

Kavinia alboviridis in the Czech Republic

JIŘÍ KOUT*, PETRA HAJŠMANOVÁ

Department of Biology, Geosciences and Environmental Education, Faculty of Education,
University of West Bohemia, Klatovská 51, Plzeň, CZ-306 19, Czech Republic; martial@seznam.cz
*corresponding author

Kout J., Hajšmanová P. (2015): *Kavinia alboviridis* in the Czech Republic. – Czech Mycol. 67(1): 59–67.

The distribution of the rare lignicolous species *Kavinia alboviridis* in the Czech Republic is summarised. Recently the species has been found at three localities in West Bohemia and at one locality in NW Bohemia. It is considered a boreal species rare in Europe and listed as extinct from the Czech Republic. The species is well distinguishable microscopically by the spores which clearly differ from other species with a resupinate, hydroid basidioma. Remarks on its world distribution are added.

Key words: Basidiomycetes, *Gomphales*, corticioid species, Bohemia.

Article history: received 4 January 2015, revised 27 April 2015, accepted 29 April 2015, published online 29 May 2015.

Kout J., Hajšmanová P. (2015): Kavinovka bělozelená v České republice. – Czech Mycol. 67(1): 59–67.

V článku je shrnuto rozšíření druhu *Kavinia alboviridis* v České republice. Tato dřevožijná houba byla nedávno nalezena na třech lokalitách v západních Čechách a na jedné lokalitě v severozápadních Čechách. Kavinovka bělozelená je považována za boreální druh, vzácný v Evropě a v Červeném seznamu hodnocený jako neznámý v České republice. Druh je dobře poznatelný podle charakteristických výtrusů, které se liší od výtrusů ostatních resupinatních hub s ostnitým hymenoforem. Jsou připojeny poznámky k celosvětovému rozšíření druhu.

INTRODUCTION

Kavinia Pilát (1938) is a small genus of corticioid Basidiomycota. It includes only one species in Europe (Bernicchia & Gorjón 2010) but three non-European species (Boidin & Gilles 2000). The genus belongs to the gomphoid-phalloid phylogenetic clade (*Gomphales*), family *Lentariaceae* (e.g. Hosaka et al. 2006). As a corticioid fungi, *Kavinia* species possess resupinate fruitbodies, a feature that is rare in *Gomphales*. Nevertheless, the unusual affiliation of *Kavinia* to the *Gomphus* group (*Gomphaceae*) was already recognised by Donk (1964) based on morphological characters. Basidiospores agree well with those of *Gomphus* Pers., the type genus of *Gomphales* (Villegas et al. 2005).

In the past, Petersen (1971) transferred *Kavinia himantia* (Schwein.) J. Erikss. from *Kavinia* to a separate genus, *Hydnocristella* R.H. Petersen, but this shift was initially not generally accepted (e.g. Eriksson & Ryvarden 1976, Hansen & Knudsen 1997, Jülich & Stalpers 1980). Boidin & Gilles (2000) created *Kavinia* subgen. *Hydnocristella* (R.H. Petersen) Boidin & Gilles. Phylogenetic studies support the independence of *Hydnocristella* (e.g. Larsson et al. 2004) and this arrangement is now becoming recognised (Bernicchia & Gorjón 2010). The monotypic genus *Hydnocristella* is distinguished by its smooth spores, while *Kavinia* has warted spores. However, the genera are clearly related and belong to the same phylogenetic clade (Binder et al. 2005, Giachini et al. 2010).

The single European species, *Kavinia alboviridis* (Morgan) Gilb. & Budington, produces a prominent hydroid hymenophore with a greenish tint (Fig. 1). It is considered to be a rare species with a boreal distribution, more abundant in Nordic countries (Eriksson & Ryvarden 1976).

According to the Czech Red list of macromycetes, *Kavinia alboviridis* is considered to be probably extinct (Pouzar 2006). Known localities in the Czech Republic have been summarised by Kotlaba (2000) and Holec (2009), however with somewhat contradictory results. *Kavinia alboviridis* has recently been rediscovered in the Czech Republic at four different localities: at first in the Bohemian Karst (Český kras) in 1998 (Holec 2009), then in Křivoklátsko Protected Landscape Area (Holec 2009) and most recently in West Bohemia and NW Bohemia. In this paper we summarise the history of *Kavinia alboviridis* in the Czech Republic and provide a description of its macro- and micromorphology.

MATERIAL AND METHODS

Specimens of *Kavinia alboviridis* in West Bohemia were collected and identified by the first author; the specimen in NW Bohemia by Lucie Zíbarová. The description is based on collections from West Bohemia and on specimens from the Czech Republic deposited in the National Museum, Prague (herbarium PRM). In addition, material from two other herbaria was studied (H – University of Helsinki, Botanical Museum, O – Botanical Museum, Oslo). For microscopic examinations, Melzer's reagent was used and an Olympus BX 51 light microscope at 1000× magnification under an oil immersion lens. SEM methods follow Kout & Zíbarová (2013). The recently collected specimens are deposited in PRM, the Mycological herbarium of the Department of Biology, Geosciences and Environmental Education, University of West Bohemia (abbreviated KBI) and the private herbarium of L. Zíbarová.

RESULTS AND DISCUSSION

Kavinia alboviridis (Morgan) Gilb. & Budington

Figs. 1, 3, 4

Basionym: *Hydnum alboviride* Morgan.Synonyms: *Kavinia bourdotii* (Bres.) Pilát, *Kavinia sajanensis* (Pilát) Pilát, *Mycoacia alboviride* (Morgan) L.W. Mill. & J.S. Boyle.

Description. Fruitbodies resupinate, consisting of several parts, the largest measuring 7×2 cm. Hymenophore hydroid, spines about 2 mm long, about 0.3 mm thick at the base, dark greenish olive, apically creamy (immature), scattered when young, becoming confluent. Whitish soft subiculum, looser when young, becoming more compact with age. Margin fimbriate, whitish, rhizomorphs present. Hyphal system monomitic, generative hyphae with clamps, thin-walled, hyaline, 2–5 μm wide (up to 7 μm in the subiculum), ampullaceous, occasionally with abundant incrustations, in top of spines without incrustations, obtuse, 2 μm wide. Cystidia absent. Basidia hyaline with four sterigmata, $28\text{--}40 \times 6\text{--}8$ μm . Basidiospores subfusiform, apiculate, warted, inamyloid, $(7)8\text{--}9(10.5) \times (3)3.5\text{--}4.5(5)$ μm . Spines apically with decreased fertility.

Ecology. Records from West Bohemia are from lying dead wood without bark (smaller trunks or branches) of conifers (probably spruce) and one broad-leaved tree. The localities in the Czech Republic do not show any distinct ecological preferences for habitat, substrate, elevation (from the colline up to submontane zones) or finding date. Kotlaba (2000) often mentioned occurrence in cavities of trunks, but this was not recorded at the recent collections. Generally, the ecology of *K. alboviridis* is rather unclear. The species is considered to be a white-rot fungus occurring on dead wood of various tree species (e.g. Ginns & Lefebvre 1993), growing in pristine forests but also in managed woodlands. Mycorrhizal association, similar to *Tomentella*, has never been demonstrated and the genus is not mentioned in the review by Tedersoo et al. (2010). Bruns et al. (1998) denote its ecology as unknown. The closely related *Hydnocristella himantia* (Schwein.) R.H. Petersen (Fig. 2) grows on hardwoods and conifers, too (Eriksson & Ryvar den 1976). This species shows a preference for sites near water (rivers or pond) in all reviewed specimens from the Czech Republic (including those from the new localities), which corresponds with the note about humid areas in Bernicchia & Gorjón (2010). On the other hand, the current Czech finds of *K. alboviridis* are from less humid habitats.

Distribution. *Kavinia alboviridis* is not common. Its distribution in Europe (often from Red lists), summarised by Bernicchia & Gorjón (2010), can be completed with the following countries: Austria (Dämon et al. on-line), Macedonia (Karadelev & Rusevska 2012), the Netherlands (Petersen 1971), Poland

(Karasiński et al. 2009), Slovakia (Hagara 1998), and Switzerland (Breitenbach & Kränzlin 1986). Outside Europe; *K. alboviridis* is known from North America (e.g. Gilbertson 1974, Ginns & Lefebvre 1993, Linder et al. 2006), South America (Greslebin & Rajchenberg 2003), Africa (Bitew & Ryvar den 2011, Nakasone 2003), Macaronesia (Beltrán-Tejera et al. 2015), and Asia (Doğan 2009 from Turkey, Maekawa et al. 2002 from China). The species is widespread and its alleged boreal preference is not so obvious.

Only four recent distribution areas of *K. alboviridis* are known in the Czech Republic: Bohemian Karst (Český kras) (Holec 2009), Křivoklátsko Protected Landscape Area (Holec 2009) as well as NW and West Bohemia (this article). The West Bohemian localities are situated in managed forests with hardwoods (oak) and conifer trees (spruce, pine) near the large city of Plzeň. Similar localities of *K. alboviridis* in man-made forests are known from Finland (e.g. collection no. 2121 by O. Manninen). One specimen is located near Ročov in NW Bohemia, on the upper part of a steep west-exposed slope in a oak-hornbeam forest on calcareous marlstone. Kotlaba (2000) mentioned three historical localities for the Czech Republic: České středohoří (Svrček 1950), Poříčko-Rataje (1953, PRM 872503) and Soběslavská blata (1954, PRM 803287). Holec (2009) added Křivoklátsko Protected Landscape Area, 25 July 2008 (PRM 915205), from where there is also an earlier find, 28 July 1966 (PRM 843145), and Central Bohemia, Český kras, near Karlštejn, top of Velká hora hill, 13 Nov. 1998, leg. et det. Z. Pouzar (PRM 893815). Our study of the specimens in PRM has revealed two other historical localities not previously published: Studený hill near Stříbrná Skalice and Lenora in the Šumava Mts.

Notes. *Kavinia alboviridis* is easily recognised by a combination of micro- and macrocharacters. In the field, its resupinate, strongly hydroid basidiomata with a greenish tint immediately indicate its identity. Microscopically the characteristic spores offer a reliable feature to identify the species. Spore dimensions separate *Kavinia alboviridis* from other species in the genus (Boidin & Gilles 2000). *Hydnocristella himantia*, formerly a member of *Kavinia*, has differently coloured spines (Fig. 2) and smooth spores. Young fruitbodies of *K. alboviridis* possess spines which are rather cream-coloured and have a less obvious greenish tint. Such specimens may be reminiscent of other hydroid genera and should be studied under a microscope for certain identification.

There are possibly more species hidden under the name *K. alboviridis*. Villegas et al. (2005) presented a SEM photo of spores with echinulate ornamentation. Such a structure is not mentioned by Petersen (1971) and our SEM photo from a European specimen shows a verruculose ornamentation (Fig. 4), similar to the SEM photo in Eriksson & Ryvar den (1976). The genetic diversity among sequences identified as *Kavinia alboviridis* and deposited in GenBank

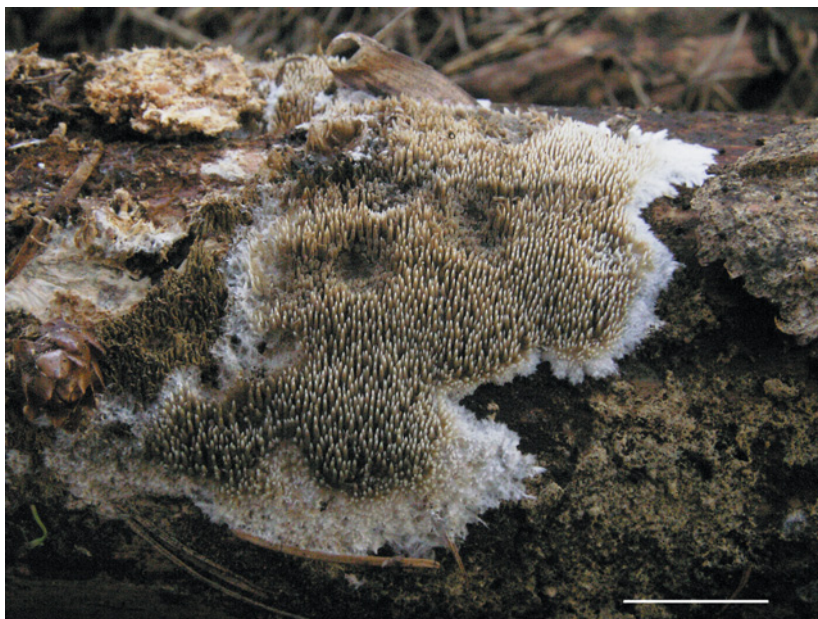


Fig. 1. Fruitbody of *Kavinia alboviridis* (shown upside down, spines facing downward), Czech Republic, Plzeň-jih District, woodland near Štěnovice, on conifer wood, 20 August 2011 (KBI, PRM 933237). Bar = 1 cm. Photo by J. Kout.



Fig. 2. Fruitbody of *Hydnocristella himantia*, Czech Republic, Třeboňsko Protected Landscape Area, beech forest near Staňkovský lake, on hardwood, 23 September 2008 (PRM 933236). Bar = 1 cm. Photo by J. Kout.

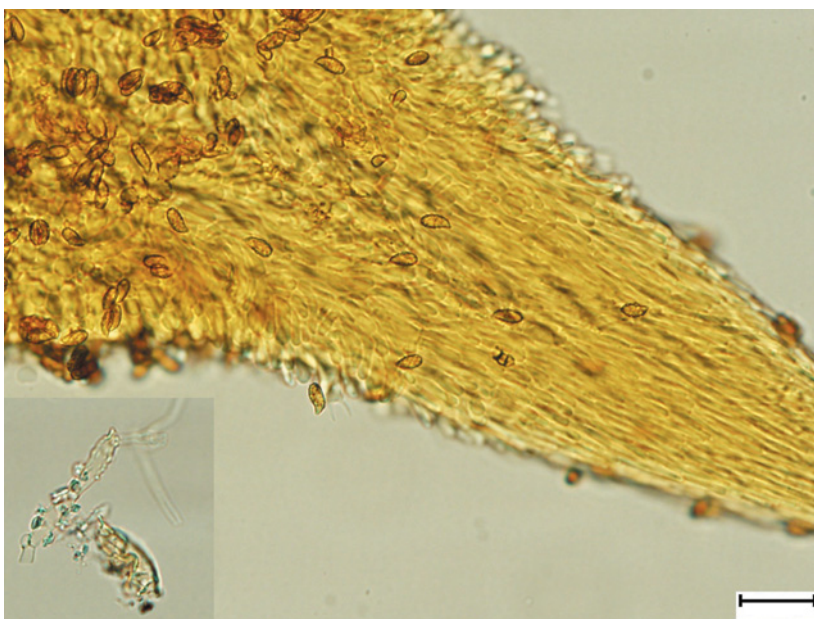


Fig. 3. Microscopic view of *Kavinia alboviridis* (spine with spores; inset: hypha of basal part with clamp-connection). Czech Republic, Plzeň-jih District, woodland near Štěnovice, on conifer wood, 20 August 2011 (KBI, PRM 933237). Bar = 20 μm . Photo by J. Kout.

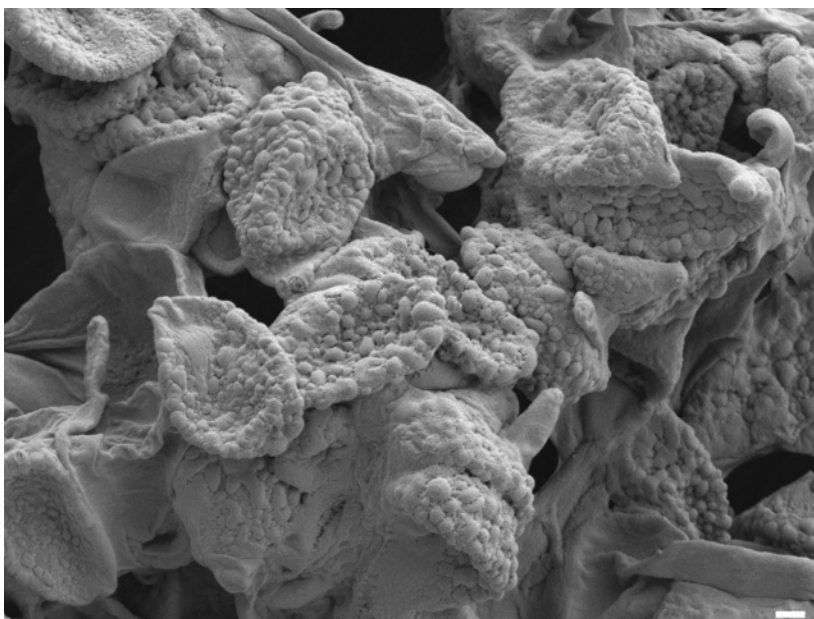


Fig. 4. Spores of *Kavinia alboviridis* (Plzeň-město District, near Petrovka Nature Reserve, 31 December 2012) in SEM. Bar = 1 μm . Photo by M. Mergl.

(GQ981506.1, KJ140634.1) also indicates that more than one species might be involved.

Specimens examined

Hydnocristella himantia

Czech Republic. South Bohemia, Třeboňsko Protected Landscape Area, beech forest near Staňkovský lake (near path to Mirochov), on bark of lying hardwood trunk, 23 Sept. 2008, leg. J. Kout, det. H. Kotiranta (PRM 933236). – Písek District, near Dolní Ostrovec, V Obouch Nature Monument, near Lomnice river, on bark of fallen hardwood, 15 Nov. 2008, leg. et det. J. Kout (KBI). – West Bohemia, Plzeň-sever District, south of Plasy, in Střela river valley (by green-marked tourist trail), on wood and terrestrial, 23 Sept. 2012, leg. et det. J. Kout (KBI).

Spain. Huesca, Ordesa National Park, on *Abies*, 9 Nov. 1977, L. Ryvarden 14938 (O: F-907316).

USA. Minnesota, 16 July 1977, L. Ryvarden 14299 (O: F-907314).

Kavinia albobiridis

Argentina. Tierra del Fuego, Monte Olivia, on *Nothofagus*, 23 Feb. 1982, L. Ryvarden 19463 (O: F-907311).

Czech Republic. West Bohemia. Plzeň Region, Plzeň-sever District, near Kaznějov, c. 2 km SE of railway station, green-marked tourist trail to Kaznějov, by gamekeeper's lodge, about 445 m a.s.l., lying log of broadleaved tree (*Populus?*), 1 Oct. 2011, leg. et det. J. Kout (KBI). – Plzeň-město District, near Petrovka Nature Reserve, close to road to Ledce, c. 375 m a.s.l., lying branch of conifer (*Picea?*) with *Oligoporus rennyi* (Berk. & Broome) Donk – teleomorph and anamorph, 31 Dec. 2012, leg. et det. J. Kout (KBI). – Plzeň-jih District, in woodland near Štěnovice, about 1 km SE of the village, c. 440 m a.s.l., lying trunk of conifer (*Picea?*), 20 Aug. 2011, leg. et det. J. Kout (KBI, PRM 933237). – NW Bohemia, Louny District, near Ročov, "Na pískách", c. 1 km W of the village centre, on the underside of a cut *Picea* trunk, soc. *Xylodon brevisetus*, 10 May 2015, leg. et det. L. Zibarová (private herbarium) – Central Bohemia, Studený vrch near Stříbrná Skalice, *Picea abies*, 21 Nov. 1953, leg. et det. Z. Pouzar (PRM 902355). – Křivoklátsko Protected Landscape Area, Týřov National Nature Reserve near Skryje, *Quercus petraea*, 28 July 1966, leg. et det. Z. Pouzar (PRM 843145); *ibid.*, hardwood, 25 July 2008, leg. J. Holec, det. Z. Pouzar (PRM 915205). – South Bohemia, Šumava Mts., Lenora, at base of *Fagus* trunk, 20 Sept. 1948, leg. et det. M. Svrček, rev. Z. Pouzar (PRM 856526).

Finland. Rovaniemi, Pisavaara National Park, Sorvannulikka, on *Picea abies*, 19 Sept. 1981, leg. H. Kotiranta (Kotiranta 3558 in H). – Nastola, Rauhaniemi, on *Picea abies*, 1 Dec. 1984, leg. V. Haikonen (Haikonen 5350 in H). – Salla, Värriö Strict Nature Reserve, on *Picea abies* subsp. *obovata*, 20 Aug. 1989, leg. P. Renvall and T. Renvall (Renvall 1842 and Renvall in H). – Uusimaa, Sipoo, Hindsby, Giller Mossarna W, on *Betula*, 18 July 1996 (H). – Lammi, Evo, Kotinen virgin forest, on *Alnus incana*, 1 Sept. 1998, leg. T. Niemelä (Niemelä 6346 in H). – Lammi, Alinen Niemijärvi, on *Picea abies?*, 8 Sept. 1999, leg. O. Miettinen (Miettinen 1001 in H). – Padasjoki, Vesijaon luonnonpuisto, on *Betula*, 15 Sept. 1999, leg. O. Miettinen (Miettinen 1226 in H). – Kittilän Lappi, Kittilä, on *Picea abies*, 24 Aug. 2000, leg. J. Kinnunen and T. Niemelä (Kinnunen 1058 and Niemelä in H). – Uusimaa, Sipoo, Pohjois-Paippinen, Rörstrand, on *Populus*, 22 Oct. 2002, leg. O. Manninen (Manninen 1680 in H). – Rovaniemi, Pisavaara Strict Nature Reserve, on *Pinus*, 29 Aug. 2003, leg. J. Kinnunen (Kinnunen 2070 in H). – Pohjois-Karjala, Lieksa, on *Populus*, 19 Sept. 2003, leg. J. Hottola (Hottola 1615 in H). – Satakunta, Mellilä, on *Pinus*, 2 Oct. 2003, leg. O. Manninen (Manninen 2121 in H). – Varsinais-Suomi, Pöytyä, on hardwood, 3 Oct. 2003, leg. O. Manninen (Manninen 2126 in H). – Pohjois-Karjala, Kontiolahti, on *Picea*, 12 Oct. 2004, leg. T. Rämä (Rämä 326/04y in H). – Yläne, Vaskijärven luonnonpuisto, Isosaari, on *Picea abies*, Nov. 2004, leg. O. Miettinen (Miettinen 9595 in H). – Sodankylä, Vanttion Kotavaara, under *Pinus* (in detritus), 8 Sept. 2005, leg. J. Kinnunen (Kinnunen 3354 in H).

USA. Massachusetts, on *Pinus rigida*, 16 Nov. 1911, A.P.D. Piguet (O: F-503895, as *Hydnum himantia*). – Minnesota, 16 July 1977, L. Ryvarden 14368 (O: F-907312). – California, Riverside

County, San Bernardino Nat. Forest, San Jacinto Mts., on coniferous wood, 17 Mar. 1984, L. Ryvarden 21782 (O: F-907310; duplicate KBI).

ACKNOWLEDGEMENTS

The authors would like to thank Prof. K.-H. Larsson (Natural History Museum, Oslo) and Prof. T. Niemelä (University of Helsinki, Botanical Museum) for enabling the first author to study the herbarium material at their institutions. Dr. J. Holec is warmly thanked for a loan from the National Museum, Prague (herbarium PRM) and L. Zíbarová for reporting the NW Bohemian locality. We acknowledge J. Nebesářová and M. Mergl for the SEM photo.

REFERENCES

- BELTRÁN-TEJERA E., RODRÍGUEZ-ARMAS J.L., TELLERÍA M.T., DUEÑAS M., MELO I., SALCEDO I., CARDOSO J. (2015): Corticioid fungi of the western Canary Islands (Spain). Chorological additions. – Mycotaxon (submitted).
- BERNICCHIA A., GORJÓN S.P. (2010): *Corticaceae* s.l. – Fungi Europaei No. 12, Ed. Candusso, Alassio.
- BINDER M., HIBBETT D.S., LARSSON K.-H., LARSSON E., LANGER E., LANGER G. (2005): The phylogenetic distribution of resupinate forms across the major clades of mushroom-forming fungi (Homobasidiomycetes). – Syst. Biodivers. 3: 1–45.
- BITEW A., RYVARDEN L. (2011): Preliminary check-list of wood inhabiting Basidiomycetes of Ethiopia. – Synopsis Fungorum 29: 11–21.
- BOIDIN J., GILLES G. (2000): Le genre *Kavinia* Pilát (Basidiomycota). – Crypt. Mycol. 21: 139–143.
- BREITENBACH J., KRÄNZLIN F. (1986): Fungi of Switzerland, Vol. 2. Non-gilled Fungi: Heterobasidiomycetes, *Aphylllophorales*, Gasteromycetes. – Verlag Mykologia, Luzern.
- BRUNS T.D., SZARO T.M., GARDES M., CULLINGS K.W., PAN J.J., TAYLOR D.L., HORTON T.R., KRETZER A., GARBELOTTO M., LI Y. (1998): A sequence database for the identification of ectomycorrhizal basidiomycetes by phylogenetic analysis. – Mol. Ecol. 7: 257–272.
- DÁMON W., HAUSKNECHT A., KRISAI-GREILHUBER I., eds. (on-line): Database of fungi in Austria. – <http://www.austria.mykodata.net>. [accessed 20 December 2014]
- DOĞAN H.H. (2009): Two new lignicolous fungi additions to Turkey mycota. – SDU Journal of Science 4: 35–39.
- DONK M.A. (1964): A conspectus of the families of *Aphylllophorales*. – Persoonia 3: 199–324.
- ERIKSSON J., RYVARDEN L. (1976): The *Corticaceae* of North Europe, Vol. 4. *Hyphodermella* – *Mycocacia*. – Fungiflora, Oslo.
- GIACHINI A.J., HOSAKA K., NOUHRA E.R., SPATAFORA J.W., TRAPPE J.M. (2010): Phylogenetic relationships of the *Gomphales* based on nuc-25S-rDNA, mit-12S-rDNA and mit-atp6-DNA combined sequences. – Fungal Biol. 114: 224–234.
- GILBERTSON R.L. (1974): Fungi that decay ponderosa pine. – The University of Arizona Press, Tucson.
- GINNS J., LEFEBVRE M.N.L. (1993): Lignicolous corticioid fungi (Basidiomycota) of North America. – The American Phytopathological Society, St. Paul.
- GRESLEBIN A.G., RAJCHENBERG M. (2003): Diversity of *Corticaceae* sens. lat. in Patagonia, Southern Argentina. – New Zeal. J. Bot. 41: 437–446.

- HAGARA L. (1998): Opätovný nález *Kavinia alboviridis* na Slovensku [Repeated record of *Kavinia alboviridis* in Slovakia]. – Mykol. Listy 65: 9. [in Slovak]
- HANSEN L., KNUDSEN H., eds. (1997): Nordic macromycetes. 3. Heterobasidioid, aphylloroid and gastromycetoid Basidiomycetes. – Nordsvamp, Copenhagen.
- HOLEC J. (2009): Red-listed macrofungi in Central Bohemia (Czech Republic), with taxonomic notes on *Entoloma mougeotii*, *Lentinellus ursinus* and *Pluteus phlebophorus*. – Journal of the National Museum (Prague), Natural History Series 177: 145–159.
- HOSAKA K., BATES S.T., BEEVER R.E., CASTELLANO M.A., COLGAN III W., DOMÍNGUEZ L.S., NOUHRA E.R., GEML J., GIACHINI A.J., KENNEY S.R., SIMPSON N.B., SPATAFORA J.W., TRAPPE J.M. (2006): Molecular phylogenetics of the gomphoid-phalloid fungi with an establishment of the new subclass Phallomycetidae and two new orders. – Mycologia 98: 949–959.
- JÜLICH W., STALPERS J.A. (1980): Resupinate non-poroid *Aphyllorales* of the temperate northern hemisphere. – Verhand. Konink. Nederl. Akad. Wetensch. Afd. Natuurk., Tweede Reeks. 74: 1–335.
- KARADELEV M., RUSEVSKA K. (2012): Contribution to Macedonian red list of fungi. – In: Proceedings of the 4th Congress of ecologists of Macedonia with international participation, p. 68–73, Ohrid.
- KARASIŃSKI D., KUJAWA A., PIĄTEK M., RONIKIER A., WOŁKOWYCKI M. (2009): Contribution to biodiversity assessment of European primeval forests: new records of rare fungi in the Białowieża forest. – Polish Bot. J. 54: 55–97.
- KOTLABA F. (2000): Třetí příspěvek k houbám Soběslavských blat [Third supplement to the fungi of the “Soběslavská blata“ peat bogs]. – Mykol. Listy 73: 1–13. [in Czech]
- KOUT J., ZÍBAROVÁ L. (2013): Revision of the genus *Cotylidia* (Basidiomycota, *Hymenochaetales*) in the Czech Republic. – Czech Mycol. 65: 1–13.
- LARSSON K.-H., LARSSON E., KÖLJALG U. (2004): High phylogenetic diversity among corticioid homobasidiomycetes. – Mycol. Res. 108: 983–1002.
- LINDER D.L., BURDSALL H. JR., STANOSZ G.R. (2006): Species diversity of polyporoid and corticioid fungi in northern hardwood forests with differing management histories. – Mycologia 98: 195–217.
- MAEKAWA N., YANG Z.L., ZANG M. (2002): Corticioid fungi (Basidiomycetes) collected in Sichuan Province, China. – Mycotaxon 83: 81–95.
- NAKASONE K.K. (2003): Type studies of resupinate hydneous Hymenomycetes described by Patouillard. – Crypt. Mycol. 24: 131–145.
- PETERSEN R.H. (1971): A new genus segregated from *Kavinia* Pilát. – Česká Mykol. 25: 129–134.
- PILÁT A. (1938): Hymenomycetes novi vel critici Čechoslovakiae. – Stud. Bot. Čechoslov. 1: 3–7.
- POUZAR Z. (2006): *Kavinia alboviridis* (Morgan) Gilb. et Budington. – In: Holec J., Beran M., eds., Červený seznam hub (makromycetů) České republiky [Red list of fungi (macromycetes) of the Czech Republic]. – Příroda 24: 149. [in Czech]
- SVRČEK M. (1950): Pozoruhodné nálezy basidiomycetů z Českého středohoří [Notable finds of Basidiomycetes in the České středohoří Mts.]. – Česká Mykol. 4: 82–85. [in Czech]
- TEDERSOO L., MAY T.W., SMITH M.E. (2010): Ectomycorrhizal lifestyle in fungi: global diversity, distribution, and evolution of phylogenetic lineages. – Mycorrhiza 20: 217–263.
- VILLEGAS M., CIFUENTES J., ESTRADA-TORRES A. (2005): Sporal characters in *Gomphales* and their significance for phylogenetics. – Fungal Divers. 18: 157–175.