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Bankeraceae in Central Europe. 1.

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The paper presents a survey of the results of a study of the genera *Bankera*, *Phellodon*, *Hydnellum*, *Sarcodon* and *Boletopsis* in selected herbaria of Central Europe (Czech Republic, Slovakia, Hungary, Austria and southern Germany in this first part). The general and current occurrence is described for each species and some possible problems are discussed under particular species.

Key words: *Bankeraceae*, distribution, Central Europe.

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Práce představuje přehled výsledků studia rodů *Bankera*, *Phellodon*, *Hydnellum*, *Sarcodon* a *Boletopsis* ve vybraných herbářích střední Evropy (první část je zaměřena na Českou republiku, Slovensko, Maďarsko, Rakousko a jižní Německo). U jednotlivých druhů je popsán celkový a současný výskyt a diskutována případná problematika.

INTRODUCTION

The presented study follows the survey of knowledge of the hydnaceous genera *Bankera*, *Phellodon*, *Hydnellum* and *Sarcodon* in the Czech Republic and Slovakia (Hrouda 1999) and deals with the ecology and distribution of the studied species in surrounding countries. This article represents first part of the study, which describes the distribution of *Bankeraceae* in Czechia, Slovakia, Hungary, Austria and southern Germany; in the second part the distribution in northern Germany and Poland will be commented and the study should be completed with a summary of the recent state of occurrence of this group in Central Europe.

General information about the ecology and phenology of the studied genera was given in the above cited study, so it is not repeated here. According to the current edition of the Dictionary of Fungi (Kirk et al. 2001), the family *Bankeraceae* contains the genera *Bankera*, *Boletopsis*, *Hydnellum*, *Phellodon* and *Sarcodon*; this is why the species of the genus *Boletopsis* are also incorporated in this study. The ecology and phenology of *Boletopsis* species was described by Kotlaba (1984) and Niemelä and Saarenoksa (1989).

MATERIAL AND METHODS

The core of the work represents revision of herbarium material; except Czech collections, material deposited in selected Slovak, Hungarian, Austrian and German herbaria (BRA, BP, WU, W, GZU, GJO, LI, IB, M, STU, KR and HBG) was revised. Specimens of critical species (not safely distinguished by macroscopical characters) were studied microscopically, as well as unidentified or uncertainly identified specimens of other species; studied specimens were provided with revision cards.

Where useful, some data from literature were taken either for completing information or for a comparison with facts based on herbarium material. The following journals have been excerpted: Czech Mycology (formerly Česká mykologie), Mykologický sborník – Časopis čs. houbařů, Mykologické listy, Spravodajca slovenských mykológov, Mikológiai Közlemények Clusiana, Österreichische Zeitschrift für Pilzkunde, Zeitschrift für Mykologie (formerly Zeitschrift für Pilzkunde), Regensburger Mykologische Schriften, Hoppea and Südwestdeutsche Pilzrundschau; besides many individual records, principal sources of literature data were Velký fotoatlas hub z jižních Čech (Papoušek 2004), Mycoflora Slovaca (Škubla 2003), Die Pilzflora des Ulmer Raumes (Enderle 2004), Die Großpilze Baden-Württembergs (Krieglsteiner 2000) and articles by Buchmann (1998) and Krieglsteiner (1999, 2004).

General information about the occurrence and distribution in particular countries and partial regions is presented for each species. In the case of very rare species, data of individual finds and collections and/or literature records are presented. In most species, "recent occurrence" involves records of the past 30 years. (This is not strictly used in the text and it may somewhat differ in particular species, but in general "recent" means approximately "since the 1970s".) The 30-year period might seems long, but the reason is that many regions are not systematically explored and some localities would be omitted if a shorter period was used (although occurrence of the species is still probable there).

Of course, the article does not present a complete survey of the occurrence of *Bankeraceae* in the region. As it is based on the study of material from selected herbaria, some further material certainly remains omitted, but the selection contains the largest herbarium collections and this should provide a general view of the situation in the whole region.

Short notes on the occurrence in surrounding countries (sometimes completed with information from other countries in southern Europe) are only informative, based on literature (Arnolds 2003, Breitenbach and Kränzlin 1991, Krieglsteiner 2000, Maas Geesteranus 1975, Otto 1992; the individual sources are not cited under every species) and records from the Central European herbaria (see abbreviations); herbarium collections from the surrounding countries have not been revised.

RESULTS

Bankera fuligineo-alba (J. C. Schmidt: Fr.) Coker et Beers ex Pouzar

Relatively rare species associated with *Pinus* (if specified, always with *Pinus sylvestris*), which seems to be the reason of its absence in higher altitudes. It rarely occurs in southern Bohemia (Cep, 1978, PRM) and the neighbouring part of Niederösterreich (Streitbach, 2001, WU), central Bavaria (scattered occurrence, few localities in Mittelfranken and the vicinity of Regensburg) and southern Baden-Württemberg, and has isolated localities in western Bohemia (Plzeň, 2002, coll. L. Zelený) and southern Moravia (Ratíškovice, 1999, BRNM). *Bankera fuligineo-alba* is a very rare species in Slovakia (Kráľova Lehota, 1982; Bílkove Humence, 1970, both BRA, cit. in Škubla 2003) and Austria (Rinner, 1979, GZU; Ötztal, 1972, M).

In surrounding countries the species is documented from northern Italy (M, LI, W, old collections) and reported from France, Switzerland and Slovenia.

Bankera violascens (Alb. et Schw.: Fr.) Pouzar

Syn.: *Bankera cinerea* (Bull.: Fr.) Rauschert sensu auct. non orig.

Compared to the previous species, *Bankera violascens* is a relatively common species especially in sub-mountainous and mountainous areas. It seems that the species is not only associated with *Picea*, but it probably mainly occurs in habitats with natural occurrence of this tree. The name *Bankera violascens* for this species is preferred to *Bankera cinerea* (see Hrouda 1996).

Bankera violascens is a rather common species in Austria. In the Czech Republic its historical occurrence has been recently confirmed in the southern half of the country (from western Bohemia to the Bohemian-Moravian Highland), in southern Germany it occurs in isolated areas: northern Bavaria, vicinity of Augsburg, Schwarzwald and Schönbuch hills. In Slovakia there are only few recent localities in the Vysoké Tatry and Beskydy Mts.; the only find in Hungary is from the westernmost part of the country (Brennbergbánya near Sopron, 1937, BP).

In surrounding countries the species has been recently documented from eastern France (LI), Switzerland (STU), northern Italy (M, W) and Slovenia (STU), and is reported also from Romania.

Phellodon niger (Fr.: Fr.) P. Karst.

Comparatively common species in Central Europe. Its recent distribution range can be divided into several areas of common occurrence: southern and central parts of Bohemia and Moravia and the neighbouring part of Niederösterreich,

the central part of the Western Carpathians in Slovakia, Steiermark and southern parts of Ober- and Niederösterreich and in Germany Baden-Württemberg and western and northern Bavaria (the Austrian and German areas are connected through southern Bavaria and Tirol, where the occurrence is recently more rare). Surprisingly, the species is almost absent from the Danube river basin – there is about a 100 km wide "zone of absence" (from Schwaben to Slovakia), which separates the Czech and the German-Austrian parts of the distribution range. In Hungary the species has been collected only in the vicinity of Budapest (Budakeszi, Mts. Budai, 1967-8, BP).

Phellodon niger is similarly common also in surrounding countries and is documented from France (M, BP), Switzerland (STU), Italy (M, WU, BP) and Slovenia (W); in southern Europe it is reported from Croatia, Spain and Portugal.

Phellodon confluens (Pers.) Pouzar

A rare species with some recent collections. In the Czech Republic there are currently two localities in southern Bohemia (Klec, 2001, CB, cit. in Papoušek 2004, and Stará Hlína, 2004, BRNU) and two new localities in eastern Bohemia (Týniště nad Orlicí and Trusnov, both 2001, HR). In Slovakia the species occurs in the Malé Karpaty Mts. and newly it was found in the Bukovské vrchy Mts. (Stakčín, 1990, BRA). In Hungary, the situation is different. Here, *Phellodon confluens* is the most frequent species of the genus (latest find: Nagymaros, 1991, BP), which corresponds with the composition of the forests in this country, where deciduous ones predominate (similarly, *Castanea* is a frequent accompanying tree just as *Quercus* in the area of its natural occurrence). In Austria there are some older records from Niederösterreich and probably the latest finds of this species in southern Germany are from Schramberg (Baden-Württemberg), "Seedorfer Wald", 1997 (KR) and Urspringen (Bavaria), "Hoher Rodkopf", 2002 (Krieglsteiner 2004), and a few more records (mainly from Oberpfalz).

In the surrounding countries, *Phellodon confluens* is documented from France, Italy (M, IB, W, WU) and Slovenia (LI), in southern Europe it is reported from Croatia, Switzerland, Spain and Portugal.

Phellodon connatus (Schultz: Fr.) P. Karst.

Syn.: *Phellodon melaleucus* (Sw.: Fr.) P. Karst.

Phellodon connatus is the correct name for the species commonly named (and documented in almost all herbaria) as *Phellodon melaleucus*. The priority of the name *Phellodon connatus* must be accepted since the shift of the "starting point" for fungi from Fries 1821 to Linnaeus 1753. The name *P. connatus* is currently used by Otto (1992, 1997), Krieglsteiner (2000, 2004) and Niemelä et al. (2003).

Northern Bavaria and southern and central parts of Bohemia and Moravia appear to be the only areas, where this species commonly occurs. In the whole surrounding area there are scattered localities (in *Fagus* and *Quercus* forests in Hungary, mostly in coniferous forests in other countries). As there is not any large area completely without this species, it is probable that this subtle fungus is rather overlooked than rare. Also wrong identifications of *Phellodon connatus* (confusion with any other species of the genus *Phellodon*) can be recorded in the herbaria.

In southern Europe the species is recently documented from the French Alps (M), Portugal (WU) and it is also known from northern Italy (M, W, BP), Slovenia (W), and reported from Switzerland.

Phellodon tomentosus (L.: Fr.) Banker

Relatively common species, especially in the southern half of Bohemia, but also in the Carpathians (especially in central Slovakia) and in central and southeastern Austria. The species has not been often collected in Moravia and nor in southern Germany, where there are only scattered localities. Similarly as *Phellodon niger*, *P. tomentosus* is rare in the Danube river basin. Specimens of this species are sometimes erroneously identified as *Hydnellum concrescens* (and conversely, too).

In the surrounding countries, *Phellodon tomentosus* has recently been documented from France (IB) and Switzerland (HBG, M, IB, GZU, W, WU, BP), also from Italy (M, W, WU) and Slovenia; in southern Europe it is reported from Romania, Bulgaria and Spain.

Hydnellum suaveolens (Scop.: Fr.) P. Karst.

Not a very frequent species, associated mostly with *Picea*, having its principal distribution centres in the mountain areas – central part of the Western Carpathians (recent finds: Malužiná in the Nízke Tatry Mts., 1999, BRA; Lutiš in the Kysucké vrchy Mts., 1998, and Mútne in the Slovenské Beskydy Mts., 2001; the last two ones cited in Škubla 2003) and the area of Tirol (still rather often collected, 3 finds in the 2000s, WU and IB) and Oberbayern (Oberstdorf, 1991, MSTR). It appears to have a scattered occurrence in Austria (the rest of the mountain part of the country, except Tirol) and Baden-Württemberg (mainly in Schwarzwald). The species is very rare in central and northern Bavaria; in the Czech Republic there is only one recent find (Hlinice, 1997, CB, cit. in Papoušek 2004), although formerly it was collected in various places of this country. It appears that the relatively great decline in occurrence of this species outside the mountain areas (the Alps, Carpathians) is continuing.

In the surrounding countries, *Hydnellum suaveolens* has recently been documented from eastern France (M), Switzerland (STU), northern Italy (W, M, HBG) and Romania (Carpathians, Transylvania, BP).

Hydnellum caeruleum (Hornem.) P. Karst.

Species similarly endangered as *Hydnellum suaveolens*. Recently it has been mainly collected in the central part of the Western Carpathians (Vysoké Tatry Mts. and surrounding mountains) in Slovakia, in the alpine part of Austria (Niederösterreich, Steiermark, Kärnten) and in the southeastern part of Baden (area east of Schwarzwald). There are scattered localities in the rest of southern Germany (Kochenthal, 1987, in Buchmann 1988), Austria (Reichenstein in Oberösterreich, 2004, LI) and southern Bohemia (Malonty, 2001, CB, cit. in Papoušek 2004); its former occurrence has not been recently confirmed in the rest of the Czech Republic (especially southern Moravia, where the species was relatively common until the 1960s) and also in Tirol. The species has always been rare in Bavaria (except Oberbayern) and western Bohemia, and surprisingly also in western and central Slovakia (west and south of the Váh river), which contrasts with the number of records from the Tatra region. In Hungary, there is only one specimen collected near the Steiermark border (Szakonyfalu, 1958, BP).

In the surrounding countries, old collections are documented from northern Italy (Südtirol, now Trentino-Alto Adige, W, HBG); the species also occurs in Romania, Switzerland, France, Spain and Portugal.

Hydnellum ferrugipes Coker

There is only one collection of this American species (similar to *Hydnellum caeruleum*) from Austria, Steiermark, Ragnitztal east of Graz, against Schweinberg, 24. IX. 1975, leg. et det. Riedl as *H. suaveolens*, rev. Maas Geesteranus 1977, GZU. Maas Geesteranus added to the exsiccate a note that it is the second find of this species in Europe. According to Jülich (1984), the species occurs in Austria, France, Norway and Sweden.

Hydnellum floriforme (Schaeff.) Banker

Syn.: *Hydnellum aurantiacum* (Batsch: Fr.) P. Karst. sensu Maas Geesteranus (1975)

Otto (1997) presents the opinion that Batsch's illustration of *Hydnum aurantiacum* (on which the basionym of this epithet is based) represents a species with a dark orange context and sometimes concentrically zoned pileus, well-known under the name *Hydnellum auratile* (Britzelm.) Maas Geest., and therefore the correct name for the species with a light context is *Hydnellum*

floriforme. As I consider his opinion correct, the name *Hydnellum floriforme* is used in this study as well. Nevertheless, this species is found under the name *Hydnellum aurantiacum* in all herbaria in Central Europe.

There are great differences in the occurrence of this species in particular countries. *Hydnellum floriforme* is recently rather common in Austria, especially in eastern Kärnten and southern Steiermark, and the zone of localities continues through southern Oberösterreich and Salzburg to Berchtesgaden in Germany; recent localities have also been discovered in Tirol and Osttirol. Besides, there are two more distribution centres of this rather rare species – southern Bohemia together with the neighbouring part of Niederösterreich and the Carpathian mountains in Slovakia (mainly in the northern part of central Slovakia). In southern Germany, the species is not common, occurring above all in the Schwarzwald region and northern Bavaria.

In the surrounding countries, *Hydnellum floriforme* is documented from eastern France (M), Switzerland (STU) and northern Italy (Südtirol, M, IB, W); in southern Europe it is reported from Romania, Spain and Portugal.

Hydnellum aurantiacum (Batsch: Fr.) P. Karst. em. Otto 1997

Syn.: *Hydnellum auratile* (Britzelm.) Maas Geest.

The species is well-known under the name *Hydnellum auratile*, as explained above, and under this name it is also deposited in the Central European herbaria (if the identification is correct; this species is often not distinguished).

It is very rare in the whole area. There are only isolated localities in Germany (Baden-Württemberg: Tuttlingen, 1969; Oberkochen, 1975; Waldenbuch, 1980, all STU; Bayern: Mühlbach, 1994, STU, cit. in Krieglsteiner 1999, and Kochenthal, 1987, in Buchmann 1988), Austria (Tirol: Brandenberg, 1998, in Peintner et al. 1999; Kärnten: Bodental, 1977, GZU; St. Margareten, 1998, in Hausknecht et al. 2000; Niederösterreich: Bad Fischau, 1984, WU; Oberösterreich: Gosau, 1989, LI), the Czech Republic (recently Vlastiboř, 1991, PRM) and Slovakia (upper Váh basin: Vavrišovo, 1974, BRA; Važec, 1988, PRM).

In the surrounding countries, the species is documented from northern Italy (M) and also reported from France and Switzerland.

Hydnellum peckii Banker in Peck

Syn.: *Hydnellum diabolus* Banker

If all basidiomes with an acrid taste of the context are identified as *Hydnellum peckii* (according to Maas Geesteranus 1975), then it seems to be a very variable species. On the other hand, some authors are of the opinion that it contains two confused species. According to Harrison et Grund (1987a, 1987b), mature

basidiomes of *Hydnellum peckii* s. str. have a darker, sometimes ridged or scrobiculate pileus with a smooth surface (somewhat similar to *H. scrobiculatum*), whereas the separate species *Hydnellum diabolus* is characterised by a velutinous pileus (possibly it represents the type which looks like *Hydnellum ferrugineum*). Pouzar (in verb.) also mentioned a difference between velutinous basidiomes from *Pinus* forests and scrobiculate ones, typically growing in *Picea* forests. Stalpers (1993) presents a difference of these species in the presence of clamps in stipe and pileus trama – present on all primary septa in *H. peckii* versus scattered in *H. diabolus*. Nevertheless, the last mentioned character is discutable, because only scattered clamps can be seen in the trama of the scrobiculate basidiome; further study, including molecular methods, might solve this problem.

In this study, *Hydnellum peckii* is still considered in a wide sense. Recently it occurs in southern Bohemia and the Šumava Mts. (Holec 2004), there are a few isolated localities in eastern Bohemia and central Moravia, and it still rather commonly occurs in the Slovak Carpathians – mainly collected in northern Slovakia, from the Beskydy to the Tatry Mts., newly also in the Bukovské vrchy Mts. (Stakčín, 1991, cit. in Škubla 2003). *Hydnellum peckii* is rather common also in almost the whole of Austria, except the northern part of the country. Here the "zone of absence" along the Danube river (described for some *Phellodon* species) is extremely prominent and begins east of Regensburg; this zone separates the Austrian and Oberbayern part of the distribution range from the localities ranging from Schwarzwald through Mittelfranken to Bohemia. In Hungary, there is only one locality near the Steiermark border (Szakonyfalu, 1958, 1963, BP).

In the surrounding countries, the occurrence of *Hydnellum peckii* is documented from Switzerland (W), northern Italy (M, W, WU) and Slovenia, and it is reported also from France (Krieglsteiner 2000) and Bosnia and Hercegovina (Otto 1992).

Hydnellum mirabile (Fr.) P. Karst.

Hydnellum mirabile is a very rare species with only three localities in the studied area: Gressenberg (Koralpe Mts., Steiermark, 1978, GZU) and Ödenhaus near Innsbruck (Tirol, 1935, W) in Austria and Partutovice (= Bartelsdorf in German, central Moravia, 1934, M and W) in the Czech Republic. In all three cases, coniferous woodland (*Picea* or *Picea* + *Pinus*) was present at the locality.

In the surrounding countries, the species is documented from northern Italy (old collections in W, recent find near Bolzano, 1991, IB) and reported from Switzerland (canton Uri, Maas Geesteranus 1975).

Hydnellum compactum (Pers.: Fr.) P. Karst.

Hydnellum compactum is similarly rare as the preceding species. Recently it is known from Neupurkersdorf in Wiener Wald (Niederösterreich, 1998 and 2002, WU; older collections from nearby Purkersdorf are deposited in W), Engel and Friederichsen (1974) report it near Lermoos (Tirol, 1961–2; the occurrence at this locality is doubtful, *H. caeruleum* has been often named *H. compactum*, but the authors distinguish these two species in the article and mixed coniferous-deciduous forest is mentioned for *Calodon compactum*) and Krieglsteiner (2000) reports four localities from Baden-Württemberg: Obersasbach (1931), Gündelwangen (1971), Breitenbach (1980–1995) and "under Büchereck" (close to Breitenbach, 1994); Krieglsteiner (1991, 1999) reports also a few localities from northern Bavaria. If the accompanying trees are mentioned, *Quercus* or *Fagus* are present (under Büchereck *Fagus* combined with *Abies*). In several herbaria, some specimens of *Hydnellum caeruleum* are documented under the name *Hydnellum compactum*.

In the surrounding countries, there are old collections from France, Switzerland (HBG) and Italy (M, W); besides, the species is also reported from Spain and Slovenia.

Hydnellum spongiosipes (Peck) Pouzar

A very rare species, associated with deciduous trees, occuring at isolated localities in all countries. In the Czech Republic the species is known from Obrubce (1970) and Poříčany (last find in 1980, both PRM), in Slovakia it has been found at five localities: Žemberovce (1987), Mačov (1980), and Gbely, Kuchyňa and Zlatníky (western Slovakia, in the 1970s, all BRA). In southern Germany *Hydnellum spongiosipes* recently occurs in Schwarzwald (near Hausach, 1987, STU), formerly it also occurred in Oberpfalz (Altenschwand, 1963, M). Other localities are situated in Austria (Klöch near Bad Radkersburg, Steiermark, 1995, WU) and in Hungary (Kőszeg near Austrian border, 1979, and Parád in Mátra Mts., 1965, both BP). *Quercus* or *Quercus* + *Pinus* occur at the localities, and *Castanea* near Kőszeg.

In surrounding countries, *Hydnellum spongiosipes* was found near Gorizia ("nördlich Triest, Gorice", IB, 1977) and reported from France, Switzerland and Slovenia.

Hydnellum ferrugineum (Fr.: Fr.) P. Karst.

Hydnellum ferrugineum shows an apparently non-uniform distribution in the area. The clear centre of its occurrence is located in the sandy pine forests of southern Bohemia and neighbouring part of Niederösterreich, where the species also does not show any distinct decline. Smaller areas of occurrence can be found in central Moravia in the Czech Republic and in the Váh river basin in Slovakia. *Hydnellum ferrugineum* rarely occurs in higher altitudes, which is confirmed in Austria – the only part with a rather frequent occurrence of this species is central Steiermark and the adjacent areas of Burgenland and Niederösterreich. Other isolated localities are located in Oberösterreich, Kärnten, and Tirol. In southern Germany, there are scattered groups of localities in several areas of the country.

In the surrounding countries, the species is known from France (BP), Switzerland, and Italy (M); Krieglsteiner (2000) also mentions its occurrence in Spain and Montenegro, Otto (1992) in Portugal.

Hydnellum tardum Maas Geest.

A very rare species, which is characterised by pink colouring of the young basidiomes, character is repeatedly presented in the determination keys. Of course, this character is not usable in the case of old basidiomes or herbarium specimens, where the pink hues disappear. As I had the possibility to see some collections from Baden-Württemberg (identified or revised by Maas Geesteranus), I discovered that *Hydnellum tardum* differs from similar species (*H. concrescens* group) by a slightly velutinous surface of the pileus and stipe (not so prominently velutinous as e. g. at *H. spongiosipes*, but not smooth as is typical for *H. concrescens*).

According to my revision, the occurrence of *Hydnellum tardum* is not limited only to a few localities in Baden-Württemberg; nevertheless, this part of Germany remains the distribution centre of this species (seven localities known to date). Outside Germany, there are single localities in Austria (Oberösterreich, Gosau, Leitgeb-kogel, foot of hill, 1985, LI) and in the Czech Republic (Bohemian-Moravian Highland, Těšenov near Horní Cerekev, Skála hill, 2001; now in my hands, will be deposited in CB). At all localities, *Picea* is mentioned as the accompanying tree or coniferous woodland is present there. In the surrounding countries, the species was also found in France (Bozel Sons Glaigetan in the Savoy Alps, 1971, M).

After discovering this species in the Czech Republic, I looked at the specimens of *Hydnellum concrescens* and *H. scrobiculatum* in the Prague herbarium (PRM), but not any specimen resembles *H. tardum*. In my opinion, it is really a rare species, not only little known.

Hydnellum scrobiculatum (Fr.) P. Karst.

A relatively rare species, especially in comparison with the very similar *Hydnellum concrescens*, from which it differs by spores with rounded warts (compared to truncate warts in *H. concrescens* and *H. tardum*). *Hydnellum scrobiculatum* remains rather common in southern Bohemia (but it is recently almost unknown from other parts of the Czech Republic). Further areas of recent occurrence are Baden-Württemberg and southern Austria. There are also scattered localities in Bavaria. Formerly the species was found in western and northern Austria, too. Only few collections are known from Slovakia (recently near Raková, 1991, and near Važec, 1988, both PRM) and only once the species was collected in Hungary (Imókö hill in the Bükk Mts., 1954, BP).

In the surrounding countries, *Hydnellum scrobiculatum* is documented from Switzerland (STU) and northern Italy (M, W), and it is also known from Portugal (W).

Hydnellum concrescens (Pers.) Banker

As said above, *Hydnellum concrescens* is a more common species than *H. scrobiculatum* and *H. tardum*. Its distribution range covers almost the whole area of the Czech Republic, and further western and northern Slovakia (with a lot of recent finds at the foot of the Tatra Mts.) and a zone in Austria through Waldviertel, the surroundings of Vienna, Burgenland and Steiermark to eastern Kärnten (a few localities in western Hungary also belong to this "branch"). Another area of recent occurrence is Baden-Württemberg and northern Bayern; almost only older collections are known from southern Bavaria and Tirol, and the species is almost absent from a wide zone covering Osttirol, Salzburg, western Steiermark and Oberösterreich (with one recent exception near Offensee, 1994, LI). Small isolated areas where it occurs are known from the Visegrád Mts. and Mátra Mts. in northern Hungary. Compared to other hydnaceous species, *Hydnellum concrescens* is found in warmer areas, but its ecological amplitude is rather wide in this regard (see finds from Tatra region or recently from Šumava Mts. in Bohemia).

In the surrounding countries, this species is documented with old collections from France (M, W, BP) and with recent ones from Italy (M, IB, W, WU; many localities not only in the northern part), Slovenia (STU, W) and Romania (M), there are also recent collections from Portugal (WU); the species is also reported from Switzerland, Croatia, Macedonia, Spain and Portugal.

Hydnellum cumulatum K. Harrison

The only record in Central Europe remains the find from Šalmanovice (southern Bohemia), 1960, preserved in herbarium L (Maas Geesteranus 1975, Kubička 1981).

Hydnellum geogenium (Fr.) Banker

Hydnellum geogenium is a species very distinctly associated with *Picea* in mountain areas. This corresponds with its distribution – the species is absent from Hungary and almost absent from Germany and the Czech Republic (very old collections from Bavaria and Bohemia, more recent ones (1950s–1970s) from Baden-Württemberg and Moravia). It seems that the great decline in occurrence still continues – its distribution range is now limited to the central part of the Slovak Carpathians (Važec, 1980, LIT; Čingov, 1985; Štrbské Pleso, 1989, both BRA) and scattered localities in Steiermark (Walstern near Mariazell, 1994, WU; Weissenbach in the Totes Gebirge Mts., 1998; Stainzer Warte, 2002, both GJO), Kärnten (St. Margareten in Rosental, 2002, WU) and Tirol (Innsbruck, Stangensteig 1995, IB; Hochpillberg, 1998, in Peintner et al. 1999) in Austria.

In the surrounding countries, *Hydnellum geogenium* has been collected in Romania (M) and is reported from Switzerland.

Sarcodon imbricatus (L.: Fr.) P. Karst.

Sarcodon imbricatus has for a long time been confused with *Sarcodon squamosus*. For details see Johannesson et al. (1999) and Schmidt-Stohn (2001). The latter publication is complemented with photographs, but in my opinion the basidiome of *S. squamosus* is extremely dark (the entire photo seems to be shifted in colour); more recommendable are the photos in Arnolds (2003) and illustrations in Maas Geesteranus (1975, tab. 26: fig. a shows typical *S. imbricatus*, whereas fig. b illustrates the pileus of *S. squamosus*). Because of the mentioned confusion, almost all specimens collected in the 20th century have been identified as *Sarcodon imbricatus*, and an exact revision is difficult in some cases. Identification according to the accompanying trees is also discutable, because in some cases of reliable identification the data on the herbarium labels do not confirm the supposed association of *S. imbricatus* with *Picea* and *S. squamosus* with *Pinus*.

Similarly as in the case of *Phellodon niger*, there appears to be a "zone of absence" along the Danube river basin. South of this zone, there is a zone of rich occurrence running from westernmost Hungary (Vas region) through Steiermark, Oberösterreich, and Salzburg to Oberbayern, Tirol and Baden-Württemberg. North of the Danube river basin, there is another zone of occurrence approximately between the 49th and 50th parallel of latitude: southern Bohemia – Moravia – northern Slovakia. *Sarcodon imbricatus* mostly accompanies *Picea* as its symbiont, but compared to some other species, it is probably not strictly associated with natural *Picea* forests. Several isolated localities occur in northern Hungary (Budapest vicinity, Mátra Mts.).

In the surrounding countries, *Sarcodon imbricatus* is documented from France (BP), Switzerland, Italy (HBG, STU, M, W, WU, BP), Slovenia and Romania (Transylvania, M, BP). Moreover, specimens from Spain, Turkey and also Georgia (W) are kept in the Central European herbaria.

Sarcodon squamosus (Schaeff.) Quél.

Species distinguished with certainty only in the past few years; this fact has some influence on its knowledge. Probably it occurs more commonly than is shown in the distribution map, which is based only on critically identified specimens. Kotlaba and Pouzar (2000) present the hypothesis that *Sarcodon squamosus* occurs more often than the real *Sarcodon imbricatus* – they described its occurrence in Bohemia (especially southern Bohemia), which can be expected according to the quantity of *Pinus* forests. The southern half of Bohemia can be considered as one of the distribution centres of *S. squamosus*; another one is found in Niederösterreich and Burgenland (recently Lockenhaus, 2001, in Hausknecht and Klofac 2004). Only isolated localities are known from southern Germany and Tirol, as well as the Carpathian region.

In the surrounding countries, *Sarcodon squamosus* is documented by old collections from northern Italy (W); recently it was collected in Portugal (WU).

Sarcodon leucopus (Pers.) Maas Geest. et Nannf.

A rare species, which has been supposed to be a species of higher altitudes, but it occurs in the lowlands as well. Its occurrence has been documented from the Outer Western Carpathians (Beskydy and surrounding mountains, Malé Karpaty Mts. and surroundings, last records in 1980), continuing in southern Niederösterreich (Mollram, 1990, WU), northern Steiermark (Vorberg above Kulm, 2002, WU), southern Oberösterreich (Grünburg, 1993, LI), Tirol, Oberbayern and Baden-Württemberg. In the past there were only a few isolated localities in western Moravia, Bohemia and the rest of Bavaria and the occurrence of *Sarcodon leucopus* has probably not been recently confirmed there.

Specimens of *Hydnum ebneri* Wettst. from the locus classicus (Tirol, Trins in Gschnitztal valley, typus deposited in GZU) are considered to be basidiomes of *Sarcodon leucopus*; as such they were revised by Maas Geesteranus in W and by Michelitsch in GJO.

In the surrounding countries, *Sarcodon leucopus* is documented from Italy (Südtirol, M, W) and Switzerland (M), reported from France, Romania and also from Portugal.

Sarcodon versipellis (Fr.) Quél.

Sarcodon versipellis is a species of mountainous habitats, occurring mainly in mountain *Picea* (maybe also *Abies*) forests. It is correspondingly rare species with two distinct distribution centres – the first of them covers the Carpathians in central Slovakia (latest record: near Liptovský Ján in the upper Váh river basin, 1985, BRA). Possibly more important is the second centre in Tirol and Oberbayern, where the species has been regularly found to date (5 collections in the late 1980s and 1990s). Beside these ones, there are isolated localities in Bodental (Kärnten, 1994, WU), near Annarotte (Niederösterreich, 1993, WU) and a few older ones in Baden-Württemberg.

In the surrounding countries, *Sarcodon versipellis* is recently documented from Italy (M), and reported from France, Switzerland and Romania.

Sarcodon scabrosus (Fr.) P. Karst.

A rather rare species with a distribution similar to *Hydnellum ferrugineum* – recently a common occurrence in southern Bohemia extending to Niederösterreich, scattered localities in other parts of the Czech Republic, Slovak Carpathians (Beskydy Mts., surroundings of the Váh river, Bukovské vrchy Mts.), eastern and central Austria, southern Baden and northern Bavaria (recently Weisbach, 2002, cit. in Krieglsteiner 2004). In southern Bohemia, the dominant accompanying tree is *Pinus*, whereas other coniferous and deciduous trees (*Pinaceae*, *Fagaceae*) occur also in other areas. In Hungary the species is reported from the Vasa region (Otto 1992).

In the surrounding countries, *Sarcodon scabrosus* is documented from Switzerland, Italy (Südtirol, W), and Romania (Carpathian region), reported also from France and Croatia.

Sarcodon glaucopus Maas Geest. et Nannf.

Rare species with scattered localities. Recently it is known from southern Bohemia (Lužnice in the Novohradské hory Mts., 2002, CB, and Hlinice, 2000, CB, cit. in Papoušek 2004) and adjacent Niederösterreich (Streitbach near Zwettl, 2001, WU), northern Slovakia (Vyšné Hágy in the Vysoké Tatry Mts., 2002, BRNU), Steiermark (Feldbach, 1982, GZU) and westernmost Hungary (Szakonyfalu, 1958, BP), Vorarlberg (Damüls, 1995, WU, cit. in Krisai-Greilhuber et al. 1997), southern Baden (Wolterdingen, 1990, STU, cit. in Gminder 1991) and northern Bayern (Sperbeslohe in Mittelfranken, 1993, WU).

In the surrounding countries, *Sarcodon glaucopus* is reported from Switzerland, documented from Italy (Trentino, M) and also from Portugal (WU).

Sarcodon fennicus (P. Karst.) P. Karst.

Formerly rare, currently almost extinct species in the region. Recently it has been documented from Baden-Württemberg (Wolterdingen in southern Baden, 1990; Zwiefalten in Schwäbische Alb, 1970, both STU), central Tirol (Hungerburg near Innsbruck, 2002; St. Martin in Gnadenwald, 1975, both IB; Tschirgant hill near Strad 1968, HBG), and southern Bohemia (Buzice, 1974; Spolí near Třeboň, 1972; Týn nad Vltavou, 1965, all PRM). A few old records from Moravia and eastern Austria have not been confirmed during the last 70 years.

In the surrounding countries, *Sarcodon fennicus* is documented from Italy (M).

Sarcodon regalis Maas Geest.

Baden-Württemberg: Tuttlingen, Russberg and Witthoh Wald, 1971, preserved in herbarium L (Maas Geesteranus 1975) remain the only known localities in the region. Besides Germany, the species is known from France and Great Britain (Krieglsteiner 2000).

Sarcodon lundellii Maas Geest. et Nannf.

There is only one find of this species in the region: Austria, Niederösterreich, Streitbach near Zwettl, 2001, WU. Formerly this species was known in northern Europe: Sweden and Norway (Maas Geesteranus 1975).

Sarcodon martioflavus (Snell) Maas Geest.

Probably only four localities of *Sarcodon martioflavus* (well distinguishable by its stipe covered with orange felt, which may be darker on dry carpophores) are known from Germany: Weidhausen near Coburg in northern Bayern (1970, M, cit. in Engel 1973; 1977, STU) and Hagelloch in Schönbuch hills, Schwenningen and Schramberg-Sulgen in Ostschwarzwald (1993, the latest record) in Baden-Württemberg (Krieglsteiner 2000). The specimen of *S. martioflavus* cited by Škubla (2003) from Slovakia does not represent this species (an old polypore with a broken hymenophore, probably *Phaeolus schweinitzii*).

In Europe the species is also known from Switzerland (canton Uri, 1970) and Norway (Maas Geesteranus 1975).

Sarcodon joeides (Pass.) Bataille

Very rare species with three known localities: western Slovakia, Kuchyňa in the Malé Karpaty Mts., 1972 (Dermek 1973), Niederösterreich, Neupurkersdorf in

Wienerwald, 1989, WU, and Baden, Hausach in Schwarzwald, 1982, STU. *Fagus* occurs at all three localities, although mixed with other deciduous trees.

In the surrounding countries, *Sarcodon joeides* is documented from Italy (Leuchtenburg near Bolzano, 1966, M), and reported from France and Switzerland.

Sarcodon fuligineo-violaceus (Kalchbr.) Pat.

Besides the type locality in eastern Slovakia (Spišské Vlachy, in German Wallendorf, in Hungarian Szepesolaszi, 1870, UPS), from which the species has not been confirmed later, there are two localities in Austria: Bodental in southern Kärnten (1971, HBG) and Seefeld in central Tirol (1975, IB), and four in Germany: Upflamör in Mittlere Donaualb (latest 1974, STU), Lauf in Oberrheingebiet, vicinity of Tuttlingen (1979) and vicinity of Wüstenstein (Oberfranken, 1979; the three latter localities according to Krieglsteiner 1991, 2000).

In southern Europe, *Sarcodon fuligineo-violaceus* has been also reported from Italy, Spain and Greece.

Boletopsis leucomelaena (Pers.) Fayod

Although the two species of the genus *Boletopsis* are well recognisable when fresh (the differences were well described by Niemelä and Saarenoksa 1989), in Germany and Austria almost all finds of *Boletopsis* have so far been named as *B. leucomelaena*. Whereas the recent herbarium specimens can usually be easily identified, some of the older ones (especially the type of "thin dark brown slices on a paper sheet") are not always certainly identifiable; these specimens were taken into consideration only if it was highly probable to be *B. leucomelaena* (e.g. growth in *Picea* forest). Omitting of some specimens may (to a certain degree) therefore have an influence on the image we have of the occurrence of this species.

In the Czech Republic, the species occurs rarely on scattered localities (recently Rychtářov, 2001, BRNM, and Hartmanice near Sušice, 2002, PRM), whereas in Slovakia there is a distinct centre in the Carpathians (from Beskydy through Malá Fatra and Veľká Fatra to the Tatra Mts.). In the Alpine region, *Boletopsis leucomelaena* has many (also recent) localities from Baden-Württemberg (mainly east of Schwarzwald) through Vorarlberg, Tirol, Oberbayern (especially vicinity of Berchtesgaden) to southern parts of Ober- and Niederösterreich and northern Steiermark, with a "southern branch" in the Koralpe Mts. and Kärnten. Summarised, the species (mostly associated with *Picea*) is rather common in mountain regions.

In the surrounding countries, *Boletopsis leucomelaena* is documented from southeastern France (BP), northern Italy (W), recently also from Spain (M), and reported from Switzerland.

Boletopsis grisea (Peck) Bondartsev et Singer

As mentioned above, *Boletopsis grisea* has not been often distinguished from the previous species – the image of its occurrence may therefore be rather incomplete, if only the finds certainly identified or revised as *B. grisea* are considered.

Compared to *B. leucomelaena*, its occurrence is not concentrated in mountain areas, but corresponds with areas with sandy *Pinus* forests as its typical habitat (but this connection is not absolute, other conifers are also acceptable as accompanying trees). The species is not very rare in the Czech Republic – mainly in southern Bohemia, recently in the Šumava Mts. (Srní, 2001, in Holec 2004), but has also scattered localities in other parts of the country. A great contrast is noticeable in Slovakia, where may be the only locality is located in Záhorská nížina (near Veľké Leváre, western Slovakia, 1975, BRA). From here, the distribution range continues to Niederösterreich and then there are scattered localities in Steiermark, Salzburg (highest locality: Lungau, Gstoder, 1600 m a. s.l., connected with *Pinus mugo*, GJO), and Tirol. In southern Germany, there are some localities in Bayern (recently Unterleinach, 1994, in Krieglsteiner 1999) and only one in Baden-Württemberg (Wolterdingen, 1990, in Gminder 1992).

In the surrounding countries, *Boletopsis grisea* is documented from Spain (IB, M; also Canary Islands), France (IB), Italy (BP, IB, M, HBG), Slovenia (STU) and Romania (M), reported also from Switzerland, and Portugal (Kotlaba 1984).

Occurrence of *Bankeraceae* – historical overview

The family *Bankeraceae* contains species of various ecological affinity. Several species are associated with deciduous trees (*Phellodon confluens*, *Hydnellum compactum*, *H. spongiosipes*, *Sarcodon joeides*) and the centres of their distribution are therefore in the lowlands or in low hills with dominance of deciduous forests. Also species connected (mainly or exclusively) with *Pinus sylvestris*, such as *Boletopsis grisea*, *Bankera fuligineo-alba*, *Sarcodon squamosus*, *Hydnellum ferrugineum*, and *Phellodon niger*, have their distribution centres in areas of lower altitude (in Central Europe, southern Bohemia connected with northern Austria represents such centre). On the other hand, species of mountain regions (connected with *Picea*, may be also with *Abies*) are above all *Sarcodon versipellis*, *Hydnellum geogenium*, *H. suaveolens*, and *Boletopsis leucomelaena*, which have their distribution centres in the Alps and Carpathians.

Tab. 1. Numbers of recorded finds in particular countries.

Country	–1915	1916–45	1946–60	1961–75	1976–90	1991–05
Czech Republic	79	259	407	168	84	148
Slovakia	42	5	20	154	137	71
Hungary	1	2	6	31	1	4
Austria	123	180	8	141	124	160
Southern Germany	76	22	33	131	101	44

The degree of mycological investigation is very different in particular countries and regions. The situation in Czechia and Slovakia was described in a previous study (Hrouda 1999) as rather permanent since World War I (in Czechia), and since 1960s (in Slovakia), respectively. In Austria, the level of mycological investigation can also be described as almost permanent (in general, of course with some local fluctuations) with exception of the 1940s and 1950s (only few records from this time). A similar situation is found in southern Germany (Bavaria, Baden-Württemberg), especially since the 1960s.

In the second half of the 20th century a decline in occurrence of the hydnaceous fungi appeared in Czechia especially in the 1970s–1980s. A rather similar situation occurred in areas with conditions similar to Czechia (e.g. northern Bavaria and northern Austria), but the decline was not so distinct there. In general, in the 1990s and the beginning of the 21st century the number of records again increases in Czechia and Austria and it is very probable that this is connected with better environmental conditions after 1990. The low total number of German records in this time can be caused by deficient data, but in northern Bavaria the decline in the 1980s and increase in the 1990s is also visible (in the 1980s, most finds in Bavaria came from the alpine region).

In mountain areas, especially in the alpine regions of Austria and Germany and in the central Western Carpathians in Slovakia, the situation is much better. A decline in occurrence is almost unknown there and also species which became extremely rare in non-mountain areas (e.g. *Hydnellum suaveolens* or *H. caeruleum*) are less rare in the mountains. The decreasing number of finds in Slovakia is probably caused by higher mycological activity in the 1970s and 1980s than now.

Tab. 2. Numbers of recorded finds of *Bankeraceae* species in particular countries.
Particular columns at each country show numbers of finds in historical periods: 1st column up to 1915, 2nd column 1916–1945, 3rd column 1946–1960, 4th column 1961–1975, 5th column 1976–1990, 6th column 1991–2005.
*) The distribution of *Boletopsis* species until 1984 was taken from Kotlaba (1984); this is why other numbers of finds from the Czech Republic are not presented here.

Species	Czech Republic						Slovakia						Hungary						Austria						Southern Germany					
Bankera fuligineo–alba	3	7	12	6	1	2				1	1								2	9		1	2	1	4	2	1	6	2	3
Bankera violascens	2	14	12	5	5	6				1	5	1		1					2	9		13	10	16		1	4	7	4	4
Phellodon niger	7	12	47	17	15	18	2			5	9	3				2			11	20		19	15	15	9		4	17	8	3
Phellodon confluens		4	4	8	2	4	2			5	1					7		1	2	2										1
Phellodon connatus	8	30	42	19	4	13	1		1	4	5	3			1	3			7	7		3	3	7	2	1		4	6	2
Phellodon tomentosus	13	28	31	23	10	14	4	2	1	18	10	11			1	1			10	19	3	17	8	17	10	1	5	11	4	1
Hydnellum suaveolens	7	16	21	6		1	12	2	5	14	4	2							17	11		8	5	7	9	3	5	8	6	1
Hydnellum caeruleum	8	29	46	11	2	1	2		2	7	11	7	1		1				17	17		14	3	5	7	1	1	8	8	2
Hydnellum ferrugipes																						1								
Hydnellum floriforme	5	14	13	2	1	4	2		2	9	12	5							10	15	2	14	14	15	7		1	6	2	
Hydnellum aurantiacum		2				1				1	1								2	1		1	4		1			3	1	1
Hydnellum peckii		8	16	2	9	4	2			13	6	4			1	1			6	12		8	5	15	2	1	3	9	13	6
Hydnellum mirabile		1																		1			1							
Hydnellum compactum																			1	1				2		1		1	1	1
Hydnellum spongiosipes		1	2	4	1					5	2					1	1		1				1	1			1	1	1	
Hydnellum ferrugineum	5	14	37	13	10	22	1			4	7	1							1	7	1	6	15	4	3		2	1	2	2
Hydnellum tardum						1																	1			1		6	3	
Hydnellum scrobiculatum	2	11	15	6	2	6	1			2	2	1			1				1	7		3	3	2	3	1	1	1	4	1
Hydnellum concrescens	6	20	41	21	5	9	4		3	17	11								11	9	1	5	7	7	4	1	3	8	4	5
Hydnellum cumulatum			1																											
Hydnellum geogenium		3	7	1			1		2	7	7									2		6		5	1			2		
Sarcodon imbricatus	10	28	19	7	4	18	5		2	9	23	26		1		6		3	11	5		7	6	13	4	3	1	7	15	5
Sarcodon squamosus	1	3	6	3	5	12			1	1	5	4							2	1				3						1
Sarcodon leucopus		2	5		1		1		1	5	1								3	7	1	1	1	2	3	2		1		
Sarcodon versipellis	1	2					1			12	3								1	7		1	1	5	3			4	1	1
Sarcodon scabrosus		8	20	10	7	7				5	6									3		1		3	1			4	1	
Sarcodon glaucopus	1		6	1		2				3	2	1			1								3	2					3	1
Sarcodon fennicus		2	4	3															2	3		2	1	1				2	1	
Sarcodon regalis																												2		
Sarcodon lundellii																								1						
Sarcodon martioflavus																												1	1	
Sarcodon joeides										1													1						1	
Sarcodon fuligineo–violaceus							1															2						4		
Boletopsis leucomelaena *)						2		1		4	3	1								1		7	9	9	2	1		6	9	1
Boletopsis grisea *)						1				1		1							3	4		1	5	2	1	2	1	1		2
Total	79	259	407	168	84	148	42	5	21	154	137	71	1	2	6	31	1	4	123	180	8	141	124	160	76	22	33	131	101	44

A somewhat different situation is found in Hungary, where the number of records shows a prominent peak in the 1960s, followed by a rapid decline. It is probably connected with the small area of woodland in this country (also with another composition of forests in which deciduous trees predominate), where any change is rapidly expressed in the number of fungal collections.

Finally, the situation of some endangered species should be commented. Among the species of deciduous forests, *Hydnellum spongiosipes* and *Phellodon confluens* have become very rare (with the exception of three new localities of *P. confluens* in Czechia during the last decade). The occurrence of *Bankera fuligineo-alba* has rapidly decreased since 1980s. Several more species of coniferous forests show decline – besides the above–mentioned *Hydnellum suaveolens* and *H. caeruleum* also *H. floriforme* and *Sarcodon leucopus* have become rare outside mountain areas. The mountain species *Sarcodon versipellis* and *Hydnellum geogenium* are still rare in general, but their occurrence is rather constant. (Extremely rare species with up to 10 localities are not commented in this paragraph.)

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