Hydnaceous fungi in Central Europe

with special regard to the Czech Republic and Slovakia

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INTRODUCTION

Systematic classification of studied genera

Division: *Basidiomycota*, class: *Basidiomycetes*, subclass: *Agaricomycetidae*, order: *Thelephorales*, family: *Bankeraceae*, resp. order: *Cantharellales*, family: *Hydnaceae* (genus *Hydnum*). Source: 9. th edition of Dictionary of the Fungi (Kirk et al. 2001); on the other hand, according to Pegler et al. (1997), only genera *Bankera* and *Phellodon* belong to the family *Bankeraceae*, whereas genera *Hydnellum* and *Sarcodon* belong to *Thelephoraceae*.

The page includes neither the less relative genera of families *Auriscalpiaceae*, *Hericiaceae* nor other genera with a hydnoid (spiny) hymenophore (resupinate and gelatinous types).

SPECIAL PART

Key to the families and genera of Czecho-Slovak stipitate Hydnums

- 1) Amyloid spores; basidiome tiny cochleariform with mostly excentric stipe
  ... ***Auriscalpium*****,** family *Auriscalpiaceae*
- 1*) Spores non-amyloid; basidiomes of various sizes, minute to relatively large, with ą central stipe
  - 2) Spores perfectly smooth, white to ochraceous in mass; basidiome fleshy
    ... ***Hydnum*****,** family *Hydnaceae*
  - 2*) Spores verrucose or spiny; basidiome fleshy or tough
    - 3) Spores short ellipsoid to oval, spinulose with hyaline wall, white in mass; basidiomes with smell of fenugreek especially after drying
      ... family *Bankeraceae*
    - 4) Basidiome fleshy, never overgrowing branchlets or grass ... ***Bankera***
    - 4*) Basidiome tough, often overgrowing branchlets, grass or other objects
      ... ***Phellodon***
    - 3*) Spores regular, moderately to roughly verrucose or spiny with coloured wall, brown or brown-ferrugineous in mass; basidiomes without a smell of fenugreek
      ... genera of family *Thelephoraceae*

(according to the Dictionary of Fungi /9th edition/, these genera belong also to the family *Bankeraceae*)

- 5) Basidiome fleshy, never overgrowing branchlets or grass ... ***Sarcodon***
- 5*) Basidiome tough, often overgrowing branchlets, grass or other objects
  ... ***Hydnellum***

In the following table the main characters of the studied genera are shown.

Genus	Basidiome	Spores	Sp. in mass	Smell
Bankera	fleshy, terminated growth	oval, spinulose, wall hyaline	white	fenugreek
Phellodon	tough, indefinite growth	oval, spinulose, wall hyaline	white	fenugreek
Hydnellum	tough, indefinite growth	irregular, roughly verrucose, wall brownish	brown	different in various species - aromatic, farinaceous, graveolent or without smell
Sarcodon	fleshy, terminated growth	irregular, roughly verrucose, wall brownish	brown	different in various species - aromatic, farinaceous, graveolent or without smell
Hydnum	fleshy, terminated growth	globose to elliptic, smooth, wall hyaline	white	

The key to the genera and the keys to the species of each genus are either based on obvious characters or on characters invisible at first sight, like characters on spores, reaction with KOH etc., which should provide a reliable and precise determination. But as one does not always have a microscope or chemical reagents at one's disposal, one more key based on visual macro-characters only (quite often on colours) is given; this is a complete key for the whole studied group. Herewith, cases can be excluded in which a wrong genus determination automatically leads to an incorrect species determination. This key is only for orientation and sometimes leads to a group of species or to probable species.

- 1) Basidiome tiny cochleariform with predominantly lateral stipe ... ***Auriscalpium vulgare***
- 1*) Basidiomes of different sizes and shapes with central stipe (distinct or covered by spines running down to its base)
  - 2) Basidiome fleshy, never overgrowing branchlets or grass
    - 3) Pileus light orange to orange, with concolorous stipe, spines whitish ... see *Hydnum:* ***H. albidum, H. ellipsosporum, H. repandum, H. rufescens***
    - 3*) Pileus with various brown tints
      - 4) Context pink or violet ... see *Sarcodon:* ***S. fuligineoviolaceus, S. joeides*** (unknown in Czechia)
      - 4*) Context whitish to brown
        - 5) Pileus surface not broken, distinctly velutinous; orange felt on the base of stipe ... ***Sarcodon martioflavus*** (unknown in Czechia)
        - 5*) Pileus surface smooth or broken, max. slightly velutinous; stipe base without orange felt
          - 6) Base of stipe grey-green (or black-green) ... see *Sarcodon:* ***S. fennicus, S. glaucopus, S. scabrosus, S. lepidus, S. regalis*** (last 2 unknown in Czechia)
          - 6*) Base of stipe differently coloured
            - 7) Surface of pileus breaking up into conspicuous, especially in the centre erect scales at maturity
              - 8) Pileus brown to dark brown; basidiomes lacking smell or aromatic, but never with a smell of fenugreek ... see *Sarcodon:* ***S. imbricatus, S. squamosus, S. lundellii*** (unknown in Czechia)
              - 8*) Pileus light brown; basidiomes, especially when dried, with a smell of fenugreek ... ***Bankera violascens***

- 7*) Surface of pileus always lacking conspicuous scales or cracked at the centre into areoles, at most breaking up into appressed squamules with raised tips which may continue towards the margin
  - 9) Context whitish (or chrome yellow where the pileus passes into the stipe - not conspicuous in exsiccates); pileus light to orange-brown with appressed squamules
    ... ***Sarcodon versipellis***
  - 9*) Context whitish to brown, without yellow colour; pileus light-brown
    - 10) Basidiome, especially when dried, with a smell of fenugreek
      - 11) Surface of pileus covered with putrefying plant remains
        ... ***Bankera fuligineoalba***
      - 11*) Surface of pileus without any putrefying remains
        ... ***Bankera violascens***
    - 10*) Basidiome lacking the smell of fenugreek, smell unpleasant

... see *Sarcodon:* ***S. lundellii*** (unknown in Czechia), ***S. leucopus, S. squamosus***

- 2*) Tough basidiome, often overgrowing branchlets, grass or other objects
  - 12) Surface of pileus with more or less conspicuous concentric zones
    - 13) Context bright to dark orange ... ***Hydnellum aurantiacum***
    - 13*) Context whitish to brown
      - 14) Spines light, more or less beige. ***Phellodon tomentosus***
      - 14*) Spines brown to dark brown... ***Hydnellum concrescens***
  - 12*) Surface of pileus without concentric zones
    - 15) Cross-section of the basidiome showing blue colours (often in zones)

... see *Hydnellum:* ***H. caeruleum, H. ferrugipes*** (unknown in Czechia), ***H. suaveolens***

- 15*) Cross-section of the basidiome not showing any blue colours
  - 16) Young basidiomes sulphur yellowish, older ones olive-green turning black on pressing, mostly more basidiomes grown together; context concolorous ***Hydnellum geogenium***
  - 16*) Basidiomes coloured otherwise
    - 17) Spines grey, grey-brown, grey-beige or dirty white; context black, grey or grey-brown; basidiome, especially when dried, with a smell of fenugreek
      ... see *Phellodon:* ***P. confluens, P. connatus, P. niger***
    - 17*) Spines whitish, pink, purple-brown, brown to dark brown; context light-brown, brown to ferrugineous or (at ***H. floriforme***) whitish and orange in the base of the stipe; basidiome lacking smell of fenugreek

... see *Hydnellum:* H. aurantiacum, H. compactum (unknown in Czechia), ***H. concrescens, H. cumulatum, H. ferrugineum, H. floriforme, H. mirabile, H. peckii, H. scrobiculatum, H. spongiosipes, H. tardum***

Bankeraceae Donk

The family established by Donk in 1961 is currently wholly accepted, but there are different opinions about its content: some authors classify the genera Hydnellum and Sarcodon in the family Bankeraceae (Hansen et Knudsen 1997, Kirk et al. 2001) or Thelephoraceae (Maas Geesteranus 1975, Pegler et al. 1997, Arnolds 2003).

Bankera Coker et Beers ex Pouzar

Basidiomes stipitate, pileate. Surface of the pileus at first tomentose, later smooth or broken up into scales, mostly light-brown; stipe concolorous. Spines light-brown to greyish. Context fleshy to tough, non-zoned, white or light coloured, monomitic. Hyphae inflating towards the centre of the pileus, thin-walled, gradually turning to slightly thick-walled and very close together, without clamp-connections. Basidia clavate, 4-spored, without basal clamp-connections. Spores semiglobose to oval, slightly verrucose, colourless. Cystidia absent.

Type species: *Bankera fuligineoalba* (J. C. Schmidt: Fr.) Pouzar.

Key to the Central European species:

1) Surface of mature pileus rarely broken into scales, but covered by a thin layer of tomentum, often with remains of overgrown putrefying plant matter; growing under *Pinus* ... ***Bankera fuligineoalba***

1*) Surface of mature pileus often broken into scales, not covered with a distinct tomentum and lacking remains of overgrown putrefying plant matter; growing under *Picea* ... ***Bankera violascens***.

Bankera fuligineoalba (J. C. Schmidt: Fr.) Pouzar

Description. Pileus about 80 mm in width, velutinous, rarely with appressed squamules, pale, whitish, yellow-brown, flesh-brown, brown, the surface tomentum overgrowing remains of putrefying plant matter. Stipe brown, only pale under the spines. Spines pale brown, greyish, with pink hue in young stages. Context whitish, with age and towards the stipe turning brown, not changing colour in KOH. Expulsion of liquid not observed. Clamp-connections absent. Spores oval with small acute warts, 4.7-5.4 x 2.7-3.6 µm.

Related species. *B. violascens* is often scaly when old and - most of all - never has any putrefying matter on the surface of its pileus, its context turns olive-green in KOH, it grows under *Picea*. The species of the genus *Sarcodon* have no smell of fenugreek and possess roughly verrucose coloured spores of a rather irregular shape.

Occurrence. Less abundant species with a strongly declined occurrence during the last three decades. In prepared Red List of Czech macromycetes (Holec et Beran in prep.) it is classified in category "CR" (critically endangered).

Accompanying trees. Literature sources associate *Bankera fuligineoalba* with *Pinus*; also in our country *Pinus* (if specified, always *Pinus sylvestris*, which seems to be the reason of its absence in high altitudes) occurs in all localities where accompanying trees were recorded, at least as an admixture.

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

synonym: *Bankera cinerea* (Bull.: Fr.) Rauschert

Stephan Rauschert (1988) has proposed the new combination Bankera cinerea (Bull.: Fr.) Rauschert instead of the so far used Bankera violascens (Alb. et Schw.: Fr.) Pouz. He does so in accordance with Bulliard's illustration (Bulliard 1789; Latin description in Bulliard 1791: 309), in which he recognized this species. In this case the description of Hydnum cinereum Bull. relating to the mentioned illustration would be the first description of this species, because Albertini and Schweinitz described Hydnum violascens Alb. et Schw. in the year 1805 (Albertini and Schweinitz 1805).

Maas Geesteranus (1958) has discussed the possible identity of Hydnum cinereum Bull. with Bankera violascens (Alb. et Schw.: Fr.) Pouz. in reaction to Lundell's opinion that Bulliard's fungus could be Hydnum nigrum var. melilotinum (Quél.) Lundell (= Phellodon niger (Fr.: Fr.) P. Karst.; Lundell 1947: 3) or Hydnum amicum Quél. (= Phellodon confluens (Pers.) Pouz.; Lundell 1947: 1). Maas Geesteranus mentions characters which are corresponding to the genus Bankera or directly to the species Bankera violascens (Alb. et Schw.: Fr.) Pouz. as depicted in Bulliard's illustration: — the smooth stipe, with at the most a thin layer of a superficial tomentum ("quelquefois aussi sa surface est pubescente...") which may bind vegetable debris;

— the cut specimen suggests that the context is homogeneous;

- *— the clustered growth;*
- *— the general colouring of the carpophore;*
- *— the pronounced funnelled shape of the full-grown pileus in some of the specimens;*
- *— the radial striation;*
- *— the concentrical zones or rugosities in the centre of the pileus;*
- *— the long stipe, which is unknown in Phellodon confluens, and the colour of its context, which excludes Phellodon niger. Maas Geesteranus stresses the spiny "cap" in young stages, which he considers characteristic of the genus Phellodon, as the only character which could raise doubts about the identity of Bulliard's fungus.*

It is however not Phellodon confluens (Pers.) Pouz. and even less Phellodon niger (Fr.: Fr.) P. Karst. (nobody really ever saw Phellodon niger with pale brown context at all). But it is not a Bankera species either.

This statement is based on the following facts:

- *— the branchlet which is passing through the basidiome is overgrown by the basidiome (picture down left) – this never occurs in the genus Bankera and is characteristic of the genera Phellodon and Hydnellum on the other hand;*
- *— the stipe swelling in the lower part is characteristic of Hydnellum (the stipe of Bankera violascens is conically tapering in the lower part);*
- *— the spiny "cap" when young , which is characteristic of the genus Phellodon, can be characteristic of some species of the genus Hydnellum as well;*

the centre of the pileus is covered by irregular outgrowths evidently accompanied by irregularity of its growth, while the scales of the genera Sarcodon and Bankera are the result of breaking up the originally smooth cuticle.

These are the reasons why it is not possible to consider the fungi in Bulliard's illustration as representatives of the genus Bankera. This is also why it is not possible to accept Rauschert's combination Bankera cinerea (Bull.: Fr.) Rauschert and it is necessary to preserve the name Bankera violascens (Alb. et Schw.: Fr.) Pouz. for this species.

Description. Pileus about 80 mm in width, surface smooth or broken into concentrically arranged scales, whitish, yellow-, grey- or flesh-brown, never covered with putrefying plant rests. Stipe brown, without a whitish zone under the spines. Spines pale brown, greyish, pinkish, white or bluish in young stages. Context whitish, brown to grey-brown, turning olive-green in KOH when cut. Expulsion of liquid not observed. Clamp-connections absent. Spores oval with small acute warts, 4.5-5.4 x 4.3-4.5 µm. Related species. *B. fuligineoalba* never has a pileus broken into erect scales and - most of all - the surface of its pileus is covered with putrefying plant matter, its context does not change colour in KOH, it grows under *Pinus*. The species of the genus *Sarcodon* have no smell of fenugreek and possess roughly verrucose coloured spores of rather irregular shape. Occurrence. Species of moderate abundance, not showing a very conspicuous decline. In prepared Red List of Czech macromycetes it is classified in category "EN" (endangered). Accompanying trees. According to the literature *Bankera violascens* is associated with *Picea*. This is confirmed by our records with only one exception (Křepice near Vodňany, forest SE of road to Libějovické Svobodné Hory, 500 m a. s. l., planted *Pinus* wood, 29. VIII. 1934, leg. et det. J. Herink ut *Sarcodon infundibulum* - but in this locality also *Picea* occurs). It seems that the species is not only associated with *Picea*, but it probably mainly occurs in habitats with natural occurrence of this tree. Distribution in Czechia and Slovakia. Formerly not very abundant species in the Czech Republic, today rare in isolated localities; recently known from the Šumava Mts., southern Bohemia (more common here) and the Sázava river basin. From Slovakia only a few collections from recent years (Tatry, Beskydy, Malé Karpaty Mts.) exist.

Phellodon P. Karst.

Basidiome pileate, stipitate; stipe sometimes shortened because of the spines running down to the base. Predominating colours of the basidiome grey or brown. Surface of the pileus tomentose at first, then fibrillose, ridged, slightly scrobiculate, variously coloured. Stipe concolorous with pileus or darker. Spines variously coloured in different species. Context fibrillose, soft or tough to woody, zoned, monomitic, pale or coloured. Hyphae cylindrical (not inflating), always thin-walled, without clamp-connections in the European species. Hyphae in spines similar, somewhat narrower, also without

clamp-connections. Basidia clavate, 4-spored, without basal clamp-connections. Spores semiglobose to oval, slightly verrucose, hyaline. Cystidia absent.

Type species: *Phellodon niger* (Fr.: Fr.) P. Karst.

Key to the Central European species:

- 1) Basidiome with conspicuously black context also in the pileus, with violet hue when young, grey-black to grey at maturity ... ***P. niger***
- 1*) Context of the pileus not conspicuously black (but ochraceous, greyish or white)
  - 2) Surface of pileus with darker brown concentric zones on a light-ochraceous to brown ground ... ***P. tomentosus***
  - 2*) Surface of pileus without conspicuous concentric zones
    - 3) Small basidiomes with dark pileus, light spines and dark, thin, smooth stipe ... ***P. connatus***
    - 3*) Basidiomes with beige to brown pileus, concolorous or darker spines, often decurrent to the tomentose base of the stipe; associated with deciduous trees ... ***P. confluens***

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

Description. Pileus about 40 mm in width, young velutinous, older smooth to rough, light-grey or violet in young stages, turning dark to black with age. Stipe tomentose (especially when young), dark. Spines white to blue-grey, grey when old. Context black (dark slate grey after drying), turning blue-green in KOH when cut. Expulsion of liquid not observed. Clamp-connections absent. Spores oval with small acute warts, 3.6-4.5 x 2.7-3.5 µm.

Related species. The context of *P. confluens* does not turn blue-green in KOH; this species grows in deciduous woods only. *P. connatus* is smaller, has conspicuously light spines contrasting to the dark stipe and does not have a velutinous pileus. Principal difference: none of the related species have such a black context.

Occurrence. Although showing decline, this species is still relatively abundant. In prepared Red List of Czech macromycetes it is classified in category "NT+LC" (near threatened + least concern). Accompanying trees. Literature sources mention its occurrence in deciduous, coniferous and mixed woods, under *Fagus, Quercus, Picea* and *Pinus*; a small number of our collections come from deciduous woods, a large majority comes from coniferous and mixed woods. *Picea* occurs in 66 %, *Pinus* in 43 % of localities, but this rate has changed during the 1970s–1980s (*Pinus* present in 62 %, *Picea* in 58 % of localities).

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

synonymum: *Phellodon melaleucus* (Sw. in Fr.: 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).

Description. Pileus about 25 mm in width, rough to wrinkled particularly in old specimens, whitish, ash-grey, grey to blackish or with brown hue. Stipe smooth, thin (1-5 mm), dark brown, grey, black. Spines whitish to pale grey or brown. Context grey to brown, turning green in KOH when cut. Expulsion of liquid not observed. Clamp-connections absent. Spores oval with small acute warts, 3.6-4.5 x 3-4 µm.

Related species. *P. confluens* does not have a stipe with colours different from the spines, its context does not turn green in KOH and grows under deciduous trees only. *P. niger* has a clearly black context. Both these species lack such a subtle stipe as *P. connatus* has. *P. tomentosus* is brown coloured with conspicuous concentric zones (*P. connatus* has such zones too, but less conspicuous) and its context does not turn green in KOH.

Occurrence. This species showed a large decline during the 1970s–1980s, but was again found in some places in the Czech Republic in the 1990s. (Has this fungus been overlooked?) In prepared Red List of Czech macromycetes it is classified in category "NT+LC" (near threatened + least concern).

Accompanying trees. In the literature its occurrence in both deciduous and coniferous woods is mentioned; a small number of our collections came from deciduous woods, a large majority from coniferous and mixed woods. *Picea* occurs in 74 %, *Pinus* in 30 %; currently *Picea* is more dominating (86 % of localities during 1960s–1980s).

***Phellodon tomentosus* (L.: Fr.) Banker**

Description. Pileus about 35 mm in width, velutinous, concentrically wrinkled, brown, ochraceous, yellow-brown or grey-brown, mostly with conspicuous darker concentric zones. Stipe smooth, more or less concolorous with the pileus. Spines white, then pale ochre-greyish, sometimes pinkish in young stages. Context pale, ochraceous, brown in the stipe, not changing colour in KOH. Expulsion of liquid not observed. Spores oval with small acute warts, 3.1-3.6 x 2.7-3 µm.

Related species. *P. connatus* does not have a velutinous pileus with such conspicuous concentric zones and its context turns green in KOH. Specimens of this species are sometimes erroneously identified as *Hydnellum concrescens* (and conversely, too), but *Hydnellum concrescens* is sienna to umbra brown with dark brown spines and has a context concolorous with the surface of the basidiome. All species of the genus *Hydnellum* have more roughly verrucose spores lack the smell of fenugreek after drying.

Occurrence. Abundant species with a relatively constant occurrence. In prepared Red List of Czech macromycetes it is classified in category "NT+LC" (near threatened + least concern).

Accompanying trees. In the literature its occurrence in coniferous and mixed woods is mentioned; data from the Czech Republic confirm this with a few exceptions. *Pinus* occurs in 61 % of localities, *Picea* on 48 %. The rate of collections under *Picea* grew during the 1970s–1980s (*Picea* being present in 64 % and *Pinus* in 46 % of localities).

Phellodon confluens (Pers.) Pouzar

Description. Pileus about 40 mm in width, surface at first tomentose, then rough to broken, whitish, greyish, yellow-brown. Stipe tomentose at base, more or less concolorous with the pileus. Spines pale to grey, in fresh young specimens light-blue. Context pale to grey-brown in the stipe, not changing colour in KOH. Expulsion of liquid not observed. Clamp-connections absent. Spores oval with small acute warts, 3.5-4.5 x 3-4 µm.

Related species. *P. niger* has a clearly black context turning blue-green in KOH. *P. connatus* is more subtle, has a thin, dark, smooth stipe (conspicuously differing from the spines) and its context turns green in KOH.

Occurrence. Relatively rare species, showing a strong decline during the 1970s–1980s, but it appears that it probably is not so threatened asi it seemed 20 years ago; some new localities have been recorded in the beginning of the 2000s, also in new regions. In prepared Red List of Czech macromycetes it is classified in category "EN" (endangered). The species is also protected by law according to regulation no. 395/92 Sb. in category "critically endangered species" (Antonín et Bieberová 1995).

Accompanying trees. Literature sources mention its occurrence under *Fagaceae* (*Fagus, Castanea*, mostly *Quercus*), more rarely in mixed woods with *Picea* and *Pinus*; records from Central Europe confirm this (Quercus or Fagus in the northern part, Castanea is a frequent accompanying tree in the area of its natural occurrence).

Hydnellum P. Karst.

Basidiomes pileate, stipitate; stipe sometimes shortened, because of the spines running down to the base. Surface of the pileus tomentose, fibrillose, ridged, rough or scrobiculate, variously coloured.

Stipe tough, concolorous with pileus or not. Spines brown at maturity in most of the species. Context fibrillose, soft or tough to woody, zoned, variously coloured, monomitic. Hyphae rarely inflating, thin-walled to thick-walled, with or without clamp-connections. Hyphae in spines similar, but remaining thin-walled; the presence or absence of clamp-connections on these hyphae and at the base of the clavate 4-spored basidia is connected with their presence or absence in the hyphae of the whole basidiome.

Spores of irregular shape, verrucose, tuberculiform or spiny, brownish. Cystidia absent. Type species: *Hydnellum suaveolens* (Scop.: Fr.) P. Karst.

Key to the Central European species:

- 1) Young basidiome sulphurous yellow, older olive-green, turning black on pressing, the context concolorous ... ***H. geogenium***
- 1*) Basidiome differently coloured, never yellow
  - 2) Context showing blue colours when cut
    - 3) Base of the stipe conspicuously orange (on the surface and especially in the context)

- 4) Pileus whitish, possibly with bluish hue, turning brown with age; clamps present at least in some hyphae ... ***H. caeruleum***
- 4*) Pileus yellowish to brown coloured; clamps absent.. ***H. ferrugipes***

- 3*) No orange colour in the base of the stipe nor elsewhere on the basidiome ... ***H. suaveolens***

- 2*) Context without blue colour when cut
  - 5) Surface of basidiome and also context orange or pale with orange hue; context not turning violet in KOH; base of stipe orange as in *H. caeruleum*
    - 6) Context pale, surface of pileus pale or orange ... ***H. floriforme***
    - 6*) Context orange to orange-brown, more or less concolorous with the pileus ... ***H. aurantiacum***
  - 5*) Basidiome (respectively pileus) pale, ferrugineous or brown, context brown to ferrugineous; context quickly turning violet (sometimes changing to olive-green) in KOH; if not turning violet, taste pungent
    - 7) Surface of pileus brown, rough, wrinkled, zoned or covered with irregular outgrowths already when young, never distinctly roughly hispid
      - 8) Taste pungent; hyphae with clamp-connections.. ***H. peckii***
      - 8*) Taste mild; hyphae without clamp-connections
        - 9) Pileus rather thin, wrinkled and concentrically zoned; sometimes covered with irregular outgrowths; spores with acute or truncate, angular warts
          - 10) Spores with truncate, angular warts ... ***H. concrescens***
          - 10*) Spores with acute warts. ***H. cumulatum***
        - 9*) Pileus rather massive (within the basidiome, which might be tiny or massive), nearly always covered with irregular outgrowths (but the previous two species may look similar)
          - 11) Spores with rounded warts; pileus and stipe surface smooth, the basidiome is brown coloured already when young ... ***H. scrobiculatum***
          - 11*) Spores with truncate, angular warts; pileus and stipe surface slightly velutinous; young basidiome might be pink coloured ... ***H. tardum***
    - 7*) Surface of pileus pale and tomentose when young, might be also roughly hispid; later possible change of the colour to darker (ferrugineous or brown) and/or the tomentum is falling off
      - 12) Growth in deciduous forests
        - 13) Stipe ferrugineous, pileus pale to ferrugineous; stipe covered with smooth tomentum ("velutinous"); context soft; taste mild ... ***H. spongiosipes***
        - 13*) Basidiome pale when young, sometimes yellowish, turning brown with age, possible with olive green hue; basidiome surface tomentose; context tough, compact; taste pungent ... ***H. compactum***
      - 12*) Growth in coniferous forests
        - 14) Basidiome distinctly hispid, long (also over 1 mm) hairs of connected hyphae standing up of the pileus surface; hyphae without clamps ... ***H. mirabile***

- 14*) Basidiome is not distinctly hispis; stipe might be covered with rough tomentum; hyphae with or without clamps
  - 15) Taste pungent; context not turning violet in KOH; hyphae with clamp-connections ... ***H. peckii***
  - 15*) Taste mild; context immediately turning violet (sometimes changing to olive-green) in KOH; hyphae without clamp-connections ... ***H. ferrugineum***

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

Description. Pileus about 75 mm in width, velutinous in young stages, rough, wrinkled when old, whitish, with bluish hue when young, turning yellow to brown with age. Stipe whitish, sometimes with translucent blue tones. Spines whitish to lightly bluish when young, soon turning pink to brown. Context whitish, brightly blue zoned when cut, a thin cut turning blue-green in KOH. Expulsion of liquid not observed. Clamp-connections present. Spores irregularly tuberculiform, not verrucose, 4-5 x 3-3.6 µm.

Related species. No other species than *H. caeruleum* and *H. ferrugipes* have the blue colouring of the context, but that species has a brightly orange stipe base. The odour of *H. suaveolens* is strong like aniseed (even after 40 years in herbarium - according to J. Herink).

Occurrence. Formerly abundant species which has recently became rare; similarly strong decrease can be recorded also in surrounding countries, threatened species! In prepared Red List of Czech macromycetes it is classified in category "CR" (critically endangered).

Accompanying trees. The literature mentions coniferous trees (*Picea* woods, more rarely other or mixed woods); this is fully confirmed by the Czech and Slovak collections. *Picea* occurs in 84 % of localities, but the rate of localities with occurrence of other trees (esp. *Pinus*) is neither negligible. Also the collection from Kersko between Praha and Poděbrady is probably connected with *Pinus*. During the last 25 years the species was found only in localities with *Picea*.

Hydnellum caeruleum (Hornem.) P. Karst.

Description. Pileus about 60 mm in width, without corrugate formations, young specimens softly velutinous, sometimes with light-blue hue, white, turning light-orange to brown when old. Stipe pale, turning dark when old like the pileus. Spines whitish, old brownish. Context pale, blue coloured in the pileus, brightly orange to ferrugineous in the base of the stipe, a thin cut turning (blue-)green in KOH. Context sometimes with (zonations of) blue lines when cut, blue colours may also be seen on the surface of the basidiome where damaged. Expulsion of liquid not observed. Clamp-connections present, scattered on old hyphae. Spores with conspicuous angular warts, 5.4-6(-6.3) x 3.4-4.3 µm.

Related species. The similar *H. floriforme* has no blue colours in cross-section. *H. ferrugipes* differs in yellowish colouring of the pileus and absence of clamps. *H. suaveolens* has no orange or ferrugineous colours in its context (which is characteristic for the stipe base of *H. caeruleum*).

ccurrence. Formerly an abundant species, but rapidly declining since the end of the 1950s; as well as at *H. suaveolens*, its occurrence is constantly decreasing also in surrounding countries, it is strongly threatened species as well. In prepared Red List of Czech macromycetes it is classified in category "EN" (endangered).

Accompanying trees. The literature mentions mostly coniferous trees, more rarely deciduous woods (*Fagus*); in our country the species is known almost exclusively from coniferous woods. *Picea* occurs in 86 %, *Pinus* in 44 % of localities.

Hydnellum floriforme (Schaeff.) Banker

synonym: *Hydnellum aurantiacum* (Batsch: Fr.) P. Karst. sensu Maas Geest.

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. These two species are not distinguished in some cases and sometimes they are considered

as conspecific; I do not accept this opinion, the subtle dark basidiomes especially from mountain regions are distinctly different than more massive light basidiomes as they are known e. g. from southern Bohemia.

Description. Pileus about 50 mm in width, at first pale beige to white, turning bright to dark orange. Stipe orange to orange-brown. Spines whitish when young, brown at maturity. Context pale in the pileus, orange in the stipe (especially its base), a thin cut turning olive-green in KOH. Expulsion of liquid not observed. Clamp-connections absent. Spores with conspicuous angular warts, (5.8-)6-6.7 x (4-)4.3-4.9 µm.

Related species. *H. aurantiacum* has a dark orange context concolorous with the pileus surface (the context of *H. floriforme* is pale). *H. caeruleum* and *H. ferrugipes* show (conspicuous) blue zones in cross-section.

Occurrence. Moderately abundant species, in the Czech Republic very rare in the last decades. In prepared Red List of Czech macromycetes it is classified in category "EN" (endangered).

Accompanying trees. The literature mentions different trees, both coniferous and deciduous. Our collections from all localities where the accompanying trees were written down, are associated with coniferous trees. *Picea* occurs in 66 %, *Pinus* in 43 % of localities.

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

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

Description. Pileus about 25 mm in width, rough, wrinkled to concentrically ridged, orange to light orange-brown, sometimes with concentric, not clearly delimited zones of appressed squamules of a bright orange (to red) colour on a darker (browner) ground; basidiomes subtle. Stipe concolorous with the pileus. Spines mostly brown. Context more or less concolorous with pileus, a thin cut turning olive-green in KOH. Expulsion of liquid not observed. Clamp-connections absent. Spores with conspicuous angular warts, 4.9-5.8 x 3.6-4.5 µm.

Related species. *H. floriforme* has the context paler than the surface (except for young specimens) and lacks the mentioned squamules on the pileus surface. The shape is similar to *H. concrescens*, but this species is brown on the surface and also inside, without any orange hue.

Occurrence. Very rare species. In prepared Red List of Czech macromycetes it is classified in category "CR" (critically endangered).

Accompanying woods. The literature mentions both coniferous and deciduous trees (*Picea, Fagus*); our collections are mostly from *Picea* woods.

Hydnellum peckii Banker

synonym: *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.

Description. Pileus about 50 mm in width, at first whitish, the type *H. diabolus* velutinous, later turning dark, ferrugineous to brown; the type *H. peckii* s. str. turns up to dark brown and soon becomes roughly fibrillose. Stipe concolorous. Spines whitish when young, turning brown with age. Context pale to brown, darker in the stipe, not changing colour in KOH. Red drops of expulsed liquid may appear on the surface of the young pileus. Clamp-connections present. Spores with conspicuous angular warts, 4.9-5.4 x 3.8-4 µm.

Related species. *H. ferrugineum* has a mild taste (*H. peckii* is sharp even as an exsiccate), its context turns violet in KOH and it lacks clamp-connections. This also counts for *H. spongiosipes*, which in addition grows only in deciduous woods. *H. concrescens* and related species have their pileus, stipe, spines and context approximately equally brown, and they also lack clamp-connections.

Occurrence. Moderately abundant species, showing gradual decline. In prepared Red List of Czech macromycetes it is classified in category "EN" (endangered).

Accompanying trees. The literature mentions coniferous trees (*Picea, Pinus*); Czech and Slovak records confirm this, coniferous trees are present in all localities. *Pinus* occurs in 67 %, *Picea* in 55 % of localities.

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

Description. Pileus about 60 mm in width, whitish and velutinous when young, less velutinous to rough and turning ferrugineous to brown with age. Stipe at its base, particularly in young stages, white to ferrugineous, velutinous, more or less concolorous with the pileus (but not always so), surface tomentose and rather scrobiculate. Spines light brown-violet when young, turning brown with age to dark brown when old. Context ferrugineous brown, a thin cut turning dark carmine in KOH. Red drops of expulsed liquid may appear on the surface of young pilei. Clamp-connections absent. Spores with conspicuous angular warts, (5.4-)5.8-6.3 x 3.6-4.5 µm.

Related species. The context of *H. peckii* is pungent even after drying, does not turn violet in KOH, and contains clamp-connections. *H. spongiosipes* has a homogeneous tomentum on the stipe, nearly spiny spores (the warts on the spores of *H. ferrugineum* have truncate apices) and grows in deciduous woods. *H. caeruleum* (older basidiomes might look like *H. ferrugineum*) clearly differs when cut, it has well visible blue zones inside.

Occurrence. Still relatively abundant species. In prepared Red List of Czech macromycetes it is classified in category "NT+LC" (near threatened + least concern).

Accompanying trees. The literature mentions coniferous trees (*Picea, Pinus, Abies*), rarely mixed and deciduous woods; our collections confirm this. *Pinus* occurs in 66 %, *Picea* in 38 % of localities; the rate of localities where *Pinus* occurs grew to 79 % during the last 30 years.

Hydnellum spongiosipes **(Peck) Pouzar**

Current classification of Karsten's species based on Fries's Hydnum velutinum is not mentioned here – I am not able to certainly identify them with any of currently recognized species. Pouzar (1956) differentiates H. velutinum sensu Bresadola (= H. spongosipes) and H. velutinum sensu Fries. He states that these two species were correctly distinguished by Lundell, but Lundell – according to Maas Geesteranus (1957) – considered Fries's H. velutinum as identic with H. ferrugineum. (In Czech herbaria, H. ferrugineum has been commonly identified as H. velutinum.) Maas Geesteranus did not agree with Lundell; he solved the problemmatics by establishing of var. velutinum (= H. velutinum sensu Fr.) and var. spongosipes (= H. velutinum sensu Bres.) of species H. velutinum (Fr.) P. Karst. (independently on separate species H. ferrugineum). Nikolajeva (1961) described H. spongosipes under the name H. velutinum. Maas Geesteranus in his monography (1975) only repeated former statements; he excluded H. velutinum from all synonymics. Later this name has not been published in literature.

Description. Pileus about 50 mm in width, velutinous, at first whitish, then fleshy, turning brown with age, often cinnamomeous. Stipe velutinous, concolorous with the pileus or darker, its surface evenly tomentose. Spines at first whitish, then turning brown. Context concolorous with pileus surface, a thin cut turning dark carmine in KOH. Expulsion of liquid not observed. Spores with very conspicuous acute warts, (5.4-)6.3-7.2 x 4.4-5.4 µm.

Related species. *H. ferrugineum* and *H. peckii* are species of coniferous woods, their spores have truncate warts and an expulsion of red drops may appear in young specimens of these species. Other characters of *H. peckii* are its pungent taste, the presence of clamp-connections and the context not changing colour in KOH.

Occurrence. Rare species, not found in the Czech Republic during the last 20 years. In prepared Red List of Czech macromycetes it is classified in category "CR" (critically endangered).

Accompanying trees. The literature mentions *Fagaceae*, most often *Quercus*. Indeed, *Quercus* is present in all Czech and Slovak localities, where the accompanying trees were recorded, in the remaining cases its presence is possible. In Germany the species occurs with *Fagus*, in Hungary with *Castanea*.

Hydnellum tardum **Maas Geest.**

Popis. Pileus about 30 mm in width, surface gibbous or covered with irregular outgrowths, yellow-brown to siena brown; stipe concolorous. Literature sources characterise this species with pink colouring of the young basidiomes; this character disappears with age or drying. Compared to the

following species, surface of pileus and stipe is usually slightly velutinous at *H. tardum*. Spines light brown (sometimes with purplish hue), context brown, a thin cut turning dark carmine in KOH. Yellowish drops of expulsed liquid may appear on the surface of the pileus. Clamp-connections absent. Spores with conspicuous angular warts, 4.7-5.8 x 3.6-4.3 µm.

Related species. The species is macroscopically not reliably distinguishable from *H. concrescens*, *H. cumulatum* and *H. scrobiculatum*. Under the microscope the spores of *H. scrobiculatum* are found to have rounded warts, *H. concrescens* and *H. tardum* have spores with truncate and *H. cumulatum* with acute warts.; basidiomes of *H. concrescens* are usually thin with smooth surface and often with conspicuous concentric zones. On the other hand, *H. spongiosipes* has the pileus and stipe surface distinctly tomentose and grows in deciduous forests.

Accompanying trees. Literature presents coniferous trees (*Picea, Abies*). *Picea* grows at all Central European localities, where the accompanying tree has been recorded.

Note: 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. In prepared Red List of Czech macromycetes it is classified in category "CR" (critically endangered).

Hydnellum scrobiculatum **(Fr.) P. Karst.**

Description. Pileus about 40 mm in width, rough, wrinkled, mostly covered with many irregular outgrowths or little secondary pileoli; concrescence of basidiomes frequent. Entire basidiome – both pileus and stipe – brown, margin of the pileus sometimes a little lighter. Spines concolorous, context too, a thin cut turning dark carmine in KOH. Yellowish drops of expulsed liquid may appear on the surface of the pileus. Clamp-connections absent. Spores with conspicuous rounded warts, 5.6-7 x 4.5-4.9 µm.

Related species. The species is macroscopically not reliably distinguishable from *H. concrescens* and *H. cumulatum*. Under the microscope the spores of *H. scrobiculatum* are found to have rounded warts, *H. concrescens* and *H. tardum* have spores with truncate and *H. cumulatum* with acute warts.

Occurrence. Less abundant species, showing a gradual decline. In prepared Red List of Czech macromycetes it is classified in category "VU" (vulnerable).

Accompanying trees. The literature mentions coniferous trees (mostly *Pinus*), but also mixed woods (with representatives of the family *Fagaceae*); Czech and Slovak collections come from coniferous (the majority), mixed and deciduous woods. *Pinus* occurs in 54 %, *Quercus* in 29 % of localities. There is a shift from deciduous woods (most collections in the 1930s and 1940s) to coniferous woods (most collections in the 1950s); recently the species has been rarely found under deciduous tree.

Hydnellum concrescens (Pers.) Banker

Description. Pileus about 40 mm in width, brown, wrinkled, with concentric zones, if not destroyed by irregular outgrowths on the surface of the pileus. Stipe concolorous with the pileus. Spines sometimes paler than pileus in young stages, turning dark brown at maturity. Context brown, concolorous with the surface of the basidiome, a thin cut turning dark carmine in KOH. Yellowish drops of expulsed liquid may appear on the surface of the pileus. Clamp-connections absent. Spores with conspicuous angular warts, 5.4-6.1 x (3.6-)4-4.5 µm.

Related species. *H. scrobiculatum*, *H. tardum* and *H. cumulatum* are macroscopically indistinguishable from this species; basidiomes of *Hydnellum* with a conspicuously concentrically zoned pileus and without surface outgrowths, very probably concern *H. concrescens*, but a microscope is needed to check this: the spores of *H. cumulatum* have acute warts, those of *H. scrobiculatum* rounded warts; the spores of *H. concrescens* have warts with truncate apices (like molar teeth), as well as the spores of *H. tardum*, which has slightly velutinous surface of pileus and stipe and pink hues might occur in young stage. It can also be confused with *H. aurantiacum* with an orange context and *Phellodon tomentosus* with light, beige to ochraceous spines, oval spores with small apices and a smell of fenugreek when dried.

Occurrence. Formerly abundant, showing certain decline. In prepared Red List of Czech macromycetes it is classified in category "NT+LC" (near threatened + least concern).

Accompanying trees. According to the literature this species grows under both coniferous and deciduous trees, which is confirmed in our country. The spectrum of accompanying trees is very wide. The most frequent are *Picea* (52 %) and *Quercus* (35 % of localities).

Hydnellum cumulatum K. Harrison

Description. Pileus about 25 mm in width, scrobiculate, sulcate to radially ridged, brown, often more basidiomes grown together. Stipe concolorous with the pileus, spines more or less so. Colour of the context similar to the surface of the pileus, a thin cut turning dark carmine in KOH. Yellowish drops of expulsed liquid may appear on the surface of the basidiome. Clamp-connections absent. Spores with conspicuous acute warts, 4.3-5.6 x 3.6-4.3 µm.

Related species. *H. cumulatum* is macroscopically indistinguishable from *H. concrescens* and *H. scrobiculatum*. It differs from these species by its acutely spiny spores; *H. concrescens* and *H. tardum* have spores with truncate, angular warts, *H. scrobiculatum* with rounded warts.

Accompanying trees. The literature mentions coniferous trees (*Picea, Pinus*).

Hydnellum geogenium (Fr.) Banker

Description. Pileus about 25 mm in width, at first sulphurous yellow, with age and by pressing turning olive-green to black, with irregular surface, wrinkled, with outgrowths or secondary pileoli, basidiomes often grown together. Stipe (often indistinguishable when basidiomes are grown together) concolorous. Spines sulphurous yellow when young, then turning brown. Context yellow when young, gradually turning to olive-green, a thin cut turning olive in KOH. Expulsion of liquid not observed. Clamp-connections present. Spores with not very conspicuous angular warts, 4.5-5.2 x 3.1-3.6 µm.

Related species. Not to be confused with any other species.

Occurrence. Rare species, still found in Slovakia, almost disappeared from the Czech Republic. Well visible occurrence decline during last decades, threatened species! In prepared Red List of Czech macromycetes it is classified in category "CR" (critically endangered). The species is also included in the Red Data Book of Slovakia and Czech Republic (Kotlaba 1995).

Accompanying trees. Literature sources mention coniferous trees. This species seems to be associated with *Picea*, which occurs (with one exception - a collection from the 19th century) in all localities where the trees were recorded.

Species of the genus *Hydnellum*, known in surrounding countries

Hydnellum mirabile

(the species is documented also from Moravia /see below/, but recently it is probably not possible to concern it as species of Czech mycoflora). Rather massive basidiome, yellowish, ochraceous to brown coloured (pileus, spines and stipe); its surface is conspicuously hispid (hairs of connected hyphae, lied down at dry material), different from tomentose or velutinous surface of another species. Context pale, "soft", hyphae without clamps. Spores 5.6-5.8 x 4.5 µm. Species of coniferous forests (*Picea, Pinus*), extremely rare.

Hydnellum mirabile is a very rare species with only three localities in Central Europe: Partutovice (= Bartelsdorf in German, central Moravia, 1934, M and W) in the Czech Republic and Gressenberg (Koralpe Mts., Steiermark, 1978, GZU) and Ödenhaus near Innsbruck (Tirol, 1935, W) in Austria. In the surrounding area, the species is recently documented from northern Italy (near Bolzano, 1991, IB).

Hydnellum compactum.

Also quite massive basidiome, pileus with rough surface, similarly to previous species lanate, tomentose to hairy; whitish to yellow when young, turning brown with age, sometimes with olive green hue. Stipe concolorous with pileus, spines whitish to brown. Context pale, tough, compact ("hard"), hyphae without clamps. Taste pungent to bitter. Spores 5.4-6.3 x 3.6-4.5 µm. Species of deciduous forests (*Quercus, Fagus*, according to literature also *Castanea*), absent in cold regions.

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), and 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*). 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. Further locality is situated in Westfalen („Paulinen-Allee“ near Tatenhausen, 1987, MSTR), and in the 1930s the species occurred also in Mecklenburg-Vorpommern; the specimen cropped in this region (Neumühler See) by Westphal in 1994 (deposited in LZ, formerly identified as *H. spongiosipes* and revised as *H.* cf. *scrobiculatum*) appears to represent an untypical basidiome of this species as well. The species is also known from central Poland („Las Łagiewnicki“ forest near Łódź, 1974, LOD).

Hydnellum ferrugipes.

Species very similar to *Hydnellum caeruleum*; *H. ferrugipes* differs in yellow-brown colouring of pileus and absence of clamps in the whole basidiome.

There is only one collection of this American species 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.

Sarcodon P. Karst.

Basidiomes pileate, stipitate. Surface of pileus at first tomentose, then glabrescent, with cuticle sooner or later breaking up into areoles or scales, mostly brown, sometimes with yellow hue; stipe similarly coloured. Spines brown. Context fleshy to tough, non-zoned, most often whitish to brown (different colours are characteristic of some species or groups of species), monomitic. Hyphae in context broadening towards the centre of pileus, thin-walled to slightly thick-walled, with or without clamp-connections. Hyphae in spines similar. Basidia with or without basal clamp-connections, corresponding to their presence or absence in the context, clavate, 4-spored. Spores of irregular shape, tuberculiform, verrucose, brownish. Cystidia absent.

Type species: *Sarcodon imbricatus* (L.: Fr.) P. Karst.

Key to the Central European species:

- 1) Context pink or violet; hyphae without clamp-connections
  - 2) Pileus turning dark (to black) with age; species of coniferous woods ... ***S. fuligineoviolaceus***
  - 2*) Pileus brown, rather with a red or pink hue; species of deciduous woods ***S. joeides***
- 1*) Context not pink or violet
  - 3) Pileus surface not broken, distinctly velutinous; orange felt on the base of stipe ... ***S. martioflavus***
  - 3*) Pileus surface smooth or broken, max. slightly velvety; stipe base without orange felt
    - 4) Base of the stipe grey- (to black-) green; hyphae without clamp-connections
      - 5) Growth under deciduous trees; spores with truncate, angular warts
        - 6) Pileus brown, cinnamomeous or purplish brown, surface might be broken into darker brown scales on lighter background; taste distinctly bitter ... ***S. scabrosus***
        - 6*) Pileus pale, beige, ochraceous to yellow-brown, surface smooth or with tiny adjacent scales; taste mild, at least slightly bitterish ... ***S. lepidus***
      - 5*) Growth under coniferous trees; spores with truncate or rounded warts
        - 7) Violet colour present in the lower part of stipe ... ***S. regalis***
        - 7*) No violet colour in the lower part of stipe
          - 8) Pileus brown, cinnamomeous or purple-brown, sometimes broken up into dark brown scales on a somewhat lighter brown ground, stipe concolorous with pileus; context turning blue-green in KOH; spores rough with angular warts ... ***S. scabrosus***
          - 8*) Pileus yellow-brown to ochraceous, sometimes broken up into scales, which may be come dark-brown, although the ground remains yellow-brown; stipe yellow-brown, ochraceous to ferrugineous; spores with small rounded warts
            - 9) Both pileus and stipe more or less equally ochraceous, pileus sometimes broken up into a

slightly darker scales on a lighter ground; context not changing colour in KOH ... ***S. fennicus***

- 9*) Pileus and stipe differently coloured, cuticle of the pileus smooth or breaking up into brown areoles in the centre and scales at the margin (darker towards the centre) on a yellowish ground; stipe dirty pale to purple-brown; context turning blue-green in KOH... ***S. glaucopus***

- 4*) Base of the stipe not differently coloured; hyphae with or without clamp-connections
  - 10) Small spores with undistinct or rounded warts, max. 6 x 4.5 µm
    - 11) Pileus brown to orange coloured, smooth or with tiny appressed squamulae; hyphae with clamps ... ***S. versipellis***
    - 11) Pileus brown, distinct scales are adjacent or with raised tips in the centre of pileus; hyphae without clamps. ***S. lundellii***
  - 10*) Large spores with truncate, angular warts, not smaller than 7 x 4.5 µm
    - 12) Pileus fleshy to dark brown, breaking up into large scales
      - 13) Pileus fleshy to dark brown, breaking up into large pronounced scales, erect in the centre of pileus and adjacent on its margin, and deep fissures; usual growth under *Picea* ... ***S. imbricatus***
      - 13*) Pileus breaking up into adjacent scales, dark brown on lighter background (which is visible or not); usual growth under *Pinus* ... ***S. squamosus***
    - 12*) Pileus pale, yellow- to light-brown, breaking up in the centre into areoles or scales with slightly raised tips ... ***S. leucopus***

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

Description. Pileus about 100 mm in width, fleshy brown, red-brown to dark brown, with age breaking up into conspicuous scales, erect in the centre of the pileus, appressed towards its margin, on a lighter ground. Stipe lighter, turning brown towards the pileus, with cylindrical or rounded base. Spines pale to brown. Context whitish, not changing colour in KOH. Expulsion of liquid not observed. Clamp-connections present. Spores with conspicuous angular warts, 7.2-8.2 x 4.9-5.4 µm.
Related species. *S. squamosus* has dark brown pileus with almost always adjacent scales and short grey-brown spines; it usually grows under *Pinus*. The pileus of *S. leucopus* is areolate or possesses only appressed squamules. *S. scabrosus* has a grey-green stipe base and a conspicuously bitter taste (the taste of *S. imbricatus* is neutral or only slightly bitterish). *S. lundellii* lacks clamp-connections and it has small spores, 5-6 µm. The context of *S. joeides* and *S. fuligineoviolaceus* is pink or violet.
Occurrence. Formerly abundant species showing a relatively conspicuous decline during the second half of the 20th century, but it is still relatively common. In prepared Red List of Czech macromycetes it is classified in category "NT+LC" (near threatened + least concern)
Accompanying trees. The literature mentions coniferous trees, which is confirmed in our countries (see note at *S. squamosus*). *Sarcodon imbricatus* mostly accompanies *Picea* as its symbiont, but compared to some other species, it is probably not strictly associated with natural *Picea* forests.

Sarcodon squamosus (Schaeff.) Quél.

Although the species (formerly as) Hydnum squamosum was described already in 1774, Sarcodon squamosus has for a long time been confused with S. imbricatus. 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. This is why the interpretation of historical records about occurrence and distribution of these species cannot be absolute.

For detailed information and summary of distinguishing characters see Johannesson et al. (1999) and Schmidt-Stohn (2001), in Czech Kotlaba and Pouzar (2000), good description was also published by Kučera (1933), who distinguished S. squamosus in his time. The second mentioned 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 Papouček

(2004), 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).

Description. Pileus about 100 mm in width, almost smooth when young; mature pileus in centre flat with conspicuos adjacent scales, smaller towards the margin, dark brown coloured on lighter background. Stipe pale, quite short, sometimes tapering towards the base. Spines short, light grey-green. Context whitish in the pileus, brown in the stipe base, not changing colour in KOH. Expulsion of liquid not observed. Clamp-connections present. Spores with conspicuous angular warts, 7.2-8.2 x 4.9-5.4 µm.

Related species. *S. imbricatus* has fleshy- to dark-brown pileus, broken into pronounced scales, erect at least in the centre of pileus, and longer brown spines; it usually grows under *Picea*. The pileus of *S. leucopus* is areolate or possesses only appressed squamules. *S. scabrosus* has a grey-green stipe base and a conspicuously bitter taste (taste of *S. squamosus* is presented as aromatic to spicy). *S. lundellii* lacks clamp-connections and it has small spores, 5-6 µm. The context of *S. fuligineoviolaceus* is violet.

Occurrence. Still rather common species. In prepared Red List of Czech macromycetes it is classified in category "VU" (vulnerable).

Accompanying trees. Literature presents *Pinus*, what is more or less confirmed in the studied area, but in some cases of reliable identification the data on the herbarium labels do not confirm the supposed association of *S. squamosus* with *Pinus* and *S. imbricatus* with *Picea*.

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

Description. Pileus about 100 mm in width, light- to dark brown, at first tomentose, later radially fibrillose towards the margin and areolate or with appressed squamules in the centre; the scales are darker on a lighter (to yellow-brown) ground. Stipe concolorous, mainly in the lower part paler, appressed squamulose with age. Spines at first whitish, later brown. Context whitish with a brown or violet, after some time sometimes also light-green hue, not changing colour in KOH. Expulsions of liquid not observed. Clamp-connections present. Spores with conspicuous angular warts, (6.7-)7.2-7.6(-9) x 4.5-5.6 µm.

Related species. *S. imbricatus* has pronounced scales with raised tips or completely erect at least in the centre of the pileus. *S. squamosus* has adjacent, but conspicuous dark brown scales; these two species do not have such an unpleasant smell as *S. leucopus*. Fresh basidiomes of *S. versipellis* are brightly orange and the spores of this species have broad rounded warts. *S. glaucopus* has a similarly light and areolate pileus, but the base of its stipe is grey-green. *S. lundellii* lacks clamp-connections and it has small spores, 5-6 µm.

Occurrence. Rare species, probably quite threatened; there are only few recent records also in surrounding countries. In prepared Red List of Czech macromycetes it is classified in category "CR" (critically endangered).

Accompanying trees. The literature mentions coniferous trees. In Slovakia *S. leucopus* was found also in deciduous woods. The most frequent accompanying tree is *Picea*, which occurs in 64 % of localities.

Sarcodon versipellis **(Fr.) Quél**

There are some specimens in the herbaria Prague (PRM) and Bratislava (BRA) named Hydnum (Sarcodon) balsamiodorus Pouz. in schaedis or Hydnum (Sarcodon) balsamiolens Pouz. in schaedis. The description of fresh type material (collected 20. VII. 1969 at Raková near Čadca, Slovakia), kindly offered to me by Z. Pouzar, is adduced here in comparison with the appearance of the same fungus more than 20 years later, as there is the opportunity to see it personally in Prague herbarium.

The fresh pileus is about 80 mm wide, early flatly infundibuliform, mostly obvolutely bent, even split, coloured ochreous-orange, its surface is smooth with innate squamules; the pileus of the exsiccate is beige, ochraceous to light brown, quite smooth, the squamules can only be seen, not touched. The fresh stipe is 40-50 mm long, 18-28 mm thick, cylindrical, peak prolonged in the lower part, the colour of its surface is orange-brown; the stipe of the exsiccate changed its colour like the pileus and is smooth. The spines are not silvery in the fresh material (in contrast to Sarcodon fennicus (P. Karst.) P. Karst.), there is a strange odour from the fresh spines, somewhat like camphor (different from the odour of Hydnellum suaveolens (Scop.: Fr.) P. Karst., not so sweet - compared with fresh material); the spines of the exsiccate are brown to purple-brown, decurrent to the stipe. The fresh context is light white-greenish on cutting; the context of exsiccate is beige to nearly white (distinctly lighter than the surface of the pileus), the green hue has disappeared; it does not change its colour by reaction with a KOH solution (examined only on the exsiccate).

If we add the microscopic characters of our specimens to this description, oblately tuberculiform, 4-5 µm large spores and the presence of clamp-connections on the hyphae, it is evident that specimens preserved in the mentioned herbaria under the name of Sarcodon balsamiodorus (or S. balsamiolens) belong to the species Sarcodon versipellis (Fr.) Quél.

Description. Pileus about 80 mm in width, orange-brown, lighter towards the margin, dried brownish (or yellowish to greyish) coloured, appressed squamulose to fibrillose towards the margin, the squamules and fibrils being darker brown. Stipe concolorous or lighter. Spines whitish to purple-brown. Context white, greyish only in the base of the stipe and where the pileus passes into the stipe; not changing colour in KOH. Expulsion of liquid not observed. Clamp-connections present. Spores irregularly tuberculiform, 4.5-5.5 x 3.5-4.5 µm.

Related species. *S. fennicus* is similarly orange-ochraceous, but does not have scales on its pileus, the base of the stipe is grey-green and it does not have clamp-connections. A grey-green stipe base and the absence of clamp-connections is characteristic of *S. glaucopus*, too. The fresh pileus of *S. leucopus* is brown (not brightly orange as the pileus of *S. versipellis*) and its at least 7 x 4.5 mm large spores have conspicuous angular warts.

Occurrence. Rare species, not found in the Czech Republic for almost 50 years (probably extinct here). Great decline also in surrounding countries, threatened species! In prepared Red List of Czech macromycetes it is classified in category "?EX" (probably extinct).

Accompanying trees. The literature mentions its occurrence in coniferous (*Picea*) and mixed (*Abies, Fagus*) woods; it was always found under coniferous trees in Czechoslovakia, *Picea* occurs everywhere with one exception (*Abies*).

Sarcodon scabrosus (Fr.) P. Karst.

Description. Pileus about 75 mm in width, soon breaking up into scales appressed on the margin, erect in the centre, red-brown, brown to black-brown, contrasting with the pale ground. Stipe fleshy-brown or concolorous with the scales of the pileus, turning to grey-, blue- or black-green, covered by whitish mycelium towards its base. Spines pale, slowly turning brown. Context whitish, grey-green in the base of the stipe, turning blue-green in KOH. Expulsion of liquid not observed. Clamp-connections absent. Spores with conspicuous prolonged angular warts, (5.4-)6.3-7.3 x (3.6-)4-5 µm

Related species. The scales of *S. glaucopus* are appressed also in the centre of the pileus (erect in *S. scabrosus*) and its spores have round warts. *S. regalis* is violet coloured in the lower part of stipe. The stipe of *S. imbricatus* and *S. squamosus* lacks the grey-green base; the taste of these two species is at most slightly bitterish (clearly acrid-bitter in *S. scabrosus*). *S. lundellii* has small spores, 5-6 µm, and it also lacks the grey-green base of stipe. The context of *S. joeides* and *S. fuligineoviolaceus* is pink or violet.

Occurrence. Relatively abundant species, showing a slight decline during the last decades. In prepared Red List of Czech macromycetes it is classified in category "EN" (endangered).

Accompanying trees. The literature mentions both coniferous (mostly *Pinus*) and deciduous (*Fagaceae - Quercus, Castanea*) trees. There are collections from deciduous forests in our country too, but collections from coniferous ones dominate. In southern Bohemia, the dominant accompanying tree is *Pinus* (it is correspondingly the most frequent accompanying tree in the Czech Republic, which occurs in 70 % of localities), whereas other coniferous and deciduous trees (*Pinaceae, Fagaceae*) occur also in other areas in Central Europe.

Sarcodon glaucopus Maas Geest. et Nannf.

Description. Pileus about 50 mm in width, pale, yellowish to brown, pink coloured or here and there with greyish hue, smooth until maturity or areolate in the centre, scaly towards the margin (brown squamulae on a lighter ground), darker in the centre. Stipe brown in the upper part, grey-green in the lower part, base whitish. Spines whitish, later brown. Context whitish, grey-green in the base of the stipe, turning blue-green in KOH. Yellowish dots of expulsed substance may appear on the pileus surface after drying. Clamp-connections absent. Spores with not very conspicuous rounded warts, (5-)5.4-5.8(-6.3) x (3.6-)4-4.5 µm.

Related species. *S. lepidus* grows in deciduous forests. *S. scabrosus* has a grey-green stipe base too, but the surface of its pileus is darker brown (light brown in *S. glaucopus*) with conspicuously ascendent or erect scales in its centre. *S. regalis* is violet coloured in the lower part of stipe. The only other species with a grey-green stipe base and whitish context is *S. fennicus*, but this has an ochraceous pileus without scales and its context does not change colour in KOH. The similarly light

coloured *S. leucopus* does not have a grey-green stipe base. The spores of *S. scabrosus* and *S. leucopus* have angular warts.

Occurrence. Always rare species, individual finds till now. In prepared Red List of Czech macromycetes it is classified in category "EN" (endangered).

Accompanying trees. The literature mentions coniferous trees which is confirmed by our records. The number of records is, however, too small to make any detailed conclusions.

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

Description. Pileus about 50 mm in width, ochraceous, yellow-brown, without scales, fibrillose, or with darker scales on a pale ground. Stipe concolorous in upper part, grey-green in below, with whitish mycelium on its base. Spines whitish to brown. Context whitish, grey-green in the base of the stipe, not changing colour in KOH. Expulsion of liquid not observed. Clamp-connections absent. Spores with not very conspicuous rounded warts, 6.3-7.6 x 4.5-5.2 µm.

Related species. *S. versipellis* is similarly orange-brown and almost scaleless, but this species does not have a grey-green stipe base. The grey-green stipe base is also characteristic of *S. glaucopus*, but its pileus is almost always areolate or (at least appressed) squamulose and its context turns green to blue-green in KOH. *S. regalis* is violet coloured in the lower part of stipe. *S. lepidus* grows in deciduous forests.

Occurrence. Very rare species. In prepared Red List of Czech macromycetes it is classified in category "CR" (critically endangered).

Accompanying trees. The literature mentions coniferous trees, which is confirmed in the Czech Republic.

Sarcodon joeides (Pass.) Bataille

Description. Pileus about 60 mm in width, sinuous, areolate or appressed scaly, pale brown to fleshy brown, more ochre after drying. Stipe concolorous with the pileus, sometimes grey-green at its base. Spines at first pale, then brown. Context at first pink, later violet in the pileus above the spines and in the stipe, grey in the base of the stipe, turning blue-green in KOH. Yellowish dots of expulsed substance may appear on the pileus surface after drying. Clamp-connections absent. Spores with conspicuous angular warts, 5.4-5.8 x 3.6-4.2 µm.

Related species. S. lepidus, growing also in deciduous forests, lacks pink colour in context; S. joeides is distinguished from all other species except S. fuligineoviolaceus by the pink or violet context, but the latter grows only in coniferous woods. Accompanying trees. According to the literature deciduous trees, mostly *Quercus*, but also *Castanea* and *Fagus*.

Sarcodon fuligineoviolaceus (Kalchbr. in Fr.) Pat.

Description. Pileus about 70 mm in width, red-brown to dark brown, sometimes with blackish hue, innately squamulose. Stipe concolorous with the pileus, paler when young. Spines brown. Context at first pink, later blue-grey-violet in the pileus, with red hue in the stipe and grey-green in its base, turning blue-green in KOH. Yellowish dots of expulsed substance may appear on the surface of the pileus after drying. Clamp-connections absent. Spores with more or less conspicuous acute warts, 5.4-6.5 x 4-4.7(-5.4) µm.

Related species. The pink or violet context distinguishes S. fuligineoviolaceus from all other species except S. joeides, which grows only in deciduous woods.

Accompanying trees. The literature mentions coniferous trees (Abies, Picea, Pinus). Slovak find of *Sarcodon fuligineoviolaceus*:

Species of the genus Sarcodon, known in surrounding countries

Sarcodon regalis.

Species related to Sarcodon scabrosus, most similar just to this species. It differs in presence of violet hue on the stipe base and smaller spores (6-6.5 µm). Very rare species growing in coniferous forests.

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 lepidus.

Species from the same group, with grey-green base of stipe. Basidiome is pale coloured, ochraceous to light-brown; squamulae on pileus darker, adjacent or at most with raised tips. Stipe often tapering towards its base. Similarly rare species growing in deciduous forests.

Very rare species with few recent localities. Poland: Lódź, „Las Łagiewnicki" forest (Quercus, 1974, LOD, originally identified as S. laevigatus = S. imbricatus). Germany: Sachsen, Mönau near Hoyerswerda, „Mönauer Teiche" (Quercus, 1999 and 2001, LZ), and Thüringen, Krimderode near Nordhausen, „Gipshügel" (Quercus + Betula, 1985, JE). Possible other German locality is in Baden, Schönberg near Freiburg (during last 15 years, not. G. Saar in letter to P. Otto – according to his information the recorded species should also be S. lepidus).

Sarcodon lundellii.

Species similar to Sarcodon imbricatus (colour of pileus) or S. squamosus (adjacent scales); it differs in absence of clamps and small spores (5-6 µm). Growth in coniferous forests

Nordic species (occurring in northern Europe: Finland, Sweden and Norway, see Hansen et Knudsen 1997) with only one known find in Central Europe: Austria, Niederösterreich, Streitbach near Zwettl, 2001, WU.

Sarcodon martioflavus.

Pileus ochraceous to brown, with velutinous surface. Stipe concolorous, with conspicuous oranfe felt in lower part, which may be darker on dry carpophores (if this character is well developed, the species is well distinguishable and almost cannot be confused with another species). Very rare species growing in coniferous forests.

Probably only four localities of Sarcodon martioflavus 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).

Hydnaceae Chev.

Hydnum L.: Fr.

synonym: *Dentinum* Gray

Long-standing dispute about the typification of the name Hydnum L.: Fr. have ended on the 13th Botanical Congress in Sydney 1981, where the species Hydnum repandum L.: Fr. has been conserved as the type species of the genus Hydnum. The name Dentinum Gray is the definitely only synonym of the genus name Hydnum, whereas brown-spored species formerly classified under the generic name Hydnum have to be classified in the genus Sarcodon P. Karst. and their combinations with the generic name Hydnum are definitely only synonyms

Pileate and stipitate basidiome. Pileus convex, sometimes depressed in centre, smooth on the surface, whitish to orange. Stipe whitish to creme. Context fleshy, fragile, non-zoned, white or pale coloured, monomitic. Hyphae thin-walled, inflated in the pileus, clamp-connections present. Basidia clavate or cylindric, most often with 3-4 spores (rarely with 1, 2 or 5-7 spores). Spores globose to elliptic, smooth, colourless. Cystidia absent.

Typový druh: *Hydnum repandum* L.: Fr.

Key to the Central European species (according to: Ostrow et Beenken 2004, cit. sec. Antonín 2005, modified):

- 1) Basidiomes whitish; spores 4-5,5 x 3-4 µm ... ***H. albidum***
- 1*) Basidiomes pale to orange; spores longer than 5,5 µm
  - 2) Basidiomes large, pileus up to 15 cm in width, beige or pale orange coloured; stipe rather short, clavate, often infleted at the base, rate of pileus width to stipe length approximates to 2; spines subuliform, pale crème ... ***H. repandum***
  - 2*) Basidiomes smaller, pileus 3-5(-8) cm in width, orange coloured; stipe cylindric, rather long, rate of pileus width to stipe length is distinctly less than 2; spines subuliform, ± irregularly flattened, orange
    - 3) Spores globose to widely elliptic, 6,5-8,5(-9) x 5,5-7 µm … ***H. rufescens***

- 3*) Spores elliptic to almost cylindriform, 9-11(-12) x 6-7 µm ***H. ellipsosporum***

Hydnum repandum L.: Fr.

Pileus 5-15 cm in width, pale orange, creme, beige to whitish. Stipe clavate, rather short (usually shorter than pileus width), it might be also slightly excentric, gradually passing into pileus, usually concolorous or slightly paler than pileus. Spines subuliform, pale, decurrent. Context whitish. Spores globose to widely oval, 6,5-9 x 5,5-7 µm.

Related species. Stipe of *Hydnum rufescens* and *H. ellipsosporum* is clearly delimited from the pileus, the spines are non-decurrent and darker orange. *H. albidum* is wholly pale and has small spores up to 6 µm. Theoretical possibility of confusion of the *Hydnum* species with older basidiomes of *Albatrellus confluens* with broken pores (looking like spines) is not very probable.

Occurrence. Common species with stable occurrence.

Accompanying trees. Growth mainly in deciduous, but often also in coniferous forests, mainly on basic oils.

Distribution. As the species is rather common, all finds have not been documented or recorded (moreover, in many cases the record of *H. repandum* can indicate any undistinguished species of the genus *Hydnum*). It occurs on most of the area of the Czech Republic (its distribution in Central Europe is similar).

Hydnum rufescens Fr.

Pileus 3-8 cm in width, orande to light ferruginous or reddish. Stipe central, cylindric, rather thin (usually up to 1 cm), commonly longer than pileus width, creme or pale orange. Spines subuliform, furcate or truncate, pale orange, nesbíhavé, stipe distinctly delimited from the pileus. Context whitish or pale orange. Spores globose to widely oval, 6,5-9 x 5,5-7 µm.

Related species. *Hydnum repandum* and *H. albidum* have decurrent spines, their stipe is not distinctly delimited from the pileus, the whole basidiome is whitish or pale coloured. Macroscopically indistinguishable *H. ellipsosporum* has elliptic spores 9-11 µm long.

Occurrence. Similarly common as previous species.

Accompanying trees. Growth in deciduous and coniferous forests, especially in acid *Fagus* and *Picea* forests.

Distribution. The species occurs on most of the area of the Czech Republic (similarly in Central Europe). Also at this species, all finds have not been documented or recorded (similarly as at the previous species, with which it often has been confused).

Species of the genus *Hydnum*, known in surrounding countries

Occurrence of the American species Hydnum albidum in Europe has been known for a long time – in Central Europe it is documented from Austria and Germany. It very probably occurs also in the Czech Republic, but it has not been distinguished from H. repandum till now.

On the other hand, Hydnum ellipsosporum is newly described species (Ostrow et Beenken 2004). Compared to probable occurrence of H. albidum in Czechia, the occurrence of H. ellipsosporum can be supposed almost certainly – only it has been confused with H. rufescens till now.

Hydnum albidum Peck.

Pileus 5-8 cm in width, whitish to yellowish (also darker when dried). Stipe clavate, gradually passing into pileus. Spines thin and dense, subuliform, whitish. Context whitish. Spores globose to elliptic, 4,5-5 x 3-4 µm – the spore size is the main character, with which it can be distinguished from the other species of the genus *Hydnum* (the colour of *H. albidum* might be the same as at *H. repandum*). Quite rare species, growing in deciduous and coniferous forests (under *Fagaceae* and *Pinaceae*) on calcareous soil.

Hydnum ellipsosporum H. Ostrow et L. Beenken.

Species macroscopically identical with *H. rufescens*, from which it differs by spore size and shape - spores of *H. ellipsosporum* are elliptic, 9-11 x 6-7,5 µm. Probably it is not a rare species, growing mostly under *Fagus* and *Pinus* on acid soils.

PUBLICATIONS

Hrouda P. (2005a): Bankeraceae in Central Europe. 1. – Czech Mycology 57: 57–78.
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.

Hrouda P. (2005b): Bankeraceae in Central Europe. 2. (submitted).
The paper presents a second part of a study of the genera *Bankera*, *Phellodon*, *Hydnellum*, *Sarcodon* and *Boletopsis* in selected herbaria of Central Europe (Poland and northern Germany in this part). The occurrence and distribution is described for each species and historical changes of the occurrence of hydnaceous fungi in the Central European area are discussed in the end of the study.
Key words: *Bankeraceae*, distribution, Central Europe.

Dvořák D. et Hrouda P. (2005): Ježaté houby / lošáky a korálovce. – 36 p. + 20 tab., Masarykova univerzita, Brno (in Czech).
The paper presents a summary of current knowledge about the studied groups of fungi. Basic information about 33 species occurring in the Czech Republic is completed with notes about 13 species, which are known in the surrounding countries and the possibility of their find in the Czech area cannot be excluded. Descriptions of particular species are completed with survey of similar species and their distinguishing characters, which should help in certain determination. Further paragraphs describe the historical changes of occurrence, phenology (not presented at hydnaceous fungi; almost all of them occur in the late summer and autumn), ecology (accompanying trees at the mycorrhizal hydnums, wood substrate at lignicolous hericia) and distribution in the Czech Republic (species of family *Bankeraceae* are completed with the note about Slovakia; material from Slovakia has not been elaborated at the other groups). Identification keys to the particular families and genera are completed with the total key for the whole heterogeneous group of terrestrial stipitate hydnums
Illustrations: P. Rychlá, P. Hrouda; **photos:** D. Dvořák, P. Lazárek, V. Janda.

Hrouda P. (1999a): Hydnaceous fungi of the Czech Republic and Slovakia. – Czech Mycology 51 (2-3): 99–155.
The paper presents a survey of the results of a study of four hydnaceous genera - *Bankera*, *Phellodon*, *Hydnellum* and *Sarcodon* - in the Czech Republic and Slovakia. It is based on material deposited in Czech and Slovak herbaria as well as on literature records of finds of the included species from the studied territory. For each species a short description is provided, highlighting characters distinguishing it from related species. Short notes about its ecology, occurrence and distribution are added. In the latter the actual state is compared with historic and literature data. The study is supplemented with distribution maps of individual species.
Key words: Hydnaceous fungi, occurrence, accompanying trees, distribution, Czech Republic, Slovakia.

Hrouda P. (1996): Notes on two hydnums – Bankera violascens and Sarcodon versipellis. – Czech Mycology 49 (1): 35–39.
This article deals with two questions concerning to hydnaceous fungi. I do not accept the name *Bankera cinerea* (Bull.: Fr.) Rauschert for *Bankera violascens* (Alb. et Schw.: Fr.) Pouzar. The reason is thet Bulliard's illustration of *Hydnum cinereum*, on which Rauschert based his combination, in my opinion does not show a species of the genus *Bankera*. The characters, on which this statement is based, are given.
The specimens of *Sarcodon balsamiodorus* Pouzar in schaedis from herbaria (PRM, BRA) belong, also according to the description of fresh material, to *Sarcodon versipellis* (Fr.) Quél.
Key words: Combination, *Bankera cinerea*, Bulliard's illustration, exsiccates, *Sarcodon balsamiodorus*.

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