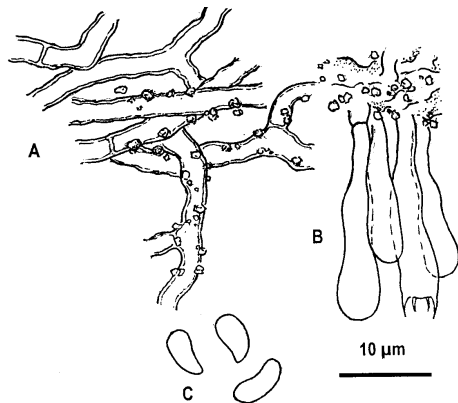
2. **BYSSOMERULIUS** Parmasto, *Eesti NSV Tead. Akad. Toim. Biol.* **16**: 383, 1967 versus *DICTYONEMA* C. Ag., 1821: nomen conservandum proponitur! — *Ceraceomerulius* (Parmasto) J. Erikss. & Ryvarden, 1973 sensu typi.

BASIDIOCARPS wood-inhabiting or lichenized, merulioid (infundibuliform to resupinate) or corticioid; HYMENOPHORE bearing auxohymenium: folded, raduloid, tuberculate to even, of ceraceous consistency; TRAMA irregular to more or less regular; CONTEXT wadded, rather dense; HYPHAL SYSTEM monomitic; HYPHAE simple septate or with rare double clamp-connections, thin- to slightly thick-walled, regularly branched at sharp angles; contextual hyphae not inflated, not wider than epibasidial segment; CYSTIDIA none; BASIDIA long-clavate, constricted, thin-walled at base, 4-spored; BASIDIOSPORES cylindrical, slightly curved (of subballantoid or sigmoid appearance), in some cases amygdaliform, thin-walled, neither amyloid, nor dextrinoid, acyanophilous. TYPE OF ROT: white.

Type: *Merulius corium* Pers.: Fr., 1828.

For more detailed data we refer to our recent paper (Spirin, Zmitrovich, 2004).

Concerning lichenized species, Erast Parmasto in his intensive studies of lichen "genus" *Dictyonema* (1978) showed that the only two fungal species are involved in the lichens as mycobionts: one is close to *Byssomerulius corium*, another to '*Phanerochaete*' *tuberculata*. There are however some specific features for both fungi in spore size and hymenophore construction. Therefore, having transferred these organisms in fungal system, we should place them into the genus *Byssomerulius* as three independent species — *B. irpicinus*, *B. moorei*, and *B. pavonius*.



**Fig. 9.** *Byssomerulius jose-ferreirae* (LE 203552): A — subicular hyphae, B — hymenium, C — spores.

**Byssomerulius avellaneus** (Bres.) Parmasto [in sched.] ex Spirin & Zmitr., *Nov. Syst. Pl. non Vasc.* **37**: 176, 2003. — *Corticium avellaneum* Bres. in Bourdot & Galzin, 1911.

~ **corium** (Pers.: Fr.) Parmasto, Eesti NSV Tead. Akad. Toim. Biol. **16**: 383, 1967. — *Merulius corium* Pers.: Fr., 1828; *Auricularia pallida* Schumach., 1801; *Boletus purpurascens* DC., 1815; *Thelephora ochroleuca* Fr.: Fr., 1821; *Merulius confluens* Schwein.: Fr., 1828; *Phlebia deglubens* Berk. & M.A. Curtis ex Cooke, 1891.

~ **flavidoalbus** (Corner) Hjortstam, Mycotaxon **54**: 183, 1995. — *Merulius purpurascens* var. *flavidoalbus* Corner, 1971.

~ **hirtellus** (Burt) Parmasto, Eesti NSV Tead. Akad. Toim. Biol. **16**: 384, 1967. — *Merulius hirtellus* Burt, 1917; *Byssomerulius armeniacus* Parmasto, 1967.

**Byssomerulius irpicinus** (Mont.) Zmitr. & V. Malysheva comb. nov. — Bas.: *Dictyonema irpicinum* Mont., Ann. Sc. Nat. III Bot. **10**: 119, 1848; *Cora ligulata* Kremp., 1875.

~ **jose-ferreirae** (D.A. Reid) Zmitr., Mikol. Fitopat. **35**: 13, 2001. — *Corticium jose-ferreirae* D.A. Reid, 1965; *Phanerochaete pallida* Parmasto, 1967 ex part. — Fig. 9.

~ **miniatus** (Wakef.) Hjortstam, Windahlia **17**: 56, 1987. — *Merulius miniatus* Wakef., 1931.

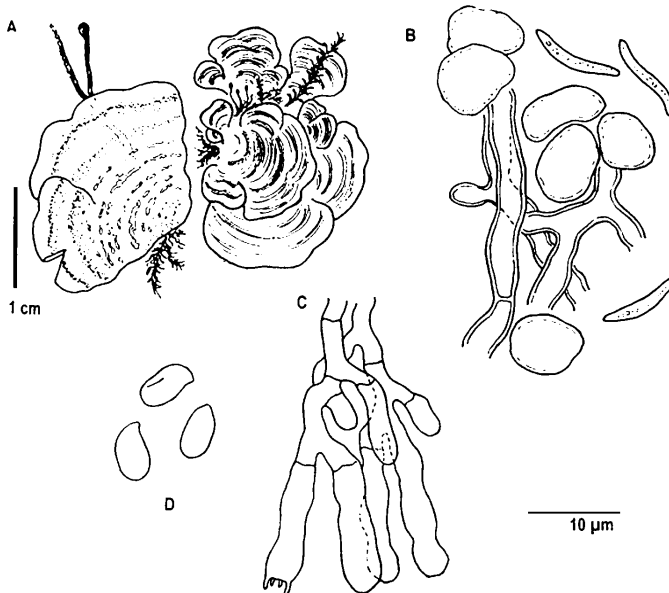
**Byssomerulius moorei** (Nyl.) Zmitr. & V. Malysheva comb. nov. — Bas.: *Leptogidium moorei* Nyl., Lich. Japon: 14, 1890; *Dictyonema japonicum* Asah., 1944.

**Byssomerulius pavonius** (Sw.) Zmitr. & V. Malysheva comb. nov. — Bas.: *Thelephora pavonia* Sw., Fl. Ind. Occid. **3**: 1930, 1806; *Ulva montana* Sw., 1788 nec Lightf., 1777; *Hydnum sericeum* Sw., 1788; *Dematium thelephora* Spreng., 1820; *Thelephora glabrata* Spreng., 1820; *Cilicia aeruginosa* Fr., 1825; *Gyrolophium elegans* Kunze in Krombh., 1831; *Cora gyrolophia* Fr., 1838; *C. bovei* Speg., 1888; *Corella brasiliensis* Vain., 1890. — Fig. 10.

~ **pirottae** (Bres.) Hjortstam, Windahlia **17**: 56, 1987. — *Odontia pirottae* Bres., 1893.

~ **sordidus** (Berk. & M.A. Curtis) Hjortstam, Mycotaxon **54**: 184, 1995. — *Merulius sordidus* Berk. & M.A. Curtis ex Cooke, 1891.

~ **sulphureus** (Burt) Lindsey in Gilb. *et al.*, Arizona Agric. Exp. St. Univ. Arizona Bull. **209**: 5, 1974. — *Merulius sulphureus* Burt, 1917.



**Fig. 10.** *Byssomerulius pavonius* (LE 168653): A — infundibuliform thalli, B — abhymental hyphae with symbiotic algae (Cyanophyta), C — basidial clusters, D — spores.

### 3. CLIMACODON P. Karst., Rev. Mycol. 3: 20, 1881.

BASIDIOCARPS annual, tyromycetoid, multipileate, fleshy (tough fibrous when dry), hygrophanous; HYMENOPHORE bearing auxohymenium: toothed, of ceraceous consistency; TRAMA consisted of  $\pm$ parallel arranged hyphae; CONTEXT sap-fleshy to fibrillose; HYPHAL SYSTEM monomitic; HYPHAE irregularly clamped, thin- to thick-walled, in context strongly inflated; CYSTIDIA: lampro- or metuloids, slightly protruding the hymenium; BASIDIA clavate with prolonged basal part, 4-spored; BASIDIOSPORES broadly ellipsoid, obscurely thin-walled, inamyloid, acyanophilous; TYPE OF ROT: white.

Type: *Hydnum septentrionale* Fr., 1821.

General shape and branching pattern of the hyphae are close to those of the most species of resupinate Phanerochaetaceae, but this genus is characterized by scattered irregular minute clamps in subhymenial layer. Clampless genus *Australohydnum* is similar, but differs by resupinate basidiocarps without inflated contextual hyphae and strongly thickened hyphal walls. The cystidia are comparable with those of *Climacocystis* (Faerberiaceae), however the last differs by narrower hyphae with regular clamps of normal appearance.

**Climacodon annamensis** (Har. & Pat.) Maas Geest., Persoonia 7: 546, 1974. — *Mycoleptodon annamensis* Har. & Pat., 1914.

~ **chlamydocystis** Maas Geest., Verh. Koninkl. Ned. Akad. Wetensch., Nat. 60(3): 132, 1971.

~ **dubitativus** (Lloyd) Ryvarden, Mycotaxon 44(1): 129, 1992. — *Polystictus dubitativus* Lloyd, 1922; *Climacodon efflorescens* Maas Geest., 1971.

~ **pulcherrimus** (Berk. & M.A. Curtis) Nikol., Fl. Pl. Crypt. U.R.S.S. 6: 194, 1961. — *Hydnum pulcherrimum* Berk. & M.A. Curtis, 1849.

~ **roseomaculatus** (Henn. & E. Nyman) Jülich, Bibl. Mycol. 85: 400, 1982. — *Hydnum roseomaculatum* Henn. & E. Nyman, 1900.

~ **sanguineus** (Beeli) Maas Geest., Verh. Koninkl. Ned. Akad. Wetensch., Nat. 60(3): 131, 1971. — *Hydnum sanguineum* Beeli, 1926.

~ **septentrionalis** (Fr.) P. Karst., Rev. Mycol. 3: 20, 1881. — *Hydnum septentrionale* Fr., 1821.

### 4. EFIBULA Sheng H. Wu, Acta Bot. Fennica 142: 21, 1990 emend.

BASIDIOCARPS annual, wood-inhabiting, corticioid with adherent, often rhizomorphic margin; HYMENOPHORE bearing auxohymenium: even to tuberculate or aculeate, of ceraceous consistency; TRAMA irregular, but subhymenium dense (*textura porrecta*); CONTEXT as thin layer of vaxy consistency (*textura intricata*); HYPHAL SYSTEM monomitic; HYPHAE simple septate or in subiculum with double clamp connections, thin- or with slightly thickened walls, regularly branched at sharp angles, in lower subiculum inflated, wider than epibasidial segment; CYSTIDIA none; BASIDIA long-clavate, clearly constricted, thin-walled at base, 4-spored; BASIDIOSPORES broadly ellipsoid, as a rule guttulate, thin-walled, neither amyloid, nor dextrinoid, acyanophilous. TYPE OF ROT: white.

Type: *Efibula tropica* Sheng H. Wu, 1990.

The closest relative is *Byssomerulius*, which has however more elongated spores, mostly free margins and not inflated contextual hyphae, not exceeding an epibasidial segment on width.

**Efibula aurata** (Bourdot & Galzin) Zmitr. & Spirin comb. nov. — Bas.: *Corticium auratum* Bourdot & Galzin, Hymen. France: 190, 1928; *C. tumulosum* P.H.B. Talbot in Wakef. & P.H.B. Talbot, 1948; *Phanerochaete tuberculascens* Hjortstam, 2000.

**Efibula bubalina** (Burds.) Zmitr. & Spirin comb. nov. — Bas.: *Phanerochaete bubalina* Burds., Mycologia Mem. 10: 44, 1985.

**Efibula cordylines** (G. Cunn.) Zmitr. & Spirin comb. nov. — Bas.: *Corticium cordylines* G. Cunn., Trans. Roy. Soc. New Zeal. **82**: 323, 1954.

**Efibula corymbata** (G. Cunn.) Zmitr. & Spirin comb. nov. — Bas.: *Corticium corymbatum* G. Cunn., Trans. Roy. Soc. New Zeal. **82**: 324, 1954.

~ **deflectens** (P. Karst.) Sheng H. Wu, Acta Bot. Fennica **142**: 23, 1990; *Grandinia deflectens* P. Karst., 1881; *Corticium umbratum* Bourdot & Galzin, 1928.

**Efibula ginnsii** (Sheng H. Wu) Zmitr. & Spirin comb. nov. — Bas.: *Phanerochaete ginnsii* Sheng H. Wu, Bot. Bull. Acad. Sin. **41**: 169, 2000.

~ **lutea** Sheng H. Wu, Acta Bot. Fennica **142**: 23, 1990.

~ **pallidovirens** (Bourdot & Galzin) Sheng H. Wu, Acta Bot. Fennica **142**: 23, 1990.

~ **rosea** (P. Henn.) Kotiranta & Saarenoksa, Ann. Bot. Fennici **30**: 217, 1993. — *Grandinia rosea* P. Henn., 1907.

**Efibula subodontioidea** (Sheng H. Wu) Zmitr. & Spirin comb. nov. — Bas.: *Phanerochaete subodontioidea* Sheng H. Wu, Bot. Bull. Acad. Sin. **41**: 172, 2000.

**Efibula subquercina** (P. Henn.) Zmitr. & Spirin comb. nov. — Bas.: *Radulum subquercinum* P. Henn., Mons. I Fungi **2**: 46, 1899; *Odontia subirpicoidea* Rick, 1959; *Phanerochaete radulans* Hallenb., 1978.

~ **tropica** Sheng H. Wu, Acta Bot. Fennica **142**: 25, 1990.

**Efibula tuberculata** (P. Karst.) Zmitr. comb. nov. — Bas.: *Corticium tuberculatum* P. Karst., Hedwigia **35**: 45, 1896; *Peniophora stereoides* Rick, 1959; *Phanerochaete pallida* Parmasto, 1967 ex part.

~ **verruculosa** (Hjortstam & Ryvarde) Kotiranta & Saarenoksa, Ann. Bot. Fennici **30**: 217, 1993. — *Phlebia verruculosa* Hjortstam & Ryvarde, 1980.

**5. EMMIA** Zmitr., Spirin & V. Malysheva, gen. nov. — *Rigidoporus* subgen. *Neooxyporus* Pouzar, 1966 nomen dissonum.

Basidiomata annua, stricti effusa, orbiculata, leviter floccosa. Hymenophorum tubulare, unistratosum. Tubuli primo cupuliformes, deinde porrigentis, tenuimarginatae, magniporiatae, leniter ceraceae. Systema hypharum monomiticum. Hyphae efibulatae, tenuitunicatae, leniter amyloideae, in hymenophoro parallele seriatas. Cystidia tenuitunicata, cylindracea, ad apices leniter incrustata. Basidia clavata, constricta, (bi-)tetrasporifera, basi efibulata. Sporae ellipsoideae ad cylindraceae, copiosae. Ad lignum putredum arborum frondosarum. Putredinem albidiae provocant.

Etymology: 'Emmia' (Latin, noun) — the name is given in honour of the Byelorussian mycologist Emma P. Komarova.

Typus: *Polyporus latemarginatus* Dur. & Mont., 1856.

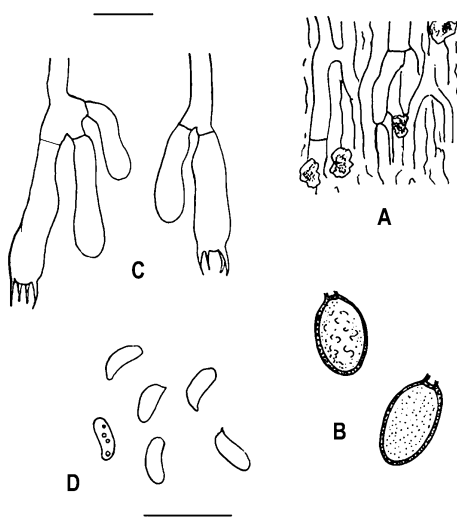
BASIDIOCARPS annual, resupinate to orbicular, soft and fragile; HYMENOPHORE bearing auxohymenium; tubular, one-layered, tubes firstly reticulate, later elongated, with thin dissepiments and large mouths, soft-waxy; TRAMA subparallel; HYPHAL SYSTEM monomitic; HYPHAE clampless, thin-walled in tubes, with thickened walls in subiculum, slightly amyloid; CYSTIDIA present as leptocystidia, thin-walled, cylindrical, naked or faintly encrusted; BASIDIA clavate, four-spored, efibulate, with shallow medial constriction; BASIDIOSPORES ellipsoid to short cylindrical, often abundant, cyanophilous; MITOSPORIC STATE present in one species, of *Sporotrichum* type (Stalpers 1984); TYPE OF ROT: white.

**Emmia latemarginata** (Dur. & Mont.) Zmitr., Spirin & V. Malysheva, comb. nov. — Bas.: *Polyporus latemarginatus* Dur. & Mont. ex Mont., Algeria: 163, 1856.

**Emmia metamorphosa** (Fuckel) Spirin, Zmitr. & V. Malysheva comb. nov. — Bas.: *Poria metamorphosa* Fuckel, Jahrb. Nassau. Ver. Naturk. **27–28**: 87, 1873. — Fig. 11 + front cover, above left image.

The species, known nowadays as *Oxyporus latemarginatus* (Dur. & Mont.) Donk, has certainly isolated position in this genus, albeit it can be formally compared (by length of basidia and presence of apically encrusted cystidia) with large-spored specimens of *O. corticola*. Many older mycologists gave the descriptions showing unclear differences between two species. Komarova (1964) was the first who showed plain hiatus between these species. According her description, the primary features of *O. latemarginatus* (= *Chaetoporus ambiguus* sensu Komarova) are shape and size of spores, and, above all, their large amount in microscopic preparation.

**Fig. 11.** *Emmia metamorphosa* (Spirin 2395): A — tramal hyphae, B — aleuria, C — basidia, D — basidiospores. Scale bar = 10  $\mu$ m.



Some other arguments can be added herein. *O. latemarginatus* has orbicular basidiocarps characterized by strictly prostrate growth. This character causes teratomorphy of its secondary-lateral forms. These forms develop on vertical substrata and appear as cushion-shaped bodies bearing strongly lacerate tubes or fused lamellate structures. Similar phenomenon is often seen in cultures of poroid fungi if Petri dishes were not turned over, but unknown in other *Oxyporus* species, which are more flexible in their morphogenetic events. Moreover, *O. latemarginatus* is strictly monomitic, while the other *Oxyporus* species have pseudodimic structure consisting of more or less sklerified narrower hyphae. Hyphal structure brings *O. latemarginatus* close to *Ceriporia* sensu auct. (Phanerochaetaceae), within which at least one species, *Poria metamorphosa* Fuckel, is rather distant from others, and displays *latemarginatus*-like pattern of hymenophore development. Being strictly monomitic, the basidiocarps of *O. latemarginatus* are soft and fragile and never wintering. Also hyphae of *O. latemarginatus* are faintly amyloid and parallel in tube trama, and spores are bigger [(4.5)4.9–6.5(6.9)  $\times$  (2.8)3.1–3.8(4.2)  $\mu$ m],<sup>9</sup> elongated-cylindrical, in some projections with shallow medial constriction (like the spores of *Raduliporus aneirinus* (Sommerf. : Fr.) Spirin & Zmitr.).

According to recent molecular data, *O. latemarginatus* is a member of phanerochaetoid clade and comes close to *Ceriporia* (Greslebin *et al.*, 2004), i.e. it is rather distant from the other *Oxyporus* species. Thus, we propose to separate *Polyporus latemarginatus* into its own genus.

Another species, *Poria metamorphosa*, often hidden under the names *Pycnoporellus* (Stalpers, 1984) or *Ceriporia* Donk (Ryvarden, Gilbertson, 1993), can be added to our new genus. It has similar fruitbodies, composed of wide mostly thin-walled clampless hyphae, and hymenium, consisting of elongated-clavate basidia and irregularly occurring leptocystidia. The main differences between *E. latemarginata* and *E. metamorphosa* are the spore shape and size

<sup>9</sup> **Specimens examined.** *Oxyporus latemarginatus*. **Russia.** Nizhny Novgorod Reg., Lukoyanov Dist., Kurlei, *Quercus robur*, 6 X 2001 Spirin (LE 211268); Pochinki Dist., Kommunar, *Q. robur*, 21 V 1999 Spirin (LE 222957).

(they are cylindrical in the latter, having dimensions  $4.3\text{--}6.1 \times 2.2\text{--}2.7 \mu\text{m}$ ),<sup>10</sup> and the presence of aleuria in *E. metamorphosa*. In other respects, both *Emmia* species are quite similar, including ecological preferences (both are connected mainly with broadleaf forests). *E. metamorphosa* is reported here as new to Russia and the former USSR. For its European distribution see Stalpers (1984), Ryvarden and Gilbertson (1993), Vampola and Pouzar (1996).

6. **GLOEOPORUS** Mont., Ann. Sci. Nat. Bot. Ser. II 17: 126, 1842 emend. — *Ceriporia* Donk, 1933. — *Meruliopsis* Bondartsev in Parmasto, 1959.

BASIDIOCARPS annual, wood inhabiting, meruloid (infundibuliform to resupinate) or poroid; HYMENOPHORE bearing auxohyemium: folded poroid to truly tubular, of ceraceous consistency; TRAMA irregular; CONTEXT wadded, rather loose; HYPHAL SYSTEM monomitic; HYPHAE simple septate, thin- to thick-walled, with  $\pm$ rectangular branching; CYSTIDIA: lepto-, fusoid, often absent; BASIDIA clavate, constricted, thin-walled at base, 4-spored; BASIDIOSPORES ellipsoid-cylindrical or subballantoid, as a rule biguttulate, thin-walled, neither amyloid, nor dextrinoid, acyanophilous. TYPE OF ROT: white.

Type: *Gloeoporus conchoides* Mont., 1842 = *Boletus thelephoroides* Hook. in Kunth, 1822.

The genus is outlined here by clampless species only, including *G. thelephoroides* (generic type) and *G. taxicola* (type of *Meruliopsis*), referred to *Gloeoporus* by Gilbertson and Ryvarden (1985) — both species having continuous hymenium — and some truly poroid species, earlier attributed to the genus *Ceriporia*. Thus, we do not accept the earlier concept of *Gloeoporus*, proposed by Ginns (1976), and exclude clamp-bearing *Gloeoporus dichrous*, the more appropriate position of which seems to be in *Gelatoporia* Niemelä, near *Tyromyces* and *Skeletocutis* (Meruliaceae Rea). As indicated by Hattori (2001b), the most of Corner's (1989) clamped gloeoporeae should be placed in the same genus or its neighbours. Among these latter, *Gloeoporus sulphureus* Corner fits well with *Gloeoporus* s. str., because it is comparable with *G. thelephoroides* in numerous aspects.

All the species included here in *Gloeoporus* are united by characteristic hypha/epibasidium ratio. In contrast to clamp-bearing gloeoporeae, its hymenium is less gelatinized and can be determined rather as ceraceous. The spore shape is varying here from allantoid (though spore quotient as a rule  $\leq 3$ ) to ellipsoid-cylindrical.

The genus *Byssomerulius* is closely related, but differs in having longer basidia, wider spores, which are as a rule amygdaloid, and non-poroid hymenium.

**Gloeoporus alachuanus** (Murrill) Zmitr. & Spirin comb. nov. — Bas.: *Poria alachuana* Murrill, Bull. Torrey Bot. Club 65: 659, 1938; *Ceriporia subreticulata* Ryvarden, 1982.

**Gloeoporus ambiguus** (Berk.) Zmitr. & Spirin comb. nov. — Bas.: *Merulius ambiguus* Berk., Grevillea 1: 69, 1872; *M. conchoides* Lloyd, 1922; *M. succineus* Lloyd, 1924.

**Gloeoporus excelsus** (S. Lundell) Zmitr. & Spirin comb. nov. — Bas.: *Poria excelsa* S. Lundell in Lundell & Nannfeldt, Fungi exs. Suec. 27–28: 1329, 1940.

**Gloeoporus ferrugineocinctus** (Murrill) Zmitr. & Spirin comb. nov. — Bas.: *Poria ferrugineocincta* Murrill, Bull. Torrey Bot. Cl. 65: 660, 1938.

**Gloeoporus leptodermus** (Berk. & Broome) Zmitr. & Spirin comb. nov. — Bas.: *Polyporus leptodermus* Berk. & Broome, J. Linn. Soc. Bot. 14: 54, 1873.

**Gloeoporus melleus** (Berk. & Broome) Zmitr. & Spirin comb. nov. — Bas.: *Polyporus melleus* Berk. & Broome, Trans. Linn. Soc. London 14: 53, 1875.

**Gloeoporus otakou** (G. Cunn.) Zmitr. & Spirin comb. nov. — Bas.: *Poria otakou* G. Cunn. in Bull. New Zeal. Dept. Sci. Industr. Res. 164: 59, 1965.

<sup>10</sup> **Specimen examined.** *Emmia metamorphosa*. Russia. Nizhny Novgorod Reg., Lukoyanov Dist., Srednii, dead *Hymenochaete rubiginosa* and *Quercus robur*, 12 VIII 2005 Spirin 2395 (H, LE).



**Gloeoporus purpureus** (Fr. : Fr.) Zmitr. & Spirin comb. nov. — Bas.: *Polyporus purpureus* Fr. : Fr., Syst. Mycol. **1**: 379, 1821; *Poria bresadolae* Bourdot & Galzin, 1928.

**Gloeoporus retamoanus** (Rajchenb.) Zmitr. & Spirin comb. nov. — Bas.: *Ceriporia retamoana* Rajchenb., Karstenia **40**: 143, 2000.

**Gloeoporus reticulatus** (Hoffm. : Fr.) Zmitr. & Spirin comb. nov. — Bas.: *Polyporus reticulatus* Hoffm. : Fr., Syst. Mycol. **1**: 1821; *Poria camaresiana* Bourdot & Galzin, 1928; *Riopa davidii* D.A. Reid, 1968.

**Gloeoporus spissus** (Schwein. : Fr.) Zmitr. & Spirin comb. nov. — Bas.: *Polyporus spissus* Schwein. : Fr., Elenchus **1**: 111, 1828.

~ **sulphureus** Corner, Beih. Nova Hedwigia **96**: 59, 1989.

**Gloeoporus sulphuricolor** (Bernicchia & Niemelä) Zmitr. & Spirin comb. nov. — Bas.: *Ceriporia sulphuricolor* Bernicchia & Niemelä, Folia Crypt. Estonica **33**: 15, 1998.

**Gloeoporus tardus** (Berk.) Zmitr. & Spirin comb. nov. — Bas.: *Polyporus tardus* Berk., L. J. Bot. **4**: 56, 1845; *P. semitinctus* Peck, 1878.

~ **taxicola** (Pers. : Fr.) Gilb. & Ryvarde, Mycotaxon **22**: 364, 1985. — *Xylomyzon taxicola* Pers. : Fr., 1828; *Polyporus rufus* (Schrad. : Fr.) Fr., 1821; *Merulius ravenelii* Berk., 1872; *Polyporus sorbicola* Fr., 1874.

~ **thelephoroides** (Hook.) G. Cunn., Bull. New Zeal. Dept. Sci. Industr. Res. **164**: 111, 1965. — *Boletus thelephoroides* Hook. in Kunth, 1822; *Gloeoporus conchoides* Mont., 1842.

**Gloeoporus totarus** (G. Cunn.) Zmitr. & Spirin comb. nov. — Bas.: *Poria totara* G. Cunn., Bull. New Zeal. Dept. Sci. Industr. Res. **164**: 59, 1965.

**Gloeoporus viridans** (Berk. & Broome) Zmitr. & Spirin comb. nov. — Bas.: *Polyporus viridans* Berk. & Broome, Ann. Mag. Nat. Hist. **3**: 379, 1861; *Polyporus rhodellus* Fr., 1821; *Poria turkestanica* Pilát, 1936.

Pieri and Rivoire (1997) described some new *Ceriporia* species; however, their identity and taxonomy deserve much closer study.

**7. GRANDINIELLA** P. Karst., Hedwigia **34**: 8, 1895 emend. — *Phanerochaete* P. Karst., 1889 pr. p. — *Membranicium* J. Erikss., 1958.

BASIDIOCARPS annual, wood inhabiting, corticioid with adherent, often rhizomorphic margin; HYMENOPHORE bearing auxohymenium: even to tuberculate or aculeate, of ceraceous consistency; TRAMA irregular, but subhymenium dense (*textura porrecta*); CONTEXT wadded, thin or thickened, of *textura intricata*; HYPHAL SYSTEM monomitic; HYPHAE simple septate or in subiculum with double clamp connections, thick-walled in subhymenium, very thick-walled and peculiarly branching in subiculum; CYSTIDIA: pseudo-, naked or with some patches of resinous encrustation, cylindrical to fusoid with abrupt apex, thick-walled (at least basally), big, protruding the hymenium; BASIDIA long-clavate, clearly constricted, thin-walled at base, 4-spored; BASIDIOSPORES ellipsoid-cylindrical, guttulate, thin-walled, neither amyloid, nor dextrinoid, acyanophilous. MITOSPORIC STATE known for *G. chrysosporium* as *Sporotrichum pruinosum* with aleuria on aerial hyphae and chlamydospores in submerged ones. TYPE OF ROT: white.

Type: *Grandiniella livescens* P. Karst., 1895 = *Corticium sordidum* P. Karst., 1882.

Two overlapping characters give a sound basis for current generic concept: 1) the presence of mostly naked, big pseudocystidia, and 2) robustly thick-walled subicular hyphae in candelabriform branching pattern.

While discussed the affinities of *Corticium martellianum* Bres., Hjortstam (2000) mentioned *Globulicium* as a possible genus for this species. We consider *Globulicium* as close to *Radulomyces* and *Erythrimum* (Hyphodermatales), and transfer *Thelephora viticola* Schwein. in the

latter genus,<sup>11</sup> while *Corticium martellianum* is a member of *Grandiniella* due to its candelabrate hyphae and clavate basidia.

**Grandiniella aculeata** (Hallenb.) Zmitr. & Spirin comb. nov. — Bas.: *Phanerochaete aculeata* Hallenb., Iranian J. Pl. Pathol. **14**: 62, 1978.

~ **allantospora** (Burds. & Gilb.) Burds., Taxon **26**: 328, 1977.

**Grandiniella arizonica** (Burds. & Gilb.) Zmitr. & Spirin comb. nov. — Bas.: *Phanerochaete arizonica* Burds. & Gilb., Mycologia **66**: 785, 1974.

**Grandiniella australis** (Jülich) Zmitr. & Spirin comb. nov. — Bas.: *Phanerochaete australis* Jülich, J. Linn. Soc. Bot. London **81**: 43, 1980.

~ **cacaina** (Bourdöt & Galzin) Burds., Taxon **26**: 329, 1977. — *Peniophora cacaina* Bourdot & Galzin, 1913.

**Grandiniella caucasica** (Parmasto) Zmitr. & Spirin comb. nov. — Bas.: *Phanerochaete cremea* var. *caucasica* Parmasto, Eesti NSV Tead. Akad. Toim. Biol. **16**: 388, 1967.

**Grandiniella chryso sporium** (Burds.) Zmitr. & Spirin comb. nov. — Bas.: *Phanerochaete chryso sporium* Burds. in Burds. & Eslyn, Mycotaxon **1**: 124, 1974.

**Grandiniella irpicoides** (Hjortstam) Zmitr. & Spirin comb. nov. — Bas.: *Phanerochaete irpicoides* Hjortstam, Karstenia **40**: 53, 2000.

**Grandiniella magnoliae** (Berk. & M.A. Curtis) Zmitr. & Spirin comb. nov. — Bas.: *Radulum magnoliae* Berk. & M.A. Curtis in Hooker, Kew Bull. Misc. Inf. **1**: 236, 1849; *R. cumulodentatum* Nikol. ex Nikol., 1970; *Phanerochaete raduloides* J. Erikss. & Ryvarden in J. Erikss. et al., 1978.

**Grandiniella martelliana** (Bres.) Zmitr. & Spirin comb. nov. — Bas.: *Corticium martellianum* Bres., Nov. Giorn. Bot. Ital. **22**: 258, 1890; *Peniophora macrospora* Bres. in Bourdot & Galzin, 1912.

~ **omnivora** (Shear) Burds., Taxon **26**: 329, 1977. — *Hydnum omnivorum* Shear, 1925.

**Grandiniella robusta** (Parmasto) Zmitr. & Spirin comb. nov. — Bas.: *Phanerochaete robusta* Parmasto, Consp. Syst. Cort.: 220, 1968.

**Grandiniella singularis** (G. Cunn.) Zmitr. & Spirin comb. nov. — Bas.: *Corticium singulare* G. Cunn., Trans. Roy. Soc. New Zeal. **82**: 325, 1954.

**Grandiniella sordida** (P. Karst.) Zmitr. & Spirin comb. nov. — Bas.: *Corticium sordidum* P. Karst., Medd. Soc. Fauna Fl. Fenn. **9**: 65, 1882; *Grandiniella livescens* P. Karst., 1895; *Corticium cremeum* Bres., 1898; *Kneiffia rudior* Rick, 1934.

**Grandiniella subceracea** (Burt) Zmitr. & Spirin comb. nov. — Bas.: *Corticium subceraceum* Burt, Ann. Mo. Bot. Gard. **13**: 239, 1926.

## 8. HJORTSTAMIA Boidin & Gilles, Bull. Soc. Mycol. France **118(2)**: 99, 2002.

BASIDIOCARPS perennial, wood-inhabiting, stereoid; HYMENOPHORE bearing auxohyemium: even to irregularly tuberculate, ochraceous to brown, of hard consistency; TRAMA irregular but subhymenium dense (of *textura porrecta* or *textura oblita*); CONTEXT as thick layer; abhymenial surface of trichodermoid appearance, pileocystidia sometimes present. HYPHAL SYSTEM pseudodimitic to subdimitic; HYPHAE simple-septate or in subiculum with occasional clamps, thin- to peculiarly thick-walled, with rectangular and candelabriform branching; CYSTIDIA: lampro-; BASIDIA long clavate, efibulate, 4-spored; BASIDIOSPORES ellipsoid-cylindrical, thin-walled, neither amyloid, nor dextrinoid, acyanophilous. TYPE OF ROT: white.

Type: *Thelephora friesii* Lév., 1854.

This genus is the rest of *Lopharia* genus complex. It is well characterized by simple-septate hyphae. Another *Lopharia* derivation with phanerochaetoid characteristics is *Porostereum*, which differs from *Hjortstamia* by its clamped hyphae (Boidin, Gilles, 2002). The core *Lopharia*

<sup>11</sup> **Erythricium viticola** (Schwein.) Zmitr. & Spirin comb. nov. — Bas.: *Thelephora viticola* Schwein., Schrift. Naturf. Ges. Leipzig **1**: 107, 1822; *Corticium subaurantiacum* Peck, 1890.

Kalchbr. & McOwan species are deprived of phanerochaetoid characteristics. Their basidia are big (over 50  $\mu\text{m}$  long in mature state), being peculiarly constricted and bearing robust sterigmata; spores are also large. Therefore, their more preferable taxonomical position seems to be within the Boreostereaceae (Hyphodermatales).

**Hjortstamia amethystea** (Hjortstam & Ryvarde) Boidin & Gilles, Bull. Soc. Mycol. France **118(2)**: 99, 2002. — *Porostereum amethysteum* Hjortstam & Ryvarde, 1990.

~ **castanea** Boidin & Gilles, Bull. Soc. Mycol. France **118(2)**: 100, 2002.

~ **crassa** (Lév.) Boidin & Gilles, Bull. Soc. Mycol. France **118(2)**: 99, 2002. — *Thelephora crassa* Lév., 1844; *Corticium vinosum* Berk., 1845; *Stereum umbrinum* Berk. & M.A. Curtis, 1873; *Hymenochaete multispinosa* Peck, 1882; *H. scabriseta* Cooke, 1883; *P. intermedia* Masee, 1889; *Hymenochaete kalchbrenneri* Masee, 1890.

~ **friesii** (Lév.) Boidin & Gilles, Bull. Soc. Mycol. France **118(2)**: 99, 2002. — *Thelephora friesii* Lév. in Zollinger, 1854; *Th. papyracea* Jungh., 1838.

~ **mexicana** (A.L. Welden) Boidin & Gilles, Bull. Soc. Mycol. France **118(2)**: 99, 2002. — *Lopharia mexicana* A.L. Welden, 1971.

~ **papyrina** (Mont.) Boidin & Gilles, Bull. Soc. Mycol. France **118(2)**: 99, 2002. — *Stereum papyrinum* Mont., 1842.

~ **percomis** (Berk. & Broome) Boidin & Gilles, Bull. Soc. Mycol. France **118(2)**: 99, 2002. — *Stereum percome* Berk. & Broome, 1875.

~ **perplexa** (D.A. Reid) Boidin & Gilles, Bull. Soc. Mycol. France **118(2)**: 99, 2002. — *Lopharia perplexa* D.A. Reid, 1963.

~ **rimosissima** (Berk. & M.A. Curtis) Boidin & Gilles, Bull. Soc. Mycol. France **118(2)**: 99, 2002. — *Corticium rimosissimum* Berk. & M.A. Curtis, 1858.

#### 9. **HYDNOPHLEBIA** Parmasto, Eesti NSV Tead. Akad. Toim. Biol. **16**: 384, 1967.

BASIDIOCARPS annual, wood-inhabiting, corticioid with free rhizomorphic margin; HYMENOPHORE bearing auxohymenium: tuberculate to odontoid, of ceraceous consistence; TRAMA irregular; CONTEXT as thin layer of film-like consistency (*textura intricata*); HYPHAL SYSTEM monomitic; HYPHAE simple septate or in subiculum with occasional big clamp connections, thin- to thick-walled, with rectangular branching; CYSTIDIA: lepto-, ventricose; BASIDIA short-clavate ( $Q \leq 3.4$ ) up to 20  $\mu\text{m}$  in length, thin-walled at base, 4-spored; BASIDIOSPORES ellipsoid-cylindrical, thin-walled, neither amyloid, nor dextrinoid, acyanophilous. TYPE OF ROT: white.

Monotypic: **Hydnophlebia chrysorhiza** (Torr.) Parmasto, Eesti NSV Tead. Akad. Toim. Biol. **16**: 384, 1967. — *Hydnum chrysorhizon* Torr. in Eaton, 1822; *H. fragillissimum* Berk. & M.A. Curtis, 1873; *H. ishodes* Berk., 1873; *H. chrysocomum* Underw., 1897.

The closest relatives seem to be *Gloeoporus* (differing by poroid hymenophore and more elongated spores) and *Leptochaete* (differing by smoothening pellicular hymenium and enclosed leptocystidia).

#### 10. **HYPHODERMELLA** J. Erikss. & Ryvarde, Cort. N. Eur. **4**: 579, 1976.

BASIDIOCARPS annual, wood-inhabiting, grandinioid, crustaceous; HYMENOPHORE bearing auxohymenium: papillate, of ceraceous consistency; HYPHAL SYSTEM monomitic; HYPHAE thin- to thick-walled, without clamps; CYSTIDIA present as leptocystidia, or absent; spines consisting of encrusted hyphal fascicles; BASIDIA hyaline, narrowly-clavate with elongated basal part, thin-walled; SPORES hyaline, ellipsoid, thin-walled, neither amyloid, nor dextrinoid. TYPE OF ROT: presumably white.

Monotypic: **Hyphodermella corrugata** (Fr.) J. Erikss. & Ryvarde, Cort. N. Eur. **4**: 579, 1976. — *Grandinia corrugata* Fr., 1874.

Probably, the genus *Columnodontia* Jülich, Persoonia **10**: 326, 1979 (type *Columnodontia resupinata* Jülich, op. cit.) is very close or even congeneric with *Hyphodermella*, albeit *C. sub-*

*fascicularis* (Wakef.) Jülich seems to be related rather to *Mycoacia* Donk (see Nakasone, Gilbertson, 1998).

**Columnodontia columellifera** (G. Cunn.) Jülich, Persoonia **10**: 327, 1979. — *Odontia columellifera* G. Cunn., 1959.

**Columnodontia lutea** (G. Cunn.) Jülich, Persoonia **10**: 327, 1979. — *Odontia lutea* G. Cunn., 1959.

**Columnodontia resupinata** Jülich, Persoonia **10**: 327, 1979.

**Columnodontia subfascicularis** (Wakef.) Jülich, Persoonia **10**: 326, 1979. — *Acia subfascicularis* Wakef., 1930.

### 11. LEPTOCHAETE Zmitr. & Spirin gen. nov.

Fungi lignicoli, athelioidei, rhizomati. Hymenophorum laeve, pelliculare (leptohymenium). Subiculum leniter fibrillosum. Systema hypharum monomiticum. Hyphae efibulatae vel fibulis duplicatis praeditae, in subhymenio tenuitunicate, leviter crassitunicate in subiculo. Leptocystidia pro more adsunt, cylindracea. Basidia longiclavata, constricta, ad basinem tenuitunicata, cum 4 sterigmatibus. Sporae ellipsoideo-cylindraceae, tenuitunicatae, inamyloideae, indextrinoideae, acyanophilae. Putredinem albidae provocant.

Typus: *Thelephora sanguinea* Fr. : Fr., 1828.

BASIDIOCARPS annual, wood inhabiting, athelioid, rhizomoid to orbicular; HYMENOPHORE bearing leptohymenium: even or  $\pm$ folded when fresh, as thin pellicular layer of soft pellicular consistency; CONTEXT loose; HYPHAL SYSTEM monomitic; HYPHAE simple septate or in subiculum with verticillate clamps, thin-walled in subhymenium, with thickened walls in subiculum; CYSTIDIA: lepto-, cylindrical, mostly enclosed, in some cases absent; BASIDIA long clavate, slightly constricted, thin-walled at base, 4-spored; BASIDIOSPORES ellipsoid-cylindrical, thin-walled, neither amyloid, nor dextrinoid, acyanophilous. TYPE OF ROT: white.

The genus *Grandiniella* is similar, but differs by thickened ceraceous hymenium, thick-walled cystidia, and robustly thick-walled, "restlessly" branched contextual hyphae.

**Leptochaete andina** (Jülich) Zmitr. & Spirin comb. nov. — Bas.: *Athelia andina* Jülich, Willdenowia Beih. **7**: 51, 1972.

**Leptochaete calotricha** (P. Karst.) Zmitr. & Spirin comb. nov. — Bas.: *Corticium calotrichum* P. Karst., Rev. Mycol. **10**: 73, 1888; *Peniophora limonia* Burt, 1926.

**Leptochaete carnosa** (Burt) Zmitr. & Spirin comb. nov. — Bas.: *Peniophora carnosa* Burt, Ann. Mo. Bot. Garden **12**: 325, 1926; *P. firma* Burt, 1926; ? *Peniophora burtii* Romell in Burt, 1926; *Phanerochaete chabarovskii* Burds. ined. in herb. TAA (15611).

**Leptochaete galactites** (Bourdot & Galzin) Zmitr. & Spirin comb. nov. — Bas.: *Corticium rhodoleucum* ssp. *galactites* Bourdot & Galzin, Hymen. France: 189, 1928.

**Leptochaete sanguinea** (Fr. : Fr.) Zmitr. & Spirin comb. nov. — Bas.: *Thelephora sanguinea* Fr. : Fr., Elenchus **1**: 203, 1828; *Thelephora bolaris* Pers., 1822; *Th. miniata* Berk., 1836; *Corticium petersii* Berk. & M.A. Curtis, 1873.

### 12. LEPTOPORUS Quéél., Ench. Fung.: 175, 1886.

BASIDIOCARPS annual, wood-inhabiting, tyromycetoid; HYMENOPHORE bearing auxohymenium, tubular, of soft-ceraceous consistency; TRAMA irregular; CONTEXT fleshy-spongioid, hygrophanous in fresh, reddening at drying; HYPHAL SYSTEM submonomitic; HYPHAE clampless, with athelioid or rectangular branching; CYSTIDIA: none; BASIDIA long clavate, constricted, 4-spored; BASIDIOSPORES ellipsoid-cylindrical to suballantoid, neither amyloid, nor dextrinoid; acyanophilous. TYPE OF ROT: brown.

Monotypic: **Leptoporus mollis** (Pers. : Fr.) Pilát, Atl. Champ. Eur. **3**: 174, 1936. — *Polyporus mollis* Pers. : Fr., 1821.

The latest molecular data verify a close relationships of this genus and *Grandiniella allantopora* (De Koker *et al.*, 2003).

13. **ODONTICIUM** Parmasto, Consp. Syst. Cort.: 126, 1968 emend. — *Candelabrochaete* Boidin, 1970. — *Granulocystis* Hjortstam, 1986. — *Botryodontia* (Hjortstam & Ryvarde) Hjortstam, 1987.

BASIDIOCARPS annual, wood-inhabiting, odontoid, grandinioid to corticioid; HYMENOPHORE even or papillose, of ceraceous consistency; TRAMA irregular; CONTEXT wadded, rather dense; HYPHAL SYSTEM monomitic; HYPHAE simple-septate, with thickened walls, regularly branched at sharp angles; CYSTIDIA: pseudo-, thick-walled, regularly septate or without septa, naked, rarely encrusted. BASIDIA short-clavate, up to 20 µm long, weakly constricted, thick-walled at base, 4-spored; BASIDIOSPORES ellipsoid, thin-walled, neither amyloid, nor dextrinoid, acyanophilous. TYPE OF ROT: white.

Type: *Odontia romellii* S. Lundell, 1958.

**Odonticum adnatum** (Hjortstam) Zmitr. & Spirin comb. nov. — Bas.: *Candelabrochaete adnata* Hjortstam, Mycotaxon **56**: 451, 1995.

**Odonticum africanum** (Boidin) Zmitr. & Spirin comb. nov. — Bas.: *Candelabrochaete africana* Boidin, Cah. Maboké **8**: 24, 1970.

~ **australe** D.A. Reid, Kew Bull. **35**: 860, 1982.

**Odonticum canoluteum** (Sheng H. Wu) Zmitr. & Spirin comb. nov. — Bas.: *Phanerochaete canolutea* Sheng H. Wu, Bot. Bull. Acad. Sin. **41**: 168, 2000.

**Odonticum cirratum** (Hjortstam & Ryvarde) Spirin & Zmitr. comb. nov. — Bas.: *Candelabrochaete cirrata* Hjortstam & Ryvarde, Mycotaxon **25**: 545, 1986.

**Odonticum denticulatum** (Hjortstam) Spirin & Zmitr. comb. nov. — Bas.: *Botryodontia denticulata* Hjortstam, Mycotaxon **28**: 20, 1987

**Odonticum dispar** (Hjortstam & Ryvarde) Zmitr. & Spirin comb. nov. — Bas.: *Candelabrochaete dispar* Hjortstam & Ryvarde, Mycotaxon **25**: 546, 1986.

**Odonticum eruciforme** (G. Cunn.) Zmitr. & Spirin comb. nov. — Bas.: *Peniophora eruciformis* G. Cunn., Trans. Roy. Soc. New Zealand **83**: 275, 1955.

**Odonticum exilis** (Burt) Zmitr. & Spirin comb. nov. — Bas.: *Peniophora exilis* Burt, Ann. Mo. Bot. Gard. **12**: 239, 1926.

~ **flabelliradiatum** (J. Erikss. & Hjortstam) Zmitr., Mikol. Fitopat. **35**: 18, 2001. — *Phanerochaete flabelliradiata* J. Erikss. & Hjortstam in J. Erikss. *et al.*, 1982.

~ **helgae** Hjortstam & Ryvarde, Mycotaxon **25**: 562, 1986.

**Odonticum langloisii** (Pat.) Zmitr. & Spirin comb. nov. — Bas.: *Hypochnus langloisii* Pat., Bull. Soc. Mycol. France **24**: 3, 1908.

~ **laxum** (L.W. Mill.) Ryvarde, Norw. J. Bot. **25**: 296, 1978. — *Odontia laxa* L.W. Mill., 1934.

**Odonticum magnahypha** (Burt) Zmitr. & Spirin comb. nov. — Bas.: *Peniophora magnahypha* Burt, Ann. Mo. Bot. Gard. **12**: 238, 1926.

~ **monfraguense** M.N. Blanco, G. Moreno & Man., Cryptog. Mycol. **10**: 137, 1989.

~ **romellii** (S. Lundell) Parmasto, Consp. Syst. Cort.: 126, 1968. — *Odontia romellii* S. Lundell, 1958.

**Odonticum septocystidiatum** (Burt) Zmitr. & Spirin comb. nov. — Bas.: *Peniophora septocystidiata* Burt, Ann. Mo. Bot. Gard. **12**: 260, 1926; *Odonticum raitviirii* Parmasto, 1968.

**Odonticum simulans** (Hjortstam) Zmitr. & Spirin comb. nov. — Bas.: *Candelabrochaete simulans* Hjortstam, Mycotaxon **56**: 452, 1995.

**Odonticum verruculosum** (Hjortstam) Zmitr. & Spirin comb. nov. — Bas.: *Candelabrochaete verruculosa* Hjortstam, Mycotaxon **17**: 566, 1983.

**14. PHANEROCHAETE** P. Karst., Bidr. Känned. Finl. Nat. Folk **48**: 426, 1889 emend.

BASIDIOCARPS annual, wood-inhabiting, corticioid or athelioid, often with marginal cords; HYMENOPHORE bearing lepto- or auxohymenium: even to tuberculate or aculeate, of ceraceous-pellicular consistency; TRAMA irregular; CONTEXT rather loose; HYPHAL SYSTEM submonomitic; HYPHAE simple-septate or in subiculum with verticillate clamp connections, thin- to thick-walled, regularly branched, in lower subiculum inflated, but without candelabriform branching; naked or encrusted; CYSTIDIA: lampro-, subulate, with robust walls, both of tramatic and hymenial origin, protruding the hymenium; BASIDIA long clavate (more 20 µm in length), clearly constricted, thin- to thick-walled at base, 4-spored; BASIDIOSPORES ellipsoid, thin-walled, neither amyloid, nor dextrinoid, acyanophilous. TYPE OF ROT: white.

Type: *Corticium decolorans* P. Karst., 1889 = *Thelephora velutina* DC. per Pers. : Fr., 1828.

This is a core genus of the family. It was originally described by P. Karsten (1881), but received its recognition about 100 years after (Donk, 1962; Parmasto, 1968; Jülich, 1975, 1976; Eriksson *et al.*, 1978a). *Corticium decolorans* P. Karst., 1889 (not *Thelephora alnea* Fr.!) should be considered as a correct lectotype of the genus (Eriksson *et al.*, 1978b). Therefore, full replacement of *Phanerochaete* by Karsten's (1895) genus *Grandiniella* P. Karst. (as did Burdsall, 1977) is absolutely not of necessity. However, contrary to most large concepts of the genus (Burdsall, 1985; Hjortstam, 1987, 1998; Wu, 2000), we are inclined to accept the strict concept (see family key). In particular, we separate the genera *Grandiniella* and *Leptochaete*. Thus, the genus *Phanerochaete* is extremely restricted here, and its species are characterized by: 1) thick-walled non-septate lamprocystidia, protruding the hymenium, 2) long basidia (exceeding 20 µm in length), forming pellicular hymenial layer, 3) usually encrusted basal hyphae without candelabriform branching.

The genus *Leptochaete* differs by nature of cystidia and rather athelioid basidiocarps, while *Grandiniella* have cystidia and candelabrate basal hyphae.

**Phanerochaete angustocystidiata** Sheng H. Wu, Bot. Bull. Acad. Sin. **41**: 166, 2000.

~ **arenata** (P.H.B. Talbot) Burds., Mycologia Mem. **10**: 35, 1985. — *Peniophora arenata* P.H.B. Talbot in Wakef. & P.H.B. Talbot, 1948.

~ **ericina** (Bourdot) J. Erikss. & Ryvarden in J. Erikss. *et al.*, Cort. N. Eur. **5**: 1011, 1978.

~ **filamentosa** (Berk. & M.A. Curtis) Burds. in Parker & Roane, Dist. Hist. Biota S. Appalach. **4**: 278, 1975; *Peniophora unicolor* Peck, 1890; *Corticium radiculatum* P. Henn., 1895; *C. byssogenum* Pat., 1924; *Phanerochaete borneensis* Jülich, 1980.

~ **flavidoalba** (Cooke) Rattan, Bibl. Mycol. **60**: 262, 1977; *Peniophora texana* Burt, 1926.

~ **laevis** (Pers. : Fr.) J. Erikss. & Ryvarden in J. Erikss. *et al.*, Cort. N. Eur. **5**: 1007, 1978; *Peniophora affinis* Burt in Peck, 1902; *P. gilvidula* Bres., 1925.

~ **laxa** Sheng H. Wu, Bot. Bull. Acad. Sin. **41**: 170, 2000.

~ **luteoaurantiaca** (Wakef.) Burds., Mycologia Mem. **10**: 93, 1985.

~ **odontioidea** Sheng H. Wu, Bot. Bull. Acad. Sin. **41**: 171, 2000.

~ **salmoneolutea** Burds. & Gilb., Mycologia **66**: 787, 1974.

~ **subiculosa** (Burt) Burds., Mycologia Mem. **10**: 130, 1985. — *Peniophora subiculosa* Burt, 1926; *P. exigua* Burt, 1926.

~ **velutina** (DC. per Pers. : Fr.) P. Karst., Krit. Finl. Basidsv. **3**: 33, 1898. — *Thelephora velutina* DC. per Pers. : Fr., 1828; *Corticium decolorans* P. Karst., 1889; *C. rhodellum* Peck, 1889; *Peniophora karstenii* Masee, 1890; *P. leprosa* Bourdot & Galzin, 1913; *P. rhodochroa* Bres., 1925; *P. phosphorescens* Burt, 1926.

**15. POROSTEREUM** Pilát, Bull. Soc. Mycol. France **52**: 330, 1936.

BASIDIOCARPS perennial, wood-inhabiting, stereoid; HYMENOPHORE bearing auxohymenium: even to irregularly tuberculate, greyish to brown, of hard consistency; TRAMA irregular, but subhymenium dense (of *textura porrecta*); CONTEXT as thick layer; abhymenial surface

of trichodermoid appearance. HYPHAL SYSTEM pseudodimitic to subdimitic; HYPHAE clamped, thin- or thick-walled, with atheloid and candelabriform branching; CYSTIDIA: lampro-, tubular pseudocystidia; BASIDIA long clavate to meruloid, 4-spored, with a basal clamp; BASIDIOSPORES ellipsoid-cylindrical, thin-walled, neither amyloid, nor dextrinoid, acyanophilous. TYPE OF ROT: white.

Type: *Porostereum phellodendri* Pilát = *Thelephora spadicea* Pers. : Fr., 1821.

**Porostereum cystidiosum** (Rehill & Bakshi) Hjortstam & Ryvarde, Synops. Fung. **4**: 33, 1990. — *Peniophora cystidiosa* Rehill & Bakshi, 1965.

~ **fulvum** (Lév.) Boidin & Gilles, Bull. Soc. Mycol. France **118(2)**: 108, 2002. — *Thelephora fulva* Lév., 1846; *Stereum schomburgkii* Berk., 1872.

~ **lilacinum** (Berk. & Broome) Hjortstam, Kew Bull. **44**: 308, 1989. — *Corticium lilacinum* Berk. & Broome, 1873.

~ **spadiceum** (Pers. : Fr.) Hjortstam & Ryvarde, Synops. Fung. **4**: 51, 1990. — *Thelephora spadicea* Pers. : Fr., 1821; *Stereum venosum* Qué., 1884; *Porostereum phellodendri* Pilát, 1936; *Stereum sponheimeri* Pilát, 1937.

~ **umbrinoalutaceum** (Wakef.) Hjortstam & Ryvarde, Synops. Fung. **4**: 53, 1990. — *Stereum umbrinoalutaceum* Wakef. in Sarasin & Roux, 1920.

For much wider concept of this genus, see Hjortstam & Ryvarde (1990). Also see note to *Hjortstamia*.

## Appendix

**CERACEOMERULIUS** (Parmasto) J. Erikss. & Ryvarde, Cort. N. Eur. **2**: 196, 1973. — *Byssomerulius* subgenus *Ceraceomerulius* Parmasto, 1968. → Atheliaceae?

BASIDIOCARPS wood-inhabiting, intermediate between atheloid and meruloid, rhizomoid; HYMENOPHORE bear slightly thickened leptohymenium: folded, then almost smooth, of pellicular to subceraceous consistency; HYPHAL SYSTEM monomitic; HYPHAE clamped or clampless, thin- to slightly thick-walled, with atheloid or candelabriform branching; CYSTIDIA none; BASIDIA clavate, slightly constricted, thin-walled at base, 4-spored; BASIDIOSPORES ellipsoid-cylindrical to subballantoid, faintly thick-walled, neither amyloid, nor dextrinoid, faintly cyanophilous. TYPE OF ROT: white to brown.

Type: *Merulius rubicundus* Litsch., 1934 = *M. albostramineus* Torrend, 1913.

The rhizomoid basidiomata, almost pellicular hymenium and rather short basidia are peculiar to atheloid fungi, like *Fibulomyces* Jülich. On the other hand, there are some similarities to *Byssomerulius* in basidiocarp construction. Type species, *Ceraceomerulius albostramineus*, is a brown-rot fungus, whereas *C. serpens* is divided into two biological groups: 1) tetrapolar fungi associated with brown rot of gymnosperms, and 2) bipolar fungi associated with white rot of angiosperms (Hallenberg, 1988).

**Ceraceomerulius albostramineus** (Torrend) Ginns, Canad. J. Bot. **54(1-2)**:107, 1976. — *Merulius albostramineus* Torrend, 1913; *Serpula rufa* var. *pinicola* P. Karst., 1896; *Merulius armeniacus* Bres., 1925; *M. aurantiacus* Bres., 1925; *M. rubicundus* Litsch., 1934; *M. purpurascens* Corner, 1971.

~ **serpens** (Tode : Fr.) J. Erikss. & Ryvarde, Cort. N. Eur. **2**: 201, 1973. — *Merulius serpens* Tode : Fr., 1821; *M. porinoides* Fr., 1821; *M. ceracellus* Berk. et M.A. Curtis, 1872; *M. farlowii* Burt, 1917.

#### IV. VELUTICEPS AMBIGUA AND A SECRET OF THE HYMENOCHAETALES (AN AFTERWORD)

This paper originally had another title, “A natural arrangement of the Phanerochaetales”, and was mostly finished in 2002, i.e. to the twentieth anniversary of Jülich’s “Higher taxa of Basidiomycetes”. The latter book strongly influenced us during our work and this circumstance, probably, conjured up some analogies between Jülich’s “Higher taxa...” and our “A natural arrangement...”. Therefore, in this conclusional essay we allow to state briefly our own vision of Jülich’s achievements in fungal taxonomy.

In 2003, in his review on our manuscript, Prof. T. Niemelä wrote: «Walter Jülich was famous in his rapid publication of enormous amounts of new combinations... Of course he created so numerous new families, genera etc. taxon names that many of them necessarily are in use today...». Another citation: «...Publication of the Jülich’s book, probably, indicated the end of those good times when we might sincerely divide the Basidiomycetes among aphylophoralean, agaric and gasteromycete fungi» (Parmasto, 1983: 74). Thus, a paradigm change in fungal taxonomy, together with descriptions of many useful taxa, demonstrate an essential achievement of Walter Jülich in cryptogamic sciences.

In the course of time, the Jülich’s system naturally became out-of-date; in respect to its many theses, the words of Erast Parmasto became rather prophetic: “An artificial system built on a basis of the microscopic features is no more sophisticated than the last artificial systems created on the macromorphological features” (Parmasto, 1968: 19). Thus, a chain of the post-Jülichian systematics demonstrates one clear rule: *large groups of the homobasidiomycetes gradually descend in their number*. There are 36 orders of the homobasidiomycetes in Knudsen (1995), 22 in Hawksworth *et al.* (1995), 12 in Zmitrovich (2001), 10 in Zmitrovich and Wasser (2004), 8 in Kirk *et al.* (2001).

In this connection, the story of this paper is very edifying: we started our work, feeling ourselves well within Jülich’s concept of the Phanerochaetales, but later see this “order” to be merging strongly with the Polyporales. While we include *Hohenbuehelia* in the former, then exclusion of *Pleurotus*, *Panus*, or *Irpex* seems to be highly strained. There is an ephemeral border between Phanerochaeteae and Phlebieae (*Byssomerulius*, *Scopuloides*, *Australohydnum*), between Phlebieae–[Pleuroteae]–Polyporeae (*Lampromerulius* [*lindtneri*]), and among Phanerochaeteae–Phlebieae–Polyporeae (*Climacocystis*).

As a result of recent molecular studies, 5–7 large groups (≈orders) of the homobasidiomycetes are delimited. There are **cantharelloid**, **gomphoid-phalloid**, **hymenochaetoid**, **russuloid**, **euagaricoid**, and **polyporoid** “clades” (Hibbett, Thorn, 2001; Kirk *et al.*, 2001; Lutzoni *et al.*, 2004; Binder *et al.*, 2005; etc.). In total, this clade division can be in agreement with a large set of morphological features (Zmitrovich, Wasser, 2004), albeit some evidences of the “molecular trees” are quite intractable: 1) rDNA phylograms “distract” an evident morphological unity *Polyporus–Pleurotus*, referring them to the different clades (polyporoid and euagaricoid respectively); 2) they bring some phanerochaetoid — phlebioid forms as *Chondrostereum*, *Fistulina*, *Gloeostereum*, *Schizophyllum* to a euagarics clade, although their close relationships with the residual phlebias were confirmed by many morphological and cultural studies; 3) the position of hymenochaetoid clade is highly inconsistent and, in some cases, includes besides *Hyphodontia* complex also some rest euagarics (*Omphalina*).

In our opinion, the results of many molecular studies are strongly infected by the artifacts caused by “long branch attraction” (Philippe, Adoutte, 1998), when long (mutation-filled) branches are grouping mostly according by their length, and, moreover, having a strong tendency to shift lower their real place in a topology — they automatically gravitate to the longest branch of an outgroup. As a result, the cladogram branches are ordering according their length, whereas a low support of basal nodes allows some parallel radiations to “exchange” their paral-



lel branches (“short branch attraction artifact”). The genus *Polyporus*, undoubtedly, is “younger” than the genus *Pleurotus*, and DNA of the former is less mutation-filled; however, it does not mean their division among different clades!

If we'll take in consideration that the basal areas within rDNA cladograms are as a rule unresolved, we come to more fundamental explanation of the “molecules vs. morphology conflict”: *rDNA-trees remain “one character's trees”, whereas morphological ones are “pattern's trees”*. But, as we remember, a system based on the only feature (in this case — on highly conservative coding sequences of rDNA) is traditionally named as *artificial system*. Thus, we see a modified version of the classical sentence: **“An artificial system built on one (let even on molecular) feature is no more sophisticated than the last artificial systems created on the macromorphological features”**.

This viewpoint on the matter allows to propose: *in a reality can exist no more only two or three basal radiations, and the rest of them (another large recently detected “clades”) are the artifacts produced by an incubation of those*.

Probably, there are **only two** real basal radiations — cantharelloid (including gomphoid — dark-spored agaricoid, boletoid, hymenochaetoid, and russuloid clades) and polyporoid (including tricholomoid and phlebioid) ones. Of course, both these radiations show large fan-like subradiations of a family level, while the numerous families are characterized by the whole or particular appearance of the basidiomata morphotypes (stereoid, agaricoid, meruloid, corticioid forms etc.).

So a riddle of the Hymenochaetales can be guessed. Evidently, this “order” belongs to the “large cantharelloid radiation”, namely, to the part, where the origins of Boletales and Hyphodermatales (=Atheliales) coincide. In this respect, such a species as *Veluticeps ambigua* is highly interesting; according to its morphology, it might be interpreted as a clampless *Basidi-radulum* “pretending to be a *Hymenochaete*”. This example, maybe, will seem curious, and has no enough meaning from an orthodox mycologist's point of view. However, the morphological patterns of *Basidi-radulum*–*Kneiffiella*–*Hyphodontia* generic complex merge gradually with *Hypochnicium*–*Lagarobasidium*, and, through the latter ones, with *Amylocorticium* and *Serpula*, whose closest relationships with the Boletales are already undoubted. Also another boletoid–gomphoid theme of the Hyphodermatales can be observed: there is a theme of *Pellidiscus* with its “cortinarioid” *P. pallidus* and “coniophoroid” *P. pezizoideus*: this latter is an evident progenitor for most *Hyphoderma* and *Athelia* species. A different subject is some resonance of the deviating athelioid fungi (*Aphanobasidium*, *Athelidium*, *Pteridomyces*, *Paullicorticium*, *Repetobasidium*) with the basal lines of cantharelloid life — Sistotremataceae and Trechisporaceae. Further, an interrelation of the Boletales and “Cortinariales” sounds in comparison of some crepidotae with the Strobilomycetaceae species (Spirin *et al.*, 2005).

It seems, phanerochaetoid and phlebioid fungi derive simultaneously with the Hyphodermatales, but within the Polyporales radiation. The synchronous beginning of many morphogenetic streams causes their parallel evolution, i.e. development of stereoid forms (*Porostereum* / *Boreostereum*), tyromycetoid fungi (*Tyromyces* / *Parmastomyces*), fleshy hydnums (*Climacodon* / *Sarcodontia*, *Meiorganum*), hyperxeromorphous crusts (*Dacryobolus*, *Tubulicrinis* / *Chaetodermella*), grandinias (*Odontium flabelliradiatum* / *Basidi-radulum crustosum*),<sup>12</sup> odontias (*Mycocacia aurea* / *Basidi-radulum quercinum*), and pellicular athelioid fungi (*Leptochaete* / *Athelia*). Exceptionally hard parallelisms exist within corticioid forms, caused by its highly economic growth organization (hypochnoid, resupinate, rhizomoid, orbicular, protothalloid basidiomata), and having no diagnostically recognized “overbuildings”. There are no reasons to place corticioid fungi near the base of homobasidiomycetes, as well as its several clades (Hibbett, Binder,

<sup>12</sup> **Basidi-radulum crustosum** (Pers. : Fr.) Zmitr., V. Malysheva & Spirin comb. nov. – Bas.: *Hydnum crustosum* Pers. : Fr., Syst. Mycol. 1: 419, 1821.

2002), and, in contrary, to regard agaricoid forms as initial ones: all they are *only the growth forms* of fungi with various origins.

Having restructured the basal (rooted in Russulales-Boletales) area of polyporoid radiation, which else absolutely recently named as Phanerochaetales, and, as we hope, having homogenized its subdomains, we realize that still huge work is necessary ahead. First of all, the task will be the embedding of rich data from the area of beautiful morphology of tropical Podoscyphaceae (=Xerulaceae) and fleshy Polyporaceae in given a new canvas.

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## References

- Ander P., Marzullo L.** Sugar oxidoreductases and vetatril alcohol oxidase as related to lignin degradation // J. Biotechnol. **1997**. Vol. 53. P. 115–131.
- Binder M., Hibbett D. S., Larsson K.-H., Larsson E., Langer E., Langer G.** The phylogenetic distribution of resupinate forms across the main clades of mushroom-forming fungi (Homobasidiomycetes) // Syst. Biodiv. **2005**. Vol. 3. P. 113–157.
- Boidin J., Gilles G.** À propos du genre *Lopharia* sensu lato (Basidiomycètes, Aphylophorales) // Bull. Soc. Mycol. France. **2002**. Vol. 118. P. 91–115.
- Burdsall H.H.** A consideration of the names *Phanerochaete*, *Membranicium*, and *Grandiniella* (Corticaceae, Aphylophorales) // Taxon. **1977**. Vol. 26. P. 327–330.
- Burdsall H.H.** A contribution to the taxonomy of the genus *Phanerochaete* (Corticaceae, Aphylophorales) // Mycol. Mem. 10. **1985**. 166 p.
- Cléménçon H.** Cytology and plectology of the Hymenomycetes // Bibl. Mycol. 199. **2004**. 488 p.
- Corner E.J.H.** A monograph of cantharelloid fungi. Oxford: Univ. Press, **1966**. 255 p.
- Corner E.J.H.** The agaric genera *Lentinus*, *Panus*, and *Pleurotus*, with particular reference to Malaysian species // Beih. Nova Hedwigia. **1981**. Vol. 69. P. 1–169.
- Corner E.J.H.** Ad *Polyporaceas* V. The genera *Albatrellus*, *Boletopsis*, *Coriolopsis* (dimitic), *Cristelloporia*, *Diacanthodes*, *Elmerina*, *Fomitopsis* (dimitic), *Gloeoporus*, *Grifola*, *Hapalopilus*, *Heterobasidion*, *Hydnopolyporus*, *Ischnoderma*, *Loweoporus*, *Parmastomyces*, *Perenniporia*, *Pyrofomes*, *Stecchericum*, *Trechispora*, *Truncospora* and *Tyromyces* // Beih. Nova Hedwigia. **1989**. Vol. 96: P. 1–218.
- De Koker, T., Nakasone K.K., Haarhof J., Burdsall H.H., Janše B.J.H.** Phylogenetic relationships of the genus *Phanerochaete* inferred from the internal transcriber spacer region // Mycol. Res. **2003**. Vol. 107. P. 1032–1040.
- Donk M.A.** Notes on resupinate Hymenomycetes. VI // Persoonia. **1962**. Vol. 2. P. 217–238.
- Donk M.A.** A conspectus of the families of Aphylophorales // Persoonia **1964**. Vol. 3. P. 199–324.
- Drechsler C.** A nematode-capturing fungus with anastomosing clamp bearing hyphae // Mycologia. **1949**. Vol. 41. P. 369–387.
- D'Souza T.M., Boominathan K., Reddy C.A.** Isolation of laccase gene-specific sequences from white rot and brown rot fungi by PCR // Appl. Environ. Microbiol. **1996**. Vol. 62. P. 3739–3744.
- Eriksson J.** Studies in the Heterobasidiomycetes and Homobasidiomycetes-Aphylophorales of Muddus national park in North Sweden // Symb. Bot. Upsal. **1958**. Vol. 16. P. 1–172.
- Eriksson J., Hjortstam K., Ryvarden L.** The Corticiaceae of North Europe. Vol. 5: *Mycocaciella* –*Phanerochaete*. Oslo: Fungiflora, **1978a**. P. 889–1047.

- Eriksson J., Weresub L.K., Burdsall H.H.** *Phanerochaete* vs. *Grandiniella* (Corticiaceae, Aphyllophorales) // Taxon. **1978b**. Vol. 27. P. 51–52, 299–300.
- Gilbertson R.L.** Wood-rotting fungi of North America // Mycologia. **1980**. Vol. 72. P. 1–49.
- Ginns J.H.** *Merulius* s.s. and s.l., taxonomic disposition and identification of species // Can. J. Bot. **1976**. Vol. 54. P. 100–167.
- Hallenberg N.** Species delimitation in Corticiaceae (Basidiomycetes) // Mycotaxon. **1988**. Vol. 31. P. 445–465.
- Hansen L., Knudsen H. (eds)**. Nordic Macromycetes. Vol. 3: Heterobasidioid, aphylloporoid and gastromycetoid Basidiomycetes. Copenhagen: Nordsvamp, **1997**. 445 p.
- Hattori T.** Type studies of the polypores described by E.J.H. Corner from Asia and West Pacific Areas II. Species described in *Gloeophyllum*, *Heteroporus*, *Microporellus*, *Oxyporus*, *Paratrichaptum* and *Rigidoporus* // Mycoscience. **2001a**. Vol. 42. P. 19–28.
- Hattori T.** Type studies of the polypores described by E.J.H. Corner from Asia and West Pacific Areas III. Species described in *Trichaptum*, *Albatrellus*, *Boletopsis*, *Diacanthodes*, *Elmerina*, *Fomitopsis* and *Gloeoporus* // Mycoscience. **2001b**. Vol. 42. P. 423–431.
- Hawksworth D.L., Kirk P.M., Sutton B.C., Pegler D.N.** Ainsworth & Bisby's dictionary of the fungi. 8th ed. Wallingford: CAB International, **1995**. 616 p.
- Hibbett D.S., Donoghue M.J.** Progress toward a phylogenetic classification of the Polyporaceae through parsimony analysis of mitochondrial ribosomal DNA sequences // Can. J. Bot. **1994**. Vol. 73 (suppl. 1, sect. E–H). P. 853–861.
- Hibbett D.S., Pine E.M., Langer E., Langer G., Donoghue M.J.** Evolution of gilled mushrooms and puffballs inferred from ribosomal DNA sequences // Proc. Natl. Acad. Sci. USA. **1997**. Vol. 94. P. 12002–12006.
- Hibbett D.S., Thorn R.G.** Basidiomycota: Homobasidiomycetes. In: McLaughlin D.J. *et al.* (eds). *The Mycota*. A comprehensive treatise on fungi as experimental systems for basic and applied research. VII. Systematics and evolution. Part B. Berlin, Heidelberg, N.Y.: Springer, **2001**. P. 121–168.
- Hibbett D.S., Binder M.** Evolution of complex fruiting-body morphologies in homobasidiomycetes // Proc. Roy. Soc. Lond. B. **2002**. P. 1963–1969.
- Hjortstam K.** A check-list to genera and species of corticioid fungi (Hymenomycetes) // Windahlia. **1987**. Vol. 17. P. 55–85.
- Hjortstam K.** A checklist to genera and species of corticioid fungi (Basidiomycotina, Aphyllophorales) // Windahlia. **1998**. Vol. 23. P. 1–55.
- Hjortstam K.** Two new species of *Phanerochaete* (Basidiomycotina, Aphyllophorales), and a key to species from subtropical and tropical areas // Karstenia. **2000**. Vol. 40. P. 53–62.
- Hjortstam K., Larsson K.-H., Ryvarden L.** The Corticiaceae of North Europe. Vol. 1.: Introduction and keys. Oslo: Fungiflora, **1987**. P. 1–59.
- Hjortstam K., Ryvarden L.** *Lopharia* and *Porostereum* (Corticiaceae) // Synopsis Fungorum 4. **1990**. P. 1–68.
- Hyde S.M., Wood P.M.** A mechanism for production of hydroxyl radicals by brown rot fungus *Coniophora puteana*: Fe (III) reduction by cellobiose dehydrogenase and Fe (II) oxidation at a distance from the hyphae // Microbiology. **1997**. Vol. 143. P. 259–266.
- Jülich W.** Studies on resupinate Basidiomycetes III // Persoonia. **1975**. Vol. 8. P. 291–305.
- Jülich W.** Studies on resupinate Basidiomycetes IV // Persoonia. **1976**. Vol. 8. P. 431–442.
- Jülich W.** On some Aphyllophorales from Australia // Persoonia. **1978**. Vol. 9. P. 453–472.
- Jülich W.** Higher taxa of Basidiomycetes // Bibl. Mycol. **85**. **1982**. 485 p.
- Jülich W.** Notes on some Basidiomycetes // Persoonia. **1982**. Vol. 11. P. 421–428.
- Karsten P.A.** Enumeratio *Thelephorearum* Fr. et *Clavariarum* Fr. Fennicarum, systemate novo dispositarum // Rev. Mycol. **1881**. Vol. 3. P. 21–23.
- Karsten P.A.** Fragmenta mycologica XLIII // Hedwigia. **1895**. Vol. 34. P. 7–9.

- Keller J.** Atlas des Basidiomycetes vus aux microscopes electroniques. Neuchâtel: Union des Societies Suisses de Mycologie, **1997**. 173 p.
- Kirk P.M., Cannon P.F., David J.C., Stalpers J.A. (eds).** Ainsworth and Bisby's dictionary of the fungi. 9th edition. Egham: CAB International, **2001**. 655 p.
- Knudsen H.** Taxonomy of the basidiomycetes in Nordic Macromycetes // Symb. Bot. Upsal. **1995**. Vol. 30. P. 169–208.
- Komarova E.P.** Opređelitel' trutovyykh gribov Belorussii [Key-book to polyporoid fungi of Byelorussia]. Minsk: Nauka i tekhnika, **1964**. 343 p. (in Russian.)
- Kotiranta H., Penzina T.** *Spongipellis sibirica*, comb. nov. (Basidiomycetes), and its affinities to the polypore genera *Tyromyces*, *Aurantioporus* and *Climacocystis* // Ann. Bot. Fenn. **2001**. Vol. 38. P. 201–209.
- Kotlaba F., Pouzar Z.** Type studies of polypores described by A. Piliát III // Česká Mykol. **1990**. Vol. 44. P. 228–237.
- Larsson E., Larsson K.-H.** Phylogenetic relationships of russuloid basidiomycetes with emphasis on aphyllorphorealean taxa // Mycologia. **2003**. Vol. 95. P. 1037–1065.
- Locquin M.** *Clavaria asterospora* et structure de ses spores // Rev. Mycol. **1945**. Vol. 10. P. 62–64.
- Locquin M.** Mycologie générale et structurale. Paris, **1984**. 552 p.
- Lutizoni F., Kauff F., Cox C. J., McLaughlin D., Celio G., Dentinger B., Padamsee M., Hibbett D., James T.Y., Baloch E., Grube M., Reeb V., Hofstetter V., Schoch C., Arnold A.E., Miadlikowska J., Spatafora J., Johnson D., Hambleton S., Crockett M., Shoemaker R., Sung G.-H., Lücking R., Lumbsch Th., O'Donell K., Binder M., Diederich P., Ertz D., Gueidan C., Hansen K., Harris R.C., Hosaka K., Lim Y.-W., Matheny B., Nishida H., Pfister D., Rogers J., Rossman A., Schmitt I., Sipman H., Stone J., Sugiyama J., Yahr R., Vilgalys R.** Assembling the fungal tree of life: progress, classification, and evolution of subcellular traits // Am. J. Bot. **2004**. Vol. 91(10). P. 1446–1480.
- Moncalvo J.-M., Vilgalys R., Redhead S.A., Johnson J.E., James T.Y., Aime M.C., Hofstetter V., Verduin S.J.W., Baroni T.J., Thorn R.G., Jacobsson S., Cléménçon H., Miller O.K. (Jr.)** One hundred and seventeen clades of euagarics // Molecular Phylog. Evol. **2003**. Vol. 23. P. 357–400.
- Nakasone K., Gilbertson R.L.** Three resupinate hydneous basidiomycetes from Hawaii // Folia Cryptog. Estonica. **1998**. Vol. 33. P. 85–92.
- Niemelä T.** New data on *Albatrellus syringae* (Parmasto) Pouzar and *A. peckianus* (Cooke) Niemelä n. comb. // Ann. Bot. Fennici. **1970**. Vol. 7. P. 52–57.
- Niemelä T., Kinnunen J., Larsson K.H., Schigel D.S., Larsson E.** Genus revision and new combinations of some North European polypores // Karstenia. **2005**. Vol. 45. P. 75–80.
- Nobles M.K.** Cultural characters as a guide to the taxonomy of the Polyporaceae. In: Evolution in higher Basidiomycetes. Knoxville: Univ. Press, **1971**. P. 169–195.
- Nuss I.** Untersuchungen zur systematischen Stellung der Gattung *Polyporus* // Hoppea. **1980**. Vol. 39. P. 127–198.
- Oberwinkler F.** The significance of the morphology of the basidium in the phylogeny of Basidiomycetes. In: Wells K., Wells E.K. (eds) Basidium and basidiocarp. L. etc., **1982**. P. 9–35.
- Oláh G. M., Piché Y., Reisinger O.** L'ontogénie pariétale des cellules sporogènes et des cellules sporales chez quelques Agarics // Trav. Soc. Fr. Phytopath. **1977**. P. 275–305.
- Parmasto E.** Corticiaceae U.R.S.S. IV. Descriptiones taxorum novarum. Combinationes novae // Eesti NSV Tead. Akad. Toim. Biol. **1967**. Vol. 16. P. 377–394.
- Parmasto E.** Conspectus systematis *Corticiacearum*. Tartu: Inst. Zool. Bot., **1968**. 261 p.
- Parmasto E.** The genus *Dictyonema* ('*Thelephorolichenes*') // Nova Hedwigia. **1978**. Vol. 29. P. 99–166.

- Parmasto E.** Review of textbook “Higher taxa of Basidiomycetes” by W. Jülich (“34 ris., 20 tabl., 2 schemy”) // Mikol. Fitopatol. **1983**. Vol. 17. P. 73–74. (in Russian.)
- Parmasto E.** On the origin of the Hymenomycetes (What are corticioid fungi?) // Windahlia. **1986**. Vol. 16. P. 3–19.
- Parmasto E.** Corticioid fungi: a cladistic study of a paraphyletic group // Can. J. Bot. **1995**. Vol. 73 (suppl. 1, sect. E–H). P. 843–852.
- Parmasto E., Hallenberg N.** A taxonomic study of phlebioid fungi // Nordic J. Bot. **2000**. Vol. 20. P. 105–118.
- Petersen J. H.** Foreningen til Svampekundskabens Fremmes farvekort. Copenhagen, **1996**. 3 pl.
- Petersen R. H.** The genus *Clavulinopsis* in North America // Mycologia Mem. **2**. **1968**. 39 p.
- Petersen R. H.** The clavarioid fungi of New Zealand // DSIR Bull. **1988**. Vol. 236. P. 1–170.
- Philippe H., Adoutte A.** A molecular phylogeny of *Eukaryota*: solid facts and uncertainties. In: Evolutionary relationships among *Protozoa*. L.: Kluwer, **1998**. P. 25–56.
- Pieri M., Rivoire B.** À propos du genre *Ceriporia* Donk // Bull. Soc. Mycol. France. **1997**. Vol. 113. P. 193–250.
- Pieri M., Rivoire B.** À propos du genre *Scutigera* // Bull. Soc. Mycol. France. **2002**. Vol. 118. P. 31–47.
- Ryman S., Fransson P., Johannesson H., Danell E.** *Albatrellus citrinus* sp. nov., connected to *Picea abies* on lime rich soils // Mycol. Res. **2003**. Vol. 107. P. 1243–1246.
- Ryvarden L.** Genera of polypores. Nomenclature and taxonomy // Synopsis Fung. 5. Oslo: Fungiflora, **1991**. P. 1–363.
- Ryvarden L., Gilbertson R.L.** European polypores. Pt. 1. Oslo: Fungiflora, **1993**. 387 p.
- Singer R.** The Agaricales in modern taxonomy. 3rd ed. Vaduz: J. Cramer, **1975**. 912 p.
- Singer R.** The Agaricales in modern taxonomy. 4th ed. Königstein: Koeltz Scientific Books, **1986**. 981 p.
- Spirin W.** *Tyromyces* P. Karst. and related genera // Mycena. **2001**. Vol. 1, No. 1. P. 64–71.
- Spirin W.** *Antrodiella romellii* in Russia // Mycena. **2003**. Vol. 3. P. 48–52. (in Russian.)
- Spirin W., Zmitrovich I.** A contribution to the taxonomy of corticioid fungi: *Merulius* Fr., *Phlebia* Fr., and related genera // Novitates systematicae plantarum non vascularium. **2004**. T. 37. P. 166–188. (in Russian.)
- Spirin W.A., Zmitrovich I.V., Malysheva V.F.** Notes on Perenniporiaceae // Folia Cryptogamica Petropolitana. **2005**. No. 3. P. 1–68.
- Stalpers J.A.** *Spiniger*, a new genus for imperfect states of Basidiomycetes // Proc. Kon. Ned. Akad. Wet., C. **1974**. Vol. 77. P. 402–407.
- Stalpers J.A.** A revision of the genus *Sporotrichum* // Stud. Mycol. **1984**. Vol. 24. P. 1–105.
- Stalpers J.A.** On the genera *Sarcodontia*, *Radulodon* and *Pseudolagarobasidium* // Folia Crypt. Estonica. **1998**. Vol. 33. P. 133–138.
- Stalpers J.A.** The genus *Ptychogaster* // Karstenia. **2000**. Vol. 40. P. 167–180.
- Stalpers J.A., Vlug I.** *Confistulina*, the anamorph of *Fistulina hepatica* // Can. J. Bot. **1983**. Vol. 61. P. 1660–1666.
- Thorn R.G., Barron G.L.** *Nematoctonus* and the tribe Resupinateae in Ontario, Canada // Mycologia. **1986**. Vol. 25. P. 321–453.
- Vampola P., Pouzar P.** Notes on some species of genera *Ceriporia* and *Ceriporiopsis* (Polyporaceae) // Czech Mykol. **1996**. Vol. 48. P. 315–324.
- Wang Z., Binder M., Dai Y., Hibbett D.S.** Phylogenetic relationships of *Sparassis* inferred from nuclear and mitochondrial ribosomal DNA and RNA polymerase sequences // Mycologia. **2004**. Vol. 96. P. 1013–1027.
- Wu S.-H.** The Corticiaceae (Basidiomycetes) subfamilies Phlebioideae, Phanerochaetoideae and Hyphodermoideae in Taiwan // Acta Bot. Fennica. **1990**. Vol. 142. P. 1–123.

- Wu S.-H.** Six new species of *Phanerochaete* from Taiwan // Bot. Bull. Acad. Sin. **2000**. Vol. 41. P. 165–174.
- Yurchenko E.O.** Non-poroid aphyllorphoraceous fungi proposed to the third edition of the Red Data Book of Belarus // Mycena. **2002**. Vol. 2, No. 1. P. 31–68.
- Zmitrovich I.V.** Macrosystem and phylogeny of Basidiomycetes: the case for a red algal progenitor // Mycena. **2001**. Vol. 1, No. 1. P. 3–58. (in Russian.)
- Zmitrovich I.V.** Review of textbook “Cytology and plectology of the Hymenomycetes” by H. Cléménçon // Mikol. Fitopatol. **2006a**. Vol. 40. (in press, in Russian.)
- Zmitrovich I.V.** Some problems of evolutionary and ecological morphology in higher fungi // Folia Cryptogamica Petropolitana. **2006b**. No 5. (in press, in Russian.)
- Zmitrovich I.V., Malysheva V.F., Malysheva E.F., Spirin W.A.** Pleurotoid fungi of Leningrad Region (with notes on rare and interesting East-European taxa) // Folia Cryptogamica Petropolitana. **2004**. Vol. 1. 124 p. (in Russian.)
- Zmitrovich I.V., Wasser S.P.** Modern view on the origin and phylogenetics reconstruction of Homobasidiomycetes fungi. In: Wasser S.P. (ed.) Evolutionary theory and processes: Modern horizons. Boston, L., **2004**. P. 230–263.
- Zmitrovich I.V., Spirin V.A.** Some ecological aspects of speciation in higher fungi // Vestnik ekologii, lesovedeniya i landshaftovedeniya [Bulletin of Ecology, Forest Science, and Landscape Science (Tyumen)]. **2005**. Vol. 6. P. 46–68. (in Russian.)

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**calcareum** Cooke & Masee → Radulodon

**chrysoecomum** Underw. → Hydnohplebia  
**chrysohiza**  
**chrysohizon** Torr. → Hydnohplebia  
**copelandii** Pat. → Radulodon  
**croceum** Schwein. : Fr. → Sarcodontia  
**crustosum** Pers. : Fr. → Basidiuradulum  
**earleanum** Sumstine → Sarcodontia crocea  
**foetidum** Velen. → Sarcodontia crocea  
**fragilissimum** Berk. & M.A. Curtis → Hydnohplebia chrysohiza  
**fulgens** Fr. → Pycnoporellus  
**griseofuscescens** Reichardt → Australohydnum dregeanum  
**ishodes** Berk. → Hydnohplebia chrysohiza  
**luteocarneum** Secr. → Sarcodontia crocea  
**multiforme** Berk. & Broome → Hypochnicium  
**omnivorum** Shear → Grandiniella  
**pachyodon** Pers. → Sarcodontia  
**pseudomucidum** Petch → Radulodon  
**pulcherrimum** Berk. & M.A. Curtis → Climacodon  
**roseomaculatum** Henn. & E. Nyman → Climacodon  
**sanguineum** Beeli → Climacodon  
**schestunowii** Nikol. → Sarcodontia pachyodon  
**schiedermayri** Heufler → Sarcodontia crocea  
**septentrionale** Fr. → Climacodon  
**sericeum** Sw. → Byssomerulius pavonius  
**setosum** Pers. → Sarcodontia crocea  
**subvelutinum** Berk. & M.A. Curtis → Sarcodontia crocea  
**subvinosum** Berk. & Broome → Radulodon

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**calotricha** (P. Karst.) Zmitr. & Spirin 39  
**carnea** (Burt) Zmitr. & Spirin 39  
**galactites** (Bourdote & Galzin) Zmitr. & Spirin 39  
**sanguinea** (Fr. : Fr.) Zmitr. & Spirin 39

**LEPTOGIDIUM**

- moorei** Nyl.→Byssomerulius

**LEPTOPORUS**

- bredecensis** Pilát→Sarcodontia delectans  
**mollis** (Pers. : Fr.) Pilát 28, 39

**LOPHARIA**

- mexicana** A.L. Welden→Hjortstamia  
**perplexa** D.A. Reid→Hjortstamia

**LOWEOMYCES**

- fractipes** (Berk. & M.A. Curtis) Jülich 13, 23  
**sibiricus** (Penzina & Ryvar den) Spirin 23  
**subgiganteus** (Berk. & M.A. Curtis) Spirin 23

**MARASMIUS**

- spodoleucus** Berk. & Broome→Hohenbuehelia

**MERIPILUS**

- giganteus** (Pers. : Fr.) P. Karst. 24

**MERULIUS**

- albostramineus** Torrend→Ceraceomerulius  
**ambiguus** Berk.→Gloeoporus  
**armeniacus** Bres.→Ceraceomerulius albostramineus  
**aurantiacus** Bres.→Ceraceomerulius albostramineus  
**castaneus** Lloyd→Australohydnum  
**ceracellus** Berk. et M.A. Curtis→Ceraceomerulius serpens  
**conchooides** Lloyd→Gloeoporus ambiguus  
**confluens** Schwein. : Fr.→Byssomerulium  
**corium** Pers. : Fr.→Byssomerulius  
**farlowii** Burt→Ceraceomerulius  
**hirtellus** Burt→Byssomerulius

- miniatus** Wakef.→Byssomerulius  
**porinoides** Fr.→Ceraceomerulius serpens  
**purpurascens** Corner→Ceraceomerulius albostramineus  
**purpurascens** var. **flavidoalbus** Corner→Byssomerulius flavidoalbus  
**ravenelii** Berk.→Gloeoporus taxicola  
**rubicundus** Litsch.→Ceraceomerulius albostramineus  
**serpens** Tode : Fr.→Ceraceomerulius sordidus Berk. & M.A. Curtis→Byssomerulius  
**succineus** Lloyd→Gloeoporus ambiguus  
**sulphureus** Burt→Byssomerulius

**MYCOLEPTODON**

- annamensis** Har. & Pat.→Climacodon

**ODONTIA**

- columellifera** G. Cunn.→Columnodontia  
**laxa** L.W. Mill.→Odonticium  
**lutea** G. Cunn.→Columnodontia  
**pirottae** Bres.→Byssomerulius  
**romellii** S. Lundell→Odonticium  
**subirpicoidea** Rick→Efibula subquercina

**ODONTICIUM**

- adnatum** (Hjortstam) Zmitr. & Spirin 40  
**africanum** (Boidin) Zmitr. & Spirin 40  
**australe** D.A. Reid 40  
**canoloteum** (Sheng H. Wu) Zmitr. & Spirin 40  
**cirratum** (Hjortstam & Ryvar den) Spirin & Zmitr. 40  
**denticulatum** (Hjortstam) Spirin & Zmitr. 40  
**dispar** (Hjortstam & Ryvar den) Zmitr. & Spirin 40  
**eruciforme** (G. Cunn.) Zmitr. & Spirin 40  
**exilis** (Burt) Zmitr. & Spirin 40  
**labelliradiatum** (J. Erikss. & Hjortstam) Zmitr. 40  
**helgae** Hjortstam & Ryvar den 40  
**langloisii** (Pat.) Zmitr. & Spirin 40  
**laxum** (L.W. Mill.) Ryvar den 40  
**magnahypha** (Burt) Zmitr. & Spirin 40  
**monfraguense** M.N. Blanco, G. Moreno & Man. 40  
**raivirii** Parmasto→O. septocystidium  
**romellii** (S. Lundell) Parmasto 40  
**septocystidium** (Burt) Zmitr. & Spirin 40  
**simulans** (Hjortstam) Zmitr. & Spirin 40  
**verruculosum** (Hjortstam) Zmitr. & Spirin 40

**PENIOPHORA**

*affinis* Burt→Phanerochaete laevis  
*arenata* P.H.B. Talbot→Phanerochaete  
*burtii* Romell→?Leptochaete carnosa  
*cacaina* Bourdot & Galzin→Grandiniella  
*cana* Burt→Scopuloides  
*carnosa* Burt→Leptochaete  
*cystidiosa* Rehil & Bakshi→Porostereum  
*eruciformis* G. Cunn→Odonticium  
*exilis* Burt→Odonticium  
*firma* Burt→Leptochaete carnosa  
*gilvidula* Bres.→Phanerochaete laevis  
*hiulca* Burt→Scopuloides  
*karstenii* Masee→Phanerochaete velutina  
*leprosa* Bourdot & Galzin→Phanerochaete  
 velutina  
*limonia* Burt→Leptochaete calotricha  
*lindtneri* Pilát→Hohenbuehelia  
*magnahypha* Burt→Odonticium  
*molleriana* Bres.→Scopuloides ravenelii  
*phosphorescens* Burt→Phanerochaete ve-  
 lutina  
*ravenelii* Cooke→Scopuloides  
*rhodochroa* Bres.→Phanerochaete velutina  
*septocystidiata* Burt→Odonticium  
*stereoides* Rick→Efibula tuberculata  
*subiculosa* Burt→Phanerochaete  
*texana* Burt→Phanerochaete flavidoalba  
*unicolor* Peck→Phanerochaete filamentosa

**PHAEOLUS**

*alborubescens* (Bourdot & Galzin) Bourdot &  
 Galzin→Aurantioporus alborubescens  
**schweinitzii** (Fr.) Pat. 27

**PHANEROCHAETE**

*aculeata* Hallenb.→Grandiniella  
**angustocystidiata** Sheng H. Wu 41  
*arenata* (P.H.B. Talbot) Burds. 41  
*arizonica* Burds. & Gilb.→Grandiniella  
*australis* Jülich→Grandiniella  
*borneensis* Jülich→Ph. filamentosa  
*bubalina* Burds.→Efibula  
*canolutea* Sheng H. Wu→Odonticium  
*chabarovskii* Burds. →Leptochaete carnosa  
*chrysosporium* Burds.→Grandiniella  
*cremea* var. *caucasica*  
 Parmasto→Grandiniella caucasica  
**ericina** (Bourdot) J. Erikss. & Ryvarden 41  
**filamentosa** (Berk. & M.A. Curtis) Burds. 41  
*flabelliradiata* J. Erikss. & Hjort-  
 stam→Odonticium  
**flavidoalba** (Cooke) Rattan 41  
*ginnsii* Sheng H. Wu→Efibula

*irpicoides* Hjortstam→Grandiniella  
**laevis** (Pers. : Fr.) J. Erikss. & Ryvarden 41  
**laxa** Sheng H. Wu 41  
**luteoaurantiaca** (Wakef.) Burds. 41  
*macrospora* Bres.→Grandiniella martelliana  
**odontoidea** Sheng H. Wu 41  
*pallida* Parmasto→Byssomerulius jose-  
 ferreirae  
*radulans* Hallenb.→Efibula subquercina  
*raduloides* J. Erikss. & Ry-  
 varden→Grandiniella magnoliae  
*robusta* Parmasto→Grandiniella  
**salmoneolutea** Burds. & Gilb. 41  
**subiculosa** (Burt) Burds. 41  
*subodontoidea* Sheng H. Wu→Efibula  
*tuberculascens* Hjortstam→Efibula aurata  
**velutina** (DC. per Pers. : Fr.) P. Karst.  
 41

**PHLEBIA**

*deglubens* Berk. & M.A. Cur-  
 tis→Byssomerulius corium  
*deflectens* (P. Karst.) Ryvarden→Efibula  
*gigantea* (Fr. : Fr.) Donk→Scopuloides  
*lindtneri* (Pilát) Parmasto→Hohenbuehelia  
*merulioidea* Parmasto→Hohenbuehelia  
 lindtneri  
*verruculosa* Hjortstam & Ryvarden→Efibula

**PHLEBIOPSIS**

*gigantea* (Fr. : Fr.) Donk→Scopuloides

**PLEUROTUS**

*cyphelliformis* (Berk.)  
 Sacc.→Hohenbuehelia spodeoleuca  
*leightonii* (Berk.) Sacc.→Hohenbuehelia  
*longipes* Boud.→Hohenbuehelia  
*petaloides* var. *geogenius* (DC. : Fr.) Pi-  
 lát→Hohenbuehelia  
*sylvanus* (Sacc.) Sacc.→Hohenbuehelia

**POLYPORUS**

*adustus* Willd. : Fr.→Grifola  
*alligatus* Fr.→Grifola fumosa  
*aneirinus* Sommerf. : Fr.→Raduliporus  
*baudonii* Pat.→Laetiporus  
*borealis* Fr.→Climacocystis  
*campylus* Berk.→Grifola  
*cinnamatus* Morgan→Laetiporus  
*cinerascens* Velen.→Grifola adusta  
*cretaceus* Lloyd→Grifola  
*croceus* Pers. : Fr.→Aurantioporus  
*delectans* Peck→Sarcodontia  
*distortus* Schwein. : Fr.→Grifola biennis

*fibrillosus* P. Karst.→*Pycnoporellus fulgens*  
*fissilis* Berk. & M.A. Curtis→*Aurantioporus*  
*fractipes* Berk. & M.A. Curtis→*Loweomyces*  
*frondosus* Dicks. : Fr.→*Grifola*  
*fumosogriseus* Cooke & Ellis→*Grifola adu-*  
*sta*  
*fumosus* Pers. : Fr.→*Grifola*  
*giganteus* Pers. : Fr.→*Meripilus*  
*latemarginatus* Dur. & Mont.→*Emmia*  
*leptodermus* Berk. & Broome→*Gloeoporus*  
*melleus* Berk. & Broome→*Gloeoporus*  
*mollis* Pers. : Fr.→*Leptoporus*  
*mutans* Peck→*Hapalopilus*  
*nidulans* Fr.→*Hapalopilus rutilans*  
*persicinus* Berk. & M.A. Curtis→*Laetiporus*  
*portentosus* Berk.→*Laetiporus*  
*purpureus* Fr. : Fr.→*Gloeoporus*  
*reticulatus* Hoffm. : Fr.→*Gloeoporus*  
*rhodellus* Fr.→*Gloeoporus viridans*  
*rosularis* G. Cunn.→*Grifola campyla*  
*rufus* (Schrad. : Fr.) Fr.→*Gloeoporus taxi-*  
*cola*  
*rutilans* Pers. : Fr.→*Hapalopilus*  
*schweinitzii* Fr.→*Phaeolus*  
*semitinctus* Peck→*Gloeoporus*  
*sorbicola* Fr.→*Gloeoporus taxicola*  
*sordulentus* Mont.→*Grifola*  
*spissus* Schwein. : Fr.→*Gloeoporus*  
*spumeus* Sowerby : Fr.→*Sarcodontia*  
*subcinereus* Berk.→*Grifola adusta*  
*subgiganteus* Berk. & M.A. Cur-  
 tis→*Loweomyces*  
*sulphureus* Bull. : Fr.→*Laetiporus*  
*tardus* Berk.→*Gloeoporus*  
*tristis* Pers.→*Grifola adusta*  
*viridans* Berk. & Broome→*Gloeoporus*

#### **POLYSTICTUS**

*dubitativus* Lloyd→*Climacodon*

#### **PORIA**

*alachuana* Murrill→*Gloeoporus*  
*bresadolae* Bourdot & Galzin→*Gloeoporus*  
*purpureus*  
*camaresiana* Bourdot & Galzin→*Gloeoporus*  
*reticulatus*  
*cocos* (Schwein.) Wolf.→*Wolfiporia*  
*excelsa* S. Lundell→*Gloeoporus*  
*ferrugineocincta* Murrill→*Gloeoporus*  
*metamorphosa* Fuckel→*Emmia*  
*ochraceolateritia* Bondartsev→*Hapalopilus*  
*otakou* G. Cunn.→*Gloeoporus*  
*terrestris* Pers.→*Grifola biennis*  
*totara* G. Cunn.→*Gloeoporus*

*turkestanica* Pilát→*Gloeoporus viridans*  
*wasjunganica* Pilát→*Raduliporus aneirinus*

#### **POROSTEREUM**

*amethysteum* Hjortstam & Ry-  
 varden→*Hjortstamia*  
**cystidiosum** (Rehll & Bakshi) Hjortstam &  
 Ryvarden 42  
**fulvus** (Lév.) Boidin & Gilles 42  
**lilacinum** (Berk. & Broome) Hjortstam 42  
*phellodendri* Pilát→*spadiceum*  
**spadiceum** (Pers. : Fr.) Hjortstam & Ry-  
 varden 42  
**umbrinolutaceum** (Wakef.) Hjortstam &  
 Ryvarden 42

#### **PSEUDOLAGAROBASIDIUM**

*leguminicola* J.C. Jang & Chen→*Radulodon*  
*subvinosus*

#### **PYCNOPORELLUS**

**alboluteus** (Ellis & Everh.) Kotl. & Pouzar  
 27  
**fulgens** (Fr.) Donk 27

#### **RADULIPORUS**

**aneirinus** (Sommerf. : Fr.) Spirin & Zmitr.  
 24, 34

#### **RADULODON**

**americanus** Ryvarden 24, 25  
**calcareus** (Cooke & Masee) Jülich 25  
**casearius** (Morgan) Ryvarden 25  
**copelandii** (Pat.) N. Maekawa 25  
**erikssonii** Ryvarden 25  
**pseudomucidus** (Petch) Stalpers 25  
**subvinosus** (Berk. & Broome) Stalpers 25

#### **RADULUM**

*cumulodentatum* Nikol.→*Grandiniella mag-*  
*noliae*  
*magnoliae* Berk. & M.A. Cur-  
 tis→*Grandiniella*  
*subquercinum* P. Henn.→*Efibula*

#### **RIOPA**

*davidii* D.A. Reid→*Gloeoporus reticulatus*

#### **SARCODONTIA**

*mail* S. Schulz.→*S. crocea*  
**delectans** (Peck) Spirin 25  
**pachyodon** (Pers.) Spirin 25  
**setosa** (Pers.) Donk 25  
**spumea** (Sowerby : Fr.) Spirin 25

**unicolor** (Schwein.) Zmitr. & Spirin 25

### SCOPULOIDES

**cana** (Burt) Zmitr. & Spirin 15

**gigantea** (Fr. : Fr.) Spirin & Zmitr. 15

**hiulca** (Burt) Zmitr. & Spirin 15

**ravenelii** (Cooke) Boidin, Lanq. & Gilles 15

### SISTOTREMA

*rufescens* Pers.→Grifola biennis

### SPARASSIS

**brevipes** Krombh. 26

**crispa** Wulfen : Fr. 26

*herbstii* Peck→S. *crispa*

*laminosa* Fr.→?S. *brevipes*

*nemecii* Pilát & Veselsky→S. *crispa*

*radicata* Weir→S. *crispa*

*spathulata* Schwein. : Fr.→?S. *crispa*

**cystidiosa** Desjardin & Wang 26

### SPONGIPELLIS

*delectans* (Peck) Pat.→Sarcodontia

*litschaueri* Lohwag→Sarcodontia *delectans*

*sibiricus* (Penzina & Ryvarden) Kotiranta &

Penzina→Loweomyces

*spumeus* (Sowerby : Fr.) Pat.→Sarcodontia

### STEREUM

*papyrinum* Mont.→Hjortstamia

*percome* Berk. & Broome→Hjortstamia

*schomburgkii* Berk.→Porostereum *fulvum*

*sponheimeri* Pilát→Porostereum *spadiceum*

*venosum* Quél.→Porostereum *spadiceum*

*umbrinoalutaceum* Wakef. in Sarasin &

Roux→Porostereum

*umbrinum* Berk. & M.A. Curtis→Hjortstamia

*crassa*

### THELEPHORA

*bolaris* Pers.→Leptochaete *sanguinea*

*crassa* Lév.→Hjortstamia

*friesii* Lév. in Zollinger→Hjortstamia

*fulva* Lév.→Porostereum

*gigantea* Fr. : Fr.→Scopuloides

*glabrata* Spreng.→Byssomerulius *pavonius*

*miniata* Berk.→Leptochaete *sanguinea*

*ochroleuca* Fr. : Fr.→Byssomerulius *corium*

*papyracea* Jungh.→Hjortstamia *friesii*

*pavonia* Sw.→Byssomerulius

*sanguinea* Fr. : Fr.→Leptochaete

*spadicea* Pers. : Fr.→Porostereum

*velutina* DC. per Pers. : Fr.→Phanerochaete

*viticola* Schwein.→Erythricium

### TYROMYCES

*aneirinus* (Sommerf. : Fr.) Bondartsev &

Singer→Raduliporus

*falcatus* G. Cunn.→Grifola *campyla*

*fissilis* (Berk. & M.A. Curtis)

Donk→Aurantiporus

*sibiricus* Penzina & Ry-

varden→Loweomyces

*transformatus* Núñez & Ry-

varden→Aurantiporus

### WOLFIPORIA

**cocos** (Schwein.) Ryvarden & Gilb. 27

**curvispora** Y.-C. Dai 27

**dilatohypha** Ryvarden & Gilb. 28

### XYLOMYZON

*taxicola* Pers. : Fr.→Gloeoporus