

## The identity of *Postia lowei* (Basidiomycota, *Polyporales*) and notes on related or similar species

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Vampola P., Ordynets A., Vlasák J. (2014): The identity of *Postia lowei* (Basidiomycota, *Polyporales*) and notes on related or similar species. – Czech Mycol. 66(1): 39–52.

In an attempt to settle the systematic position of Pilát's species *Leptoporus lowei* (currently *Postia lowei*), which is sometimes incorrectly interpreted in mycological literature, a study of rich type material deposited in the mycological herbarium of the National Museum, Prague (PRM) was undertaken. Detailed description of macroscopic and microscopic features is presented together with molecular characterisation. The most important macroscopic and microscopic features differentiating *P. lowei* from similar or related species are discussed. Phylogenetic analysis clearly demonstrated that *P. lowei* is a well-separated taxon with closest affinity to *P. leucomallella* and *P. tephroleuca*.

**Key words:** *Postia*, polypores, taxonomy, identification, internal transcribed spacer.

Vampola P., Ordynets A., Vlasák J. (2014): Příspěvek k poznání bělochoroše Loweova – *Postia lowei* (Basidiomycota, *Polyporales*) a poznámky k příbuzným nebo podobným druhům. – Czech Mycol. 66(1): 39–52.

Ve snaze o vyjasnění systematického postavení Pilátova druhu choroše *Leptoporus lowei* (nyní *Postia lowei*), který je v mykologické literatuře někdy chybně interpretován, autoři prostudovali bohatý typový materiál uložený v mykologickém herbáři Národního muzea v Praze (PRM). Je podán podrobný makroskopický a mikroskopický popis tohoto druhu společně s molekulární charakteristikou. Fylogenetická analýza prokázala, že *P. lowei* je dobře oddělený taxon s nejbližší příbuzností k *P. leucomallella* a *P. tephroleuca*. Současně jsou diskutovány nejdůležitější makroskopické a mikroskopické znaky, které odlišují *P. lowei* od podobných nebo blíže příbuzných druhů.

### INTRODUCTION

In the course of his lifetime, prominent Czech mycologist Dr. Albert Pilát described many species of polypores (*Polyporales* s. l.) not only from Europe, but also from North America, Africa and Asia. Most of his European taxa come from the westernmost region of today's Ukraine (Eastern Carpathians) which was the easternmost region of former Czechoslovakia in 1918–1939 (Holec 2002, Kotlaba

& Pouzar 1988). *Leptoporus lowei* Pilát, recently named *Postia lowei* (Pilát ex Pilát) Jülich, was collected by its author on lying spruce logs in an old-growth forest composed of *Abies alba*, *Picea abies* and *Fagus sylvatica* in the valley of the river “Berlebáš” (currently named Velykyj) northeast of “Trebušany” (Dilove) in August 1937. In 1938, Pilát described the collection as a new species in his compendium of *Polyporaceae* s. l. (Pilát 1936–42), but without a Latin diagnosis; this was published 15 years later (Pilát 1953). Rich type material, deposited in the mycological herbarium of the National Museum, Prague (PRM), comprises 22 specimens containing dozens of basidiomes in different stages of development. The material is rather homogeneous and agrees well with the holotype, PRM 487991. Examination of the type material showed that *Leptoporus lowei* characters in mycological literature (e.g. Ryvar den 1978, Jülich 1984) are sometimes incorrectly or not exactly understood, so that this species is often misinterpreted. The aim of this study is to present a detailed macroscopic and microscopic description of *L. lowei* and discuss the features differentiating it from all similar and related species. The phylogenetic analysis which is also presented shows the sequence-based relationships of some of the studied species. As the generic concept of *Postia/Oligoporus/Spongiporus* is not yet fully resolved, we use the Index Fungorum (<http://www.indexfungorum.org/>) concept.

#### MATERIAL AND METHODS

**Macroscopic and microscopic study.** Twenty-two herbarium specimens of the *Leptoporus lowei* Pilát type material, deposited in the PRM herbarium (National Museum Prague, Mycological Department) were studied together with three recent collections of this species from Białowieża virgin forest and the Russian Far East deposited in the herbarium of the Botanical Museum, University of Helsinki (H). All the specimens were studied microscopically in detail to ascertain the variation of characteristic features. Vouchers of some related or similar species (36 specimens) deposited in BRNM, KUO, MJ, PRM (abbreviations according to Thiers on-line), and in private herbaria of the first and third authors (abbreviated PV, JV) were also included. The macroscopic chemical reaction of the context was tested with a 10% solution of FeSO<sub>4</sub>. Microscopic characters were observed in Melzer’s reagent under Olympus BX41 and Meopta D816Bi microscopes with an oil immersion lens at a magnification of 1000×. For basidiospores, the following abbreviations are used: L = mean spore length (arithmetical mean of all spores), W = mean spore width (arithmetical mean of all spores), Q = variation in L/W ratios, n = number of spores measured in a particular number of specimens.

**DNA isolation and sequencing.** An amount of 0.25 g of context tissue was disintegrated for 60 s with an MM301 RETSCH steel ball mixer mill at room

temperature. DNA was isolated using the CTAB/NaCl extraction buffer as described by Murray & Thompson (1980), followed by repeated extraction with chloroform and isopropanol precipitation. In some cases, gelatinous matter was co-extracted with DNA samples, which interfered with further purification and amplification. In such cases, the tissue debris material was re-extracted once more and this preparation was used for further purification. Crude DNA was dissolved in 100 µl of sterile water and further purified using Promega Wizard Clean Up kit. The resulting DNA solution (50 µl) was diluted ten times and 1 µl was used as a template for amplification with ITS5 and ITS4 primers (White et al. 1990) in 25 µl reaction mixture using an annealing temperature of 55 °C. Amplified DNA was sequenced in the Genomics laboratory of the Biology Centre, Academy of Sciences of the Czech Republic, České Budějovice, on an ABI 3730xl DNA analyzer, using a BigDye Terminator 3.1 kit.

**Phylogenetic analysis.** As we could not isolate DNA from Pilát's old type material, we sequenced a recent collection of *P. lowei* TN8775 from Białowieża virgin forest in Poland, which is both macroscopically and microscopically identical with Pilát's type, and also a slightly aberrant specimen, SP5692, from the Russian Far East. We also sequenced three specimens of *P. lateritia* (KUO 021153, KUO 020197, JV 0809/65A), three specimens of *P. fragilis* (MJ 106/04, MJ 182/04, JV 0610/8), one specimen of *P. leucomallella* (MJ 24/02), one specimen of *P. tephroleuca* (JV1310/9) and two specimens of *P. folliculocystidiata* (MJ 27/06, JV 0907/7). Three other sequences of *P. lowei*, *P. leucomallella* and *P. tephroleuca* were retrieved from GenBank for comparison and also sequences of similar but distantly related *Amylocystis lapponica* (Rom.) Sing., *Sarcoporia polyspora* P. Karst., and *Auriporia aurulenta* David, Tortić & Jelić to root the phylogeny (for details, see Tab. 1). The sequences were aligned with Clustal X and manually pruned. There were a total of 686 characters in the final dataset, 293 variable and 210 parsimony informative, and all were used in the analysis. Evolutionary analyses were conducted in MEGA6 (Tamura et al. 2013) using the maximal likelihood method.

## RESULTS AND DISCUSSION

***Postia lowei*** (Pilát ex Pilát) Jülich, *Persoonia* 11(4): 423, 1982.

Basionym: *Leptoporus lowei* Pilát ex Pilát, *Sborn. Nár. Mus. Praha, ser. B, vol. 9*: 101, 1953.

Synonymy: *Leptoporus lowei* Pilát, in Kavina & Pilát, *Atlas Champ. l'Europe (Praha)* 3: 205, 1938; *Oligoporus lowei* (Pilát ex Pilát) Gilb. & Ryvarden, *Mycotaxon* 22(2): 365, 1985; *Spongiporus lowei* (Pilát ex Pilát) A. David, *Bull. Mens. Soc. Linn. Lyon* 49(1): 27, 1980; *Tyromyces lowei* (Pilát ex Pilát) Bondartsev, *Trut. Griby Evrop. Chasti SSSR Kavkaza [Bracket Fungi Europ. U.S.S.R. Caucasus] (Moscow-Leningrad)*: 227, 1953.

**Tab. 1.** Collections and sequences used for the DNA study.

Species	Country	Voucher	GenBank	Reference
<i>Amylocystis lapponica</i>	Czech Rep.	NFLI 2000-103/21/1	JQ358796	Alfredsen et al. (2012), unpublished
<i>Auriporia aurulenta</i>	Czech Rep.	PRM 915967	GU594153	Vlasák (2010), unpublished
<i>P. folliculocystidiata</i>	Czech Rep.	MJ 27/06	JF950564	This paper
<i>P. folliculocystidiata</i>	Czech Rep.	JV 0907/7	JF950565	This paper
<i>P. fragilis</i>	Czech Rep.	MJ 182/04	JF950571	This paper
<i>P. fragilis</i>	Czech Rep.	MJ 106/04	JF950574	This paper
<i>P. fragilis</i>	Czech Rep.	JV 0610/8	JF950573	This paper
<i>P. lowei</i>	Poland	TN 8775	KJ509193	This paper
<i>P. lowei</i>	Russia	SP 5692	KJ509192	This paper
<i>P. lowei</i>	Finland	X 1417	KC595942	Ortiz-Santana et al. (2013)
<i>P. lateritia</i>	Finland	KUO 021153	JF950567	This paper
<i>P. lateritia</i>	Finland	KUO 020197	JF950566	This paper
<i>P. lateritia</i>	USA	JV 0809/65A	KJ509195	This paper
<i>P. leucomallella</i>	Czech Rep.	MJ 24/02	JF950561	This paper
<i>P. leucomallella</i>	UK	K(M) 31057	AY599565	Yao et al. (2005)
<i>P. tephroleuca</i>	Czech Rep.	JV 1310/9	KJ509194	This paper
<i>P. tephroleuca</i>	Sweden	olrim394	AY781269	Vasiliauskas et al. (2005)
<i>Sarcoporia polyspora</i>	Finland	TN 7672	KC595953	Ortiz-Santana et al. (2013)

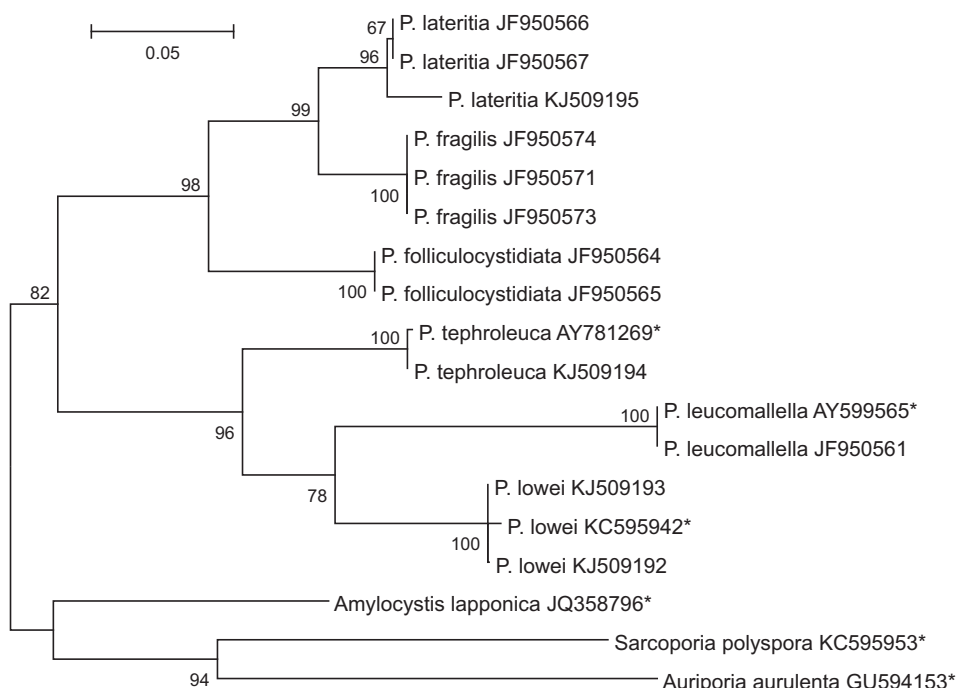
### ITS sequence analysis

Phylogenetic analysis clearly demonstrated that *Postia lowei* is a well-separated taxon with closest affinity to *P. leucomallella* and *P. tephroleuca* (Fig. 1). The same clade of three species was obtained by Ortiz-Santana et al. (2013), who believe that it confirms that genus *Postia* is different from *Spongiporus* and *Oligoporus*, whose species clustered in separate clades (e.g. *Spongiporus undosus*, *S. balsameus*, *S. guttulatus*, *Oligoporus sericeomollis*, *O. rennyi*). Unfortunately, they did not include other typical *Postia* species (*P. fragilis*, *P. lateritia*, *P. folliculocystidiata*) in their broad-range analysis, although these species (quite similar to *P. lowei*) make a distinctly separated cluster in our phylogeny (Fig. 1), where also many *Spongiporus* species (not shown) are grouped. We infer that the number of different genera in *Oligoporus* sensu lato is not yet settled, nor is the classification of species into the respective genera.

### Description

*Postia lowei* (Pilát ex Pilát) Jülich – description based on type material.

[To some extent, the description makes use of characteristics already published by Albert Pilát (1936–42, 1953) and later also by other mycologists who



**Fig. 1.** Evolutionary relationships of 15 *Postia* specimens based on sequences comprising ITS1, 5.8S and ITS2. The bootstrap consensus tree inferred from 1000 replicates has been taken to represent the evolutionary history of the taxa analysed. The percentages of replicate trees in which the associated taxa clustered together in the bootstrap test are shown next to the branches. The tree is drawn to scale, with branch lengths in the same units as those of the evolutionary distances used to infer the phylogenetic tree. Accession numbers with asterisks indicate sequences retrieved from GenBank.

studied the type material (Domański 1964, Lowe 1975, Gilbertson & Ryvarden 1987, Kotlaba & Pouzar 1989, Renvall 1992).]

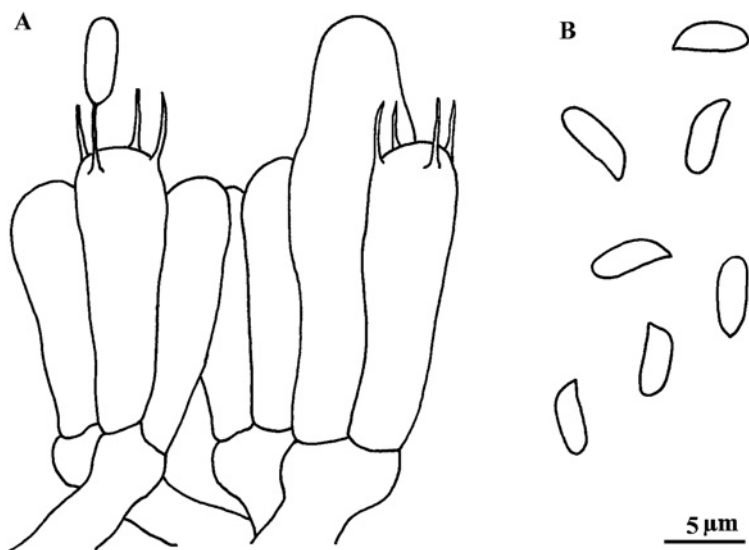
Basidiomes annual, mostly dimidiate but also effused-reflexed to resupinate, fleshy to somewhat fibrous when fresh, brittle when dry, up to 4 cm long, 2 cm wide and 5 mm thick at the point of attachment, with several pilei arranged laterally in most cases, sometimes also arranged imbricately. Upper surface white when fresh, finely velutinate, with scattered, radial, agglutinated fibrils, later glabrous, crème or light brownish when dry. Dry basidiomata often distorted, tending to detach from the substrate. Pileus surface frequently very light rusty brown and resinous at the margin. Tubes white when fresh, 1–4 mm long, very thin-walled and brittle, light yellowish when dry. Pores white when fresh, bruising or drying light rusty brown in places, angulate, about 3–4 per mm, on sloping surface somewhat elongated, pore edges finely pruinose, sometimes dentate. Context

white when fresh, fleshy fibrillose, rather watery, very brittle, up to 1 mm thick. A darker line in the context is often mentioned in the literature as one of the diagnostic features of *P. lowei* (e.g. Ryvar den 1978, Jülich 1984). Ryvar den & Gilbertson (1994) actually declare that “the distinct black line above the tubes is the only character that with certainty separates this species from *O. cerifluus*”. Nonetheless, we could not find any such line on cut pilei when studying the type material. We can only confirm that old, or naturally dried pilei often show a rusty resinous margin or resinous line on the surface. In our opinion, basidiomes with a black line in cut pilei may belong to another species.

Hyphal system monomitic, generative hyphae with clamps, 2–5 µm in diam., sometimes up to 7 µm in diam. in the context, thin-walled to thick-walled, sometimes slightly dextrinoid. In rare cases, hyphae with short, branched protuberances can be observed. These were nicely depicted by Lowe (1975: fig. 45b), who regarded them as binding hyphae. Such hyphae are only common in specimen PRM 885319/487979.

Cystidia. Regarding the presence or absence of hymenial cystidia in *Postia lowei*, very contradictory data appear in the literature. Neither Pilát (1953) in his original description nor, later, Lowe (1975) mention hymenial cystidia. Domański (1964), however, notes that there are some cylindrical cells, reminding of cystidia, in the hymenium, 18–28 × 4.5–6 µm in size, somewhat protruding (5–10 µm) over the hymenial layer. In the drawing of microscopic characters (Fig. 2a) and in the table where he compares diagnostic features, Domański indicates these structures as cystidia. Gilbertson and Ryvar den (1987), in their description of microscopic features, state that “cystidia or other sterile hymenial elements” are absent, but in the detailed drawing of the type specimen (Fig. 230c) four gloeocystidia are depicted. Our inspection of the type material confirmed that among basidia, thin-walled, cylindrical or clavate and sometimes also fusoid cystidioles are actually present. They usually protrude (3–5 µm) only indistinctly above the basidial layer and only very rarely they are large, protruding up to 10 µm. We assessed their size to be 18–33 × 5–10 µm. In the type specimen (PRM 487991) and in several other specimens these cystidioles are rather rare but in some others (e.g. PRM 885320/487982) they are locally common and distinct. These thin-walled cystidioles are especially distinct when they are filled with refractive material and, in such cases, they can be considered to be gloeocystidia. Gloeocystidia, however, do not always seem to be present in the *P. lowei* hymenium because we were able to find them in only 7 specimens, e.g. in about one third of the type material studied. Therefore, their presence cannot be taken as a diagnostic feature and has only secondary importance in practical identification (Fig. 2A).

Basidia clavate, tetrasporic, with a basal clamp, 13–23 × 4–6 µm. Pilát (1936–42) in his compendium presented the basidia size as 8–9 × 4–5 µm, but in the following Latin diagnosis this incorrect characterisation is already deleted (Pilát 1953).



**Fig. 2.** *Postia lowei* (PRM 487991, holotype): A – fragment of hymenium with basidia and gloeocystidium, B – spores. Del. P. Vampola.

Basidiospores hyaline, cylindrical, obliquely tapered to the base,  $4.3\text{--}5.5 \times 1.5\text{--}2.2 \mu\text{m}$  (Fig. 2B),  $L = 4.93 \mu\text{m}$ ,  $W = 1.86 \mu\text{m}$ ,  $Q = 2.2\text{--}3$  ( $n = 315/21$ ). In just one collection (PRM 885322/488453) much narrower basidiospores were observed ( $4.3\text{--}5.4 \times 1.1\text{--}1.5 \mu\text{m}$ ) and, at the same time, a distinctly amyloid reaction of the hyphae in Melzer's reagent. The basidiomes of PRM 885322 are also more robust and without rusty colours in bruised places. We think that this specimen is in fact *P. tephroleuca* (Fr.) Jülich.

**Ecology and distribution.** *Postia lowei* grows on lying dead logs of conifers (the type material was collected on spruce) and causes a brown rot. It is very probably distributed all over the temperate zone of Northern Hemisphere, where it prefers old-growth forests, but it is a rather rare species everywhere. Albert Pilát collected this fungus in the Eastern Carpathians in large amounts in 1937, but in the following year he could only find one specimen in this region. Alexander Ordynets visited the still well-preserved type locality in 2012, but he could not find any *P. lowei* specimen. No collection is known from the Czech Republic or Slovakia, but two recent samples collected by T. Niemelä at Białowieża, Poland (H 8767, 8775) are surely identical with Pilát's type collections. Two sequenced specimens from Finland (KC595941, KC595942) show the same sequence and also represent the same species. We do not list other published localities since we have not examined those collections and, in our opinion, many published collections may be misidentified.

### Notes on similar species

*Postia fragilis* (Fr.) Jülich. This species is macro- and microscopically very similar but in most cases somewhat more robust. The most important diagnostic feature, also applicable in the field, is the reaction with an FeSO<sub>4</sub> solution. *P. fragilis* reacts positively and shows a greenish colour whereas *P. lowei* shows no reaction. The reaction with FeSO<sub>4</sub> is most readily observed with fresh basidiomes of *P. fragilis* which change to plain green; in case of exsiccates, the colour changes to greyish green. Both species are at first white but after bruising or drying show brownish discolouration. In the case of *P. lowei*, this change is, however, not so pronounced. Microscopically, *P. fragilis* differs by the absence of thin-walled cystidioles slightly protruding from the hymenial layer.

*Postia lateritia* Renvall. Very similar species differing from *P. lowei* mainly by narrower basidiospores, measuring  $4.5\text{--}5.9 \times 1.1\text{--}1.6 \mu\text{m}$ . In the original description of *P. lateritia*, Renvall (1992) notes that in some Finnish mycofloristic papers *P. lateritia* has been misinterpreted as *Oligoporus lowei* (or *Postia lowei*). *P. lateritia* is very similar also to *P. leucomallella* but shows a more pronounced brownish discolouration after bruising, has no gloeocystidia in the hymenium and possesses slightly narrower basidiospores.

*Postia leucomallella* (Murrill) Jülich. This species is distinguished mainly by the presence of striking, large gloeocystidia with a refractive content. Also, the basidiospores are somewhat narrower than in *P. lowei*, measuring  $4.5\text{--}6.0 \times 1.2\text{--}1.7 \mu\text{m}$ .

### Notes on other similar or related species

*Postia balsamea* (Peck) Jülich. This species differs from *P. lowei* mainly by its broader basidiospores, measuring  $3.5\text{--}5.3 \times 2.0\text{--}2.9 \mu\text{m}$ , and by the presence of thin-walled to thick-walled, fusiform cystidia in the hymenium which are sometimes apically incrustated. In our experience, *P. balsamea* is a very variable species. Although pileate in most cases, it develops sometimes fully resupinate basidiomes, reminding of the recently described *P. balsamina* Niemelä et Y.C. Dai (Niemelä et al. 2004). Also, the amyloidity of hyphae or cystidia is quite variable. Some specimens show a distinct to strong amyloid reaction in Melzer's reagent while others are completely inamyloid.

*Postia balsamina* Niemelä et Y.C. Dai. This recently described, Nordic species differs from *P. lowei* microscopically by having broader basidiospores, measuring  $4.3\text{--}5.6 \times 2.3\text{--}2.9 \mu\text{m}$ , and fusiform cystidia in the hymenium. It is closely related to *P. balsamea*, showing reputedly slightly larger basidiospores and mostly resupinate basidiomes with a gelatinous subiculum (Niemelä et al. 2004).



*Postia ceriflua* (Berk. et M.A. Curtis) Jülich. This species has distinctly broader basidiospores, measuring  $3.7\text{--}4.8 \times 2.0\text{--}2.3 \mu\text{m}$ , and differs also in the construction of the subhymenial layer, which is formed by strikingly twisted hyphae with plentiful short excrescences; this layer is well depicted by David (1980).

*Postia floriformis* (Quél.) Jülich. Rather similar to *P. balsamea* but often growing in large, dense groups formed of laterally substipitate to sessile or effused-reflexed basidiomes. It has no cystidia. Basidiospores, in our observation measuring  $3.5\text{--}4.3 \times 1.9\text{--}2.3 \mu\text{m}$ , are narrower than in *P. balsamea* and broader than in *P. lowei*.

*Postia folliculocystidiata* (Kotl. et Vampola) Niemelä. This species, considered by some mycologists (Niemelä 2005, Kotiranta et al. 2009) as a synonym of *P. ceriflua* (Berk. et M.A. Curtis) Jülich, has much larger basidiospores ( $4.3\text{--}6.3 \times 2.0\text{--}2.8 \mu\text{m}$ ) than *P. lowei*. The striking thin-walled cystidia in the hymenium are mostly widely clavate to globose in their upper parts. An important diagnostic feature of *P. folliculocystidiata* is sometimes also the presence of an anamorph stage producing ellipsoid, thick-walled chlamydospores, measuring  $4.0\text{--}6.5 \times 3.0\text{--}4.3 \mu\text{m}$  (Kotlaba & Vampola 1993).

*Postia gloeocystidiata* Y.L. Wei et Y.C. Dai. Described recently from China (Wei & Dai 2006), this species with cyanophilous gloeocystidia comes very close to *P. leucomallella* (Murrill) Jülich. Judging from its description, the most important difference with *P. leucomallella* are larger and somewhat whiter basidiomes and slightly narrower spores. We did not have this species at hand for study but we would like to note that cyanophilous gloeocystidia are quite often also present in *P. leucomallella*, and the variability in basidiome size and colour is considerable, too. On the other hand, the size of *P. gloeocystidiata* basidiomes indicated in the original description (triquetrous, up to 4 cm thick at the base) very probably excludes *P. leucomallella* and *P. lowei*.

*Postia minusculoides* (Pilát ex Pilát) Boulet. The type specimen (*Leptoporus minusculoides*) was collected by A. Pilát at the same locality and in the same time of the year as the type of *Leptoporus lowei*. Nevertheless, both species are very different, not only because of the minute basidiocarps of *Postia minusculoides*, but also due to its microscopic characteristics. *P. minusculoides* has much larger spores, in our study  $4.0\text{--}5.5(6) \times 2.2\text{--}3.0(3.5)$ , and the hyphae of the context and trama are thin-walled only. In some mycological literature, *P. minusculoides* is considered a synonym of *P. ceriflua* (Jülich 1984, Ryvarden & Gilbertson 1994). On the other hand, Kotlaba & Pouzar (1989) regard *P. minusculoides* as a distinct species. In our opinion, *P. ceriflua* and *P. minusculoides* are definitely two different species. About 20 years ago the first author studied the types of *Polyporus cerifluus* (K) and *Polystictus revolutus* (S) in detail and found that these species differ from *Postia minusculoides* distinctly by having thick-

walled hyphae and a special subhymenial layer made up of strange, tortuous hyphae with many short excrescences.

*Postia ptychogaster* (F. Ludw.) Vesterh. This species is commonly found in its anamorph stage, forming white, cushion-like outgrowths which later disintegrate in a brown mass of chlamydospores. Sometimes, however, basidiomes develop as well, forming pilei that may be somewhat similar to *P. lowei*. They have, however, broader basidiospores ( $3.9\text{--}5.2 \times 2.0\text{--}3.1 \mu\text{m}$ ) and always thin-walled hyphae. Judging by its microscopic characters, *P. ptychogaster* is rather close to *P. minusculoides*.

*Postia subpendula* (G.F. Atk.) Boulet. Unfortunately, we did not have the opportunity to study this North-American species ourselves. According to its description, *P. subpendula* has broader spores ( $4.0\text{--}5.0 \times 2.0\text{--}2.5 \mu\text{m}$ ) and yellowish gloeophorous hyphae up to  $12 \mu\text{m}$  broad in the trama (Lowe 1975, Gilbertson & Ryvarden 1987).

*Postia subundosa* Y.L. Wei et Y.C. Dai. Recently described from China (Wei & Dai 2006), this species must be closely related to *P. lowei* judging by its macro- and microscopic characteristics. Unfortunately, we have not had the opportunity to study specimens of this fungus, so we cannot assess its taxonomical value.

*Postia tephroleuca* (Fr.) Jülich. This species usually has much larger basidiomes than *P. lowei* and also differs microscopically by slightly amyloid hyphae of the tubulotrampa and somewhat slimmer basidiospores, measuring  $4.5\text{--}6.0 \times 1.0\text{--}1.5 \mu\text{m}$ .

*Postia undosa* (Peck) Jülich. This species differs from *P. lowei* by having much larger, often labyrinthic pores, microscopically by strikingly thick-walled contextual hyphae up to  $8 \mu\text{m}$  broad, and somewhat narrower basidiospores, measuring  $4.5\text{--}6.0 \times 1.0\text{--}1.5 \mu\text{m}$ .

*Spongiporus rhodophilus* Spirin et Zmitr. *S. rhodophilus* is closely related to *Postia undosa* (Peck) Jülich, but has somewhat broader basidiospores ( $3.6\text{--}4.8 \times 1.7\text{--}2.1 \mu\text{m}$ ) that strongly resembles the basidiospores of *P. lowei* in size and shape. The species differs from *P. lowei* by its undulate pilei and growth on old basidiomes of *Fomitopsis rosea* (Spirin et al. 2006).

#### Specimens examined

The specimen data are cited in the form used on the herbarium labels. Czech texts have been translated into English.

#### *Postia balsamea*

Czech Republic. Podolsko (distr. Písek), Vltava river valley, *Picea abies*, July 2005, leg. et det. J. Vlasák (JV 0507/26). – Hluboká nad Vltavou, Karvanice Nature Reserve, ca. 4 km N of the town, alt. 400 m, *Picea abies*, on fallen trunk, 30 Sept. 2007, leg. et det. P. Vampola (MJ 78/07). – Horní Kosov, Bradlo forest, 5 km W of Jihlava, alt. 550 m, *Picea abies*, on fallen trunk, 29 July 1988, leg. et det.

P. Vampola (MJ 504/88-3188). – Jihlava, Březinovy sady park, alt. 500 m, *Picea abies*, on base of living trunk, 4 Mar. 1989, leg. et det. P. Vampola (MJ 475/89-1564).

Slovakia. Svidník, town park, *Malus* sp., 21 Sept. 1986, leg. et det. J. Vlasák (JV 8609/9).

***Postia ceriflua***

U.S.A. *Polyporus cerifluus* Berk. et Curt. (K: Ravenel 2926, typus).

France. *Polystictus revolutus* Bres. (S: 91/138, typus).

***Postia floriformis***

Czech Republic. Čeminy (distr. Plzeň-sever), on the ground, 10 Oct. 2010, leg. Anonymus, det. J. Kout (JV 1010/10K). – Hracholusky (distr. Rakovník), ad truncum putridum Piceae, 19 Sept. 1940, leg. J. Herink, det. F. Kotlaba et Z. Pouzar 6 Nov. 1963 ut *Tyromyces floriformis* (PRM 807411). – Karlštejn, codex Piceae, 11 Sept. 1955, leg. Z. Pouzar, det. F. Kotlaba et Z. Pouzar 28 June 1967 ut *Tyromyces floriformis* (PRM 516547).

***Postia folliculocystidiata***

Czech Republic. Karlův Hrádek near Hluboká nad Vltavou, *Pinus sylvestris*, 5 July 2009, leg. et det. J. Vlasák (JV 0907/7). – Borovsko prope Dol. Kralovice, in valle rivi Želivka, ad codicem Piceae abietis, 24 May 1964, leg. F. Kotlaba, det. F. Kotlaba et Z. Pouzar ut *Tyromyces revolutus*, rev. P. Vampola 17 May 1993 (PRM 604499, typus). – Area tuta “Ranšpurk” apud Lanžhot (distr. Břeclav), alt. 150 m, *Quercus robur*, in cavitate trunci emortui, 2 Mar. 2002, leg. et det. P. Vampola ut *Oligoporus folliculocystidiatus* (MJ 4253, *Polyporales* exsiccati Českoslovaciae no. 190); *ibid.*, *Carpinus betulus*, on fallen trunk, 22 Oct. 1998, leg. et det. P. Vampola ut *Oligoporus folliculocystidiatus* (MJ 4582); *ibid.*, 9 June 2006, leg. et det. P. Vampola ut *Oligoporus folliculocystidiatus* (MJ 27/06).

Estonia. Saaremaa Co., Viidumäe Nature Reserve, *Quercus robur*, on a rotten stump, 21 Sept. 2000, leg. et det. E. Parmasto ut *Oligoporus folliculocystidiatus*, rev. P. Vampola 29 March 2001 (TAA 180316).

***Postia fragilis***

Czech Republic. Varvažov-Zbonín, Vltava river valley, *Picea abies*, Oct. 2006, leg. et det. J. Vlasák (JV 0610/8). – Velmovice, Dubské vrchy the forest, 1.5 km NW of Tábor, alt. 580 m, *Picea abies*, on fallen trunk, 24 Oct. 2004, leg. et det. P. Vampola (MJ 107/04-4866); *ibid.*, *Pinus sylvestris*, on fallen trunk, 24 Oct. 2004, leg. et det. P. Vampola (MJ 106/04-4865). – Zbilidy, Panský les forest S of the village, 13 km WNW of Jihlava, alt. 650 m, *Pinus sylvestris*, on stump, 28 Oct. 2004, leg. et det. P. Vampola (MJ 182/04-4925).

***Postia lateritia***

Finland. Malahvia forest, pine dominated old-growth forest, *Pinus sylvestris*, 14 Oct. 2005, leg. Teppo Hello (KUO 021153). – Hossa, Moilasenvaara, *Pinus sylvestris*, 23 Sept. 1998, leg. Kaisa Juninen 1002 (KUO 020197). – Koillismaa, Salla, Värrio Strict Nature Reserve, Jappyrävaara virgin pine forest of *Empetrum-Myrtillus* type, on fallen, decorticated trunk of *Pinus sylvestris*, 26 Aug. 1992, leg. et det. P. Renvall 3064 (PRM 879837).

USA. New Hampshire, White Mountains, Bartlett, *Picea* sp., Sept. 2008, leg. J. Vlasák (JV 0809/65A).

***Postia leucomallella***

Czech Republic. Hluboká nad Vltavou, Libochovka Nature Reserve, *Picea abies*, 6 Nov. 2010, leg. et det. J. Vlasák (JV 1011/3). – Sezimovo Ústí, Koží Hrádek, forest near Nechyba forest hut, alt. 420 m, *Pinus sylvestris*, on fallen trunk, 21 Sept. 2002, leg. et det. P. Vampola (MJ 24/02-4714). – Mirochov, Losí blato Nature Reserve, 1 km E of the village, 14 km E of Třeboň, alt. 480 m, *Pinus*, on fallen trunk, 21 Sept. 2010, leg. et det. P. Vampola (MJ 55/10, 58/10, 63/10). – České Švýcarsko National Park, Doubice, Divoká rokle gorge (Hřebcův důl), valley of Červený potok stream, on fallen trunk of

*Picea*, 17 Oct. 2003, leg. A. Vágner, det. P. Vampola 10 Jan. 2004 as *Oligoporus leucomallellus* (PV-dupl. ex BRNM 686407).

***Postia lowei***

Poland. Białowieża Nat. Res., Dzedzinka, *Picea excelsa*, 5 Oct. 2010, leg. et det. T. Niemelä (Niemelä 8767, 8775 in H).

Ukraine. Carpatorossia, in silvis mixtis virgineis (*Abies alba*, *Picea excelsa*, *Fagus sylvatica* etc.) in valle rivi Berlebaš prope vicum Trebušany (for current names, see Introduction), alt. 800–1000 m, *Picea excelsa*, Aug. 1937, leg. et det. A. Pilát ut *Leptoporus lowei* (PRM 487991, holotypus); ibid. (PRM 885306/488455, 885307/487476, 885308/488452, 885309/487987, 885311/487986, 885312/487993, 885313/487989, 885314/487988, 885315/487976, 885316/487974, 885317/487975, 885318/487984, 885319/487979, 885320/487982, 885321/487978, 885324/487981, 885325/487983, 885326/487990, 885327/487992). – Carpatorossia, in silvis mixtis ad pratum Tiščora, prope Trebušany, *Picea excelsa*, Aug. 1938, leg. et det. A. Pilát (PRM 885323/494333).

Russia. Khabarovsk Reg., Khabarovsk Distr., Ulun, *Picea ajanensis*, fallen log, 26 Aug. 2012, leg. et det. V. Spirin (Spirin 5692 in H).

***Postia minusculoides***

Ukraine. Carpatorossia, in silvis mixtis virgineis (*Abies alba*, *Picea excelsa*, *Fagus sylvatica* etc.) in valle rivi Berlebaš prope vicum Trebušany, alt. 800–1000 m, *Picea excelsa*, 5 Aug. 1937, leg. et det. A. Pilát (PRM 488457, isotypus).

***Postia ptychogaster***

Czech Republic. Hluboká nad Vltavou, Libochovka Nature Reserve, *Picea abies*, 2 Nov. 2010, leg. et det. J. Vlasák (JV 1011/1). – Mirochov, Losí blato Nature Reserve, 1 km E of the village, 14 km E of Třeboň, alt. 480 m, *Pinus*, on fallen trunk, 21 Sept. 2010, leg. et det. P. Vampola as *Oligoporus ptychogaster* (MJ 64/10). – Horní Kosov, Bradlo forest, 5 km W of Jihlava, alt. 550 m, *Picea abies*, on stump, 29 Oct. 1989, leg. et det. P. Vampola as *Oligoporus ptychogaster* (MJ 839/89-1714). – Brtnice, north part of Černé lesy forest, 2.5 km E of the town, 13.5 km SE of Jihlava, alt. 600 m, *Picea abies*, on fallen trunk, 18 Dec. 1992, leg. et det. P. Vampola as *Oligoporus ptychogaster* (MJ 331/92-2789).

***Postia tephroleuca***

Czech Republic. Hluboká nad Vltavou, Bezdrev lake, *Populus tremula*, 12 Oct. 2013, leg. et det. J. Vlasák (JV 1310/9). – Ostrava, SW margin of the city, Svinov town district, Polanský les Nature Reserve, alt. 220 m, *Fraxinus excelsior*; on fallen trunk, 4 Oct. 2002, leg. et det. P. Vampola (MJ 68/02-4753).

Ukraine. Carpatorossia, in silvis mixtis virgineis (*Abies alba*, *Picea excelsa*, *Fagus sylvatica* etc.) in valle rivi Berlebaš prope vicum Trebušany, alt. 800–1000 m, *Picea excelsa*, Aug. 1937, leg. et det. A. Pilát ut *Leptoporus lowei*, rev. P. Vampola 1 Mar. 2010 ut *Postia tephroleuca* (PRM 885322/488453).

***Postia undosa***

Czech Republic. Giant Mountains, Janské Lázně, Mt. Černá hora (1299 m), Černoohorské rašeliniště Nature Reserve, 3 km NNW of the town, alt. 1200 m, *Picea abies*, on fallen trunk, 13 Oct. 1992, leg. et det. P. Vampola (MJ 229/92-2727).

ACKNOWLEDGEMENTS

The authors thank Dr. Jan Holec (National Museum Prague, Mycological Department, Czech Republic) for the kind loan of the complete type material of *Leptoporus lowei* Pilát, Dr. Pertti Renvall (Kuopio Natural History Museum, Fin-

land) for the loan of two specimens of *Postia lateritia* Renvall, Dr. Tuomo Niemelä and Dr. Viacheslav Spirin (Botanical Museum, University of Helsinki, Finland) for the loan of recent collections of *P. lowei*, and anonymous reviewers for their valuable comments.

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