

Gymnopilus igniculus – find from the Czech Republic and notes on its variability

JAN HOLEC^{1*}, VLADIMÍR ANTONÍN², MICHAL GRACA³
and PIERRE-ARTHUR MOREAU⁴

¹ National Museum, Mycological Department, Václavské nám. 68,
115 79 Praha 1, Czech Republic

² Moravian Museum, Department of Botany, Zelný trh 6, 659 37 Brno,
Czech Republic

³ Nádražní 54, 701 00 Ostrava, Czech Republic

⁴ Geobotanisches Institut ETH, Zollikerstrasse 107, CH 8008 Zürich, Switzerland

*corresponding author, jan.holec@nm.cz

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Gymnopilus igniculus Deneyer, P.-A. Moreau et Wuilbaut (Agaricales, *Cortinariaceae*), a violet-coloured species described in 2002 from Belgium, was found in the city of Ostrava, part Radvanice, Czech Republic. The fruitbodies grew on decaying wood of *Fraxinus* in a unique habitat – a burning coal mine dump, the surface of which reached about 45 °C. The most important characters of the fruitbodies are the purplish to vinaceous- or reddish-brown colour of the pileus covering which is tomentose-fibrillose when young and fibrillose-squamulose to distinctly scaly at maturity, the yellow pileus ground, the absence of any ring, the whitish membranaceous to fibrillose veil, the stipe distinctly longitudinally purplish brown fibrillose on the dirty white or slightly violaceous ground, the context yellowish with reddish-violaceous tinge and fungoid smell, the relatively large spores [8.0–9.5(–11) × 6.0–6.8(–7.2) μm] with rough verrucose to verrucose-rugulose ornamentation, the variable shape of cheilocystidia and the absence of pleurocystidia. A detailed description of macro- and microcharacters, colour photographs of fresh fruitbodies and line drawings are provided. Some characters deviating from the Belgian collections are discussed and remarks on other European finds of *Gymnopilus* with violet colours are added.

Key words: fungi, Agaricales, *Cortinariaceae*, violet-coloured *Gymnopilus*, Europe, taxonomy, ecology, coal mine dumps.

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Gymnopilus igniculus Deneyer, P.-A. Moreau et Wuilbaut (Agaricales, *Cortinariaceae*), druh s fialovými odstíny na plodnici popsaný v roce 2002 z Belgie, byl nalezen v Ostravě-Radvanicích. Plodnice rostly na tlejícím dřevě jasanu v neobvyklém prostředí – na hořící hornické haldě, kde teplota povrchu dosahovala až 45 °C. Nejdůležitějšími znaky nalezených plodnic jsou: purpurová až vínově nebo červeně hnědá barva klobouku, který je v mládí plstnatě vláknitý, v dospělosti vláknitě šupinatý až zřetelně šupinatý na žlutém podkladu, nepřítomnost prstenu, bílé blanité až vláknité velum, třeh zřetelně podélně purpurově hnědě vláknitý na špinavě bílém nebo lehce nařalovělém podkladu, žlutavá dužnina s červenavě fialovým odstínem a houbovou vůní, poměrně velké výtrusy [8.0–9.5(–11) × 6.0–6.8(–7.2) μm] s hrubě bradavčitou až bradavčité vrásčitou ornamentikou, proměnlivý tvar cheilocystid a nepřítomnost pleurocystid. Je publikován podrobný popis makro- a mikroznaků, barevné fotografie čerstvých plodnic a kresba a fotografie mikroznaků. Jsou diskutovány některé odlišnosti od belgických sběrů a připojeny poznámky k dalším evropským nálezům fialově zbarvených druhů z rodu *Gymnopilus*.

INTRODUCTION

In spring 1999, M. Graca found an interesting *Gymnopilus* species growing in a unique habitat – a burning coal mine dump in the city of Ostrava, part Radvanice, Czech Republic. The fruitbodies were remarkable by the purplish to vinaceous brown colours on the pileus and stipe surface, a character which is unique in *Gymnopilus* species collected in Europe. M. Graca photographed the fruitbodies on site and sent them immediately to the Department of Botany, Moravian Museum, Brno, where V. Antonín and A. Vágner made two independent and thorough descriptions of macrocharacters. Later, V. Antonín handed the dried material over to Jan Holec for detailed elaboration, who included it in his taxonomic study of the genus *Gymnopilus* in Central Europe (see e.g. Holec 2001).

Gymnopilus species with purplish, violaceous or vinaceous tinged fruitbodies are rare in Europe. They mostly represent species imported from the tropics or subtropics. It is e.g. *Gymnopilus purpuratus* (Cooke et Masee) Singer, described from tree fern stems in the Royal Botanic Gardens, Kew (Cooke and Masee, *Grevillea* 18: 73, 1890; Cooke 1883: 375; coloured picture: Cooke 1881-1891: plate 964). Fruitbodies identified as *G. purpuratus* were also found in the greenhouse of the Botanical Garden in Zürich (Breitenbach and Kränzlin 2000: 140). The name *G. purpuratus* was further used for collections from compost heaps of wood and bark remnants in the Ribnitz-Damgarten district in Germany (Kreisel and Lindequist 1988, Ludwig 2001: 154, coloured picture by Ludwig 2000: p. 45). Röllin (1998) published finds identified as *Gymnopilus* cf. *peliolepis* from a base of a palm tree in a bureau in Genève, Switzerland. Find of *Gymnopilus dilepis* (Berk. et Broome) Singer from a pot with *Philodendron* purchased from a supermarket in Great Britain was published by Watling (1998); a more recent, abundant find, on heap of woodchips, has been illustrated by T. Leech in Henrici (2002: back cover).

Recently, Deneyer et al. (2002) described the new species *Gymnopilus igniculus* Deneyer, P.-A. Moreau et Wuilbaut found at two burning schist dumps in Belgium. Coloured photographs of this species were published in the work by Bon and Roux (2002: pl. 1-B) and by Wuilbaut (2002: p. 31). Finally, Bon and Roux (2002) used the name *Gymnopilus luteifolius* (Peck) Singer for *G. purpuratus* s. Breitenbach et Kränzlin (2000) and the name *Gymnopilus peliolepis* (Speg.) Singer for *G. purpuratus* s. Ludwig (2000, 2001).

A comparison of our finds with purplish to violaceous coloured *Gymnopilus* species known from Europe showed that our fungus is identical with *Gymnopilus igniculus*. Detailed data on characters and ecology of the finds from the Czech Republic are presented here.

MATERIAL AND METHODS

Herbarium specimens are kept in the Mycological Department, National Museum, Prague (PRM) and Department of Botany, Moravian Museum, Brno (BRNM). The colour codes are according to Kornerup and Wanscher (1981). Microcharacters were studied in a 5 % KOH solution. The pigmentation of the pileus and stipe cuticle was studied in pure water. Iodine reactions were studied in Melzer's reagent prepared according to the formula given by Moser (1983). For spore size measurements, 20 spores from each collection were randomly selected.

Abbreviations: E = length/width ratio of the spores, Q = mean value of E for all spores studied.

RESULTS

Gymnopilus igniculus Deneyer, P.-A. Moreau et Wuilbaut

Doc. Mycol., vol. 32, no. 125: 11, 2002 (the species was at first published without Latin description and type designation in Bon and Roux 2002: p. 4, p. 15-16)

Illustrations: Bon and Roux (2002: pl. 1-B), Wuilbaut (2002: p. 31).

Description of the fruitbodies from the Czech Republic (see collections studied):

Basidiocarps single or in small groups, never cespitose, growing on decaying wood of *Fraxinus*.

Pileus (7-)15-40 mm broad, broadly conical to convex, involute at margin when young, then convex with applanate centre and inflexed margin, almost applanate with slightly inflexed margin at the end, entirely distinctly tomentose when young, then except for centre \pm adpressed radially fibrillose, almost pyramidal fibrillose-squamulose at centre and radially adpressed fibrillose towards margin when old, vesture purplish or vinaceous brown (9-11E6-7, 10F7), with paler margin (9E7) when young, then vinaceous only at centre and paler, purplish ochraceous brown (8-9D7-8) towards margin, when old reddish brown (9D-E7) at centre and paler (8-9D6) towards margin, ground yellowish to pale dirty yellow; margin sometimes decorated with almost membranaceous velar remnants.

Lamellae rather distant, L = 18-24, l = 2-3, broadly adnate or emarginate and shortly decurrent with tooth, \pm horizontal, light yellow (3A4) to orange-yellow (4-5A5), with concolorous, irregularly serrulate, finely pubescent edge.

Stipe 20-80 \times 2-6 mm, cylindrical, sometimes slightly clavate (up to 7 mm) or attenuated towards base, often curved, distinctly longitudinally purplish brown (10D5-6, 10-11E6-7) fibrillose or fibrillose-squamulose on dirty white or slightly violaceous ground, whitish or with violaceous tinge, less distinctly fibrillose (paler than other parts of stipe) and sometimes striate (decurrent lamellar tooth) at apex; with dirty whitish basal mycelium.

Velum membranaceous, dirty whitish or pale dirty brownish, at margin yellowish when young, its remnants sometimes distinct at pileus margin and near stipe apex (when young) and only as indistinct fibrils on stipe surface (when old).

Context hollow in stipe, whitish to yellowish, in stipe apex and above lamellae more distinctly yellow, pale violaceous under pileipellis, slightly violaceous (reddish) in stipe middle; with fungoid or indistinct smell and bitterish taste.

Spores $8.0-9.5(-11) \times 6.0-6.8(-7.2) \mu\text{m}$, $E = 1.25-1.50$, $Q = 1.39$, broadly ellipsoid, with small but distinct suprahilar depression visible in side view, rusty yellow in KOH with darker, rusty brown wall which is slightly thick-walled, surface densely covered with low but small to large (up to $1.5 \mu\text{m}$ broad) and irregular verrucose to rugulose-verrucose ornamentation, hilar appendix tiny, spore interior distinctly dextrinoid (staining vinaceous reddish brown) in Melzer's reagent with the wall remaining rusty yellow.

Basidia $24-28 \times 8-9 \mu\text{m}$, mostly 4-spored, rarely 2- or 1-spored, clavate to subutriform, sometimes with a slight medial constriction, clamped. Basidioles $10-30 \times 3-9 \mu\text{m}$, cylindrical when young, then distinctly clavate, some of them filled with a homogeneous yellow-rusty pigment (in 5% KOH), clamped.

Cheilocystidia $24-35 \times 6-10 \mu\text{m}$, arranged in "nests" on edge or mixed with basidioles, narrowly clavate to fusiform-lageniform when young, then typically lageniform to subutriform with $3-4 \mu\text{m}$ broad neck and more or less distinct globose head $5-8 \mu\text{m}$ in diameter, thin-walled, hyaline, clamped. Pleurocystidia not observed.

Lamellar trama regular to subregular, consisting of parallel hyphae $3-20 \mu\text{m}$ broad, narrower hyphae located near the subhymenium, cells cylindrical, slightly fusiform to narrowly ellipsoid, with hyaline interior and yellowish wall, non-dextrinoid, clamped, subhymenium of densely arranged hyphae.

Pileus cuticle a cutis, $60-70 \mu\text{m}$ thick, 2-layered, upper layer thin, dark reddish to violet brown in KOH, of densely and radially arranged (parallel in a section) hyphae $4-20 \mu\text{m}$ broad, cells cylindrical to narrowly fusiform or narrowly ellipsoid, with distinct violet to reddish brown incrustations arranged in a zebra to tiger pattern, terminal cells indistinct, subfusoid to narrowly clavate, lower layer thick, less coloured, yellow in KOH, of loosely arranged parallel to slightly interwoven hyphae with less distinct incrustations, this layer gradually passing into the pileus context made up of cylindrical, narrowly fusiform to narrowly ellipsoid hyphae up to $25 \mu\text{m}$ broad, hyaline or pale brownish in KOH. When a pileus scalp is observed, the pileus surface is covered with fascicles or a sparse net of cells forming the upper layer of the pileus cuticle.

Stipe cuticle a cutis of densely arranged, parallel, cylindrical hyphae $3-8 \mu\text{m}$ broad, yellow-brown with violet tinge, cells with yellow-brown to rusty brown incrustations, slightly thick-walled, clamped, terminal cells indistinct, cylindrical;



Fig. 1. *Gymnopilus igniculus*, Czech Republic, Ostrava-Radvanice, burning coal mine dump, on decaying wood of *Fraxinus*, 1 May 1999, found and photographed by M. Graca (PRM 900986). Young and mature fruitbodies.



Fig. 2. *Gymnopilus igniculus*, for explanations see Fig. 1. Mature fruitbodies.



Fig. 3. Collecting site of *Gymnopilus igniculus*: flat part of the burning coal mine dump in Ostrava-Radvanice, Czech Republic. The fungus grew on decayed wood of *Fraxinus* among the moss *Aulacomnium palustre* (left bottom part of the photograph). Photo M. Graca, August 2003.

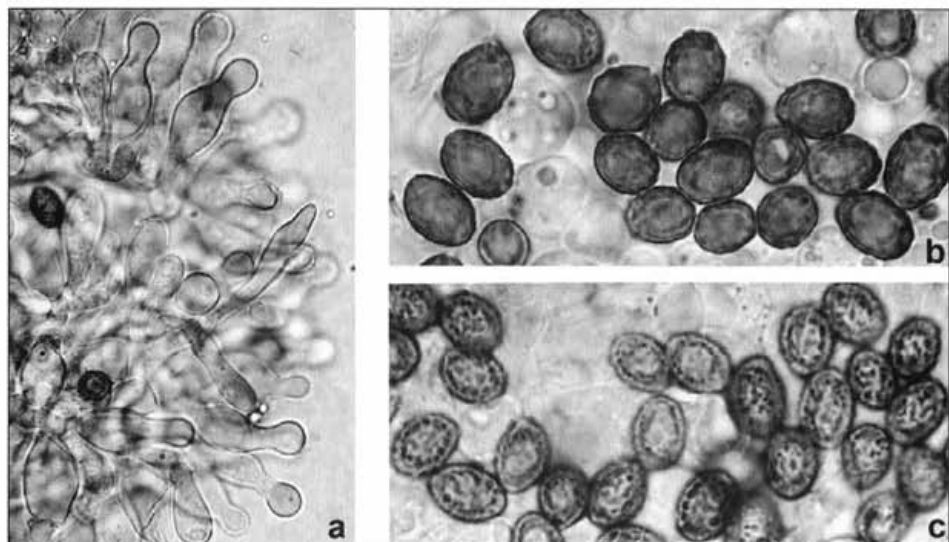


Fig. 4. *Gymnopilus igniculus* (PRM 900986). a: cheilocystidia, b: spores – outline, c: spores – ornamentation. Photo J. Holec.

caulocystidia not observed, but a sparse net of interwoven, yellow-brown incrusting veil hyphae 2–8 μm broad covering the cuticle.

Stipe context made up of cylindrical to subellipsoid, slightly thick-walled, yellowish hyphae up to 15 μm broad, mixed with 5–10 μm broad branched hyphae with yellow content in KOH. Clamp connections present in all tissues.

Fragments of lamellae exuding a bright yellow pigment when mounted in 5 % KOH.

Collecting site

Localisation: Czech Republic, northeastern part: Silesia region, city of Ostrava, 5.4 km E of the Central Bus Station, 0.5 km SE of dead-end street called "Slunná" in Ostrava-Michálkovice, coal mine dump situated S of Ostrava-Michálkovice, NE of Ostrava-Radvanice and W of Petřvald, 270 m a.s.l. The dump belonged to the former coal mine "Hedvika" in Petřvald (concern "Julius Fučík").

Habitat: coal mine dump formed by rocks typical of the Carboniferous of the Czech part of the "Hornoslezská pánev" basin. The dump is composed of silty shales, claystones, siltstones and fossil soil with *Stigmaria*; to a lesser extent of fine-grained sandstones. At present, most parts of the dump are reclaimed and planted mainly with *Betula* stands (30–40 years), further mixed stands (*Betula*, *Tilia*, *Populus*, *Quercus*, *Fagus*) and somewhere also with stands of *Pinus nigra* or *Quercus robur*. In some places, heat and gasses escape from lower parts of the dump containing coal with a relatively high content of sulphur. The soil of the collecting site is rather warm. During collecting days, its surface reached a temperature of about 45 °C. Although the site is insolated, it is moist due to the escaping humid heat and gasses. Both collections are from the same site (about 10 m²) in the flat part of the burning mine heap.

Vegetation: The surface is overgrown by the moss *Aulacomnium palustre* (det. V. Plášek; a moss species mostly growing in moist meadows and spring areas), the grass *Setaria pumila* and a tree stand of *Fraxinus excelsior*. The herb *Solidago canadensis* and trees like *Betula pendula* and a young individual of *Quercus robur* occur at the margins of the collecting site. Concerning other species of fungi, *Leucoagaricus meleagris* and *Polyporus ciliatus* were observed.

Collections studied

Czech Republic, northeastern part: Silesia region, Ostrava-Radvanice, burning coal mine dump, on decaying wood of *Fraxinus*, 24 April 1999, leg. M. Graca (BRNM 686264); *ibid.*, 1 May 1999 (PRM 900986). – Belgium, Cuesmes, "Terril du Levant", among *Campylopus retroflexus* on hot mineral ground (charcoal), 9 Dec. 2001, leg. Y. Deneyer, P.-A. Moreau, J. Nuytinck and J. J. Wuilbaut (herb.

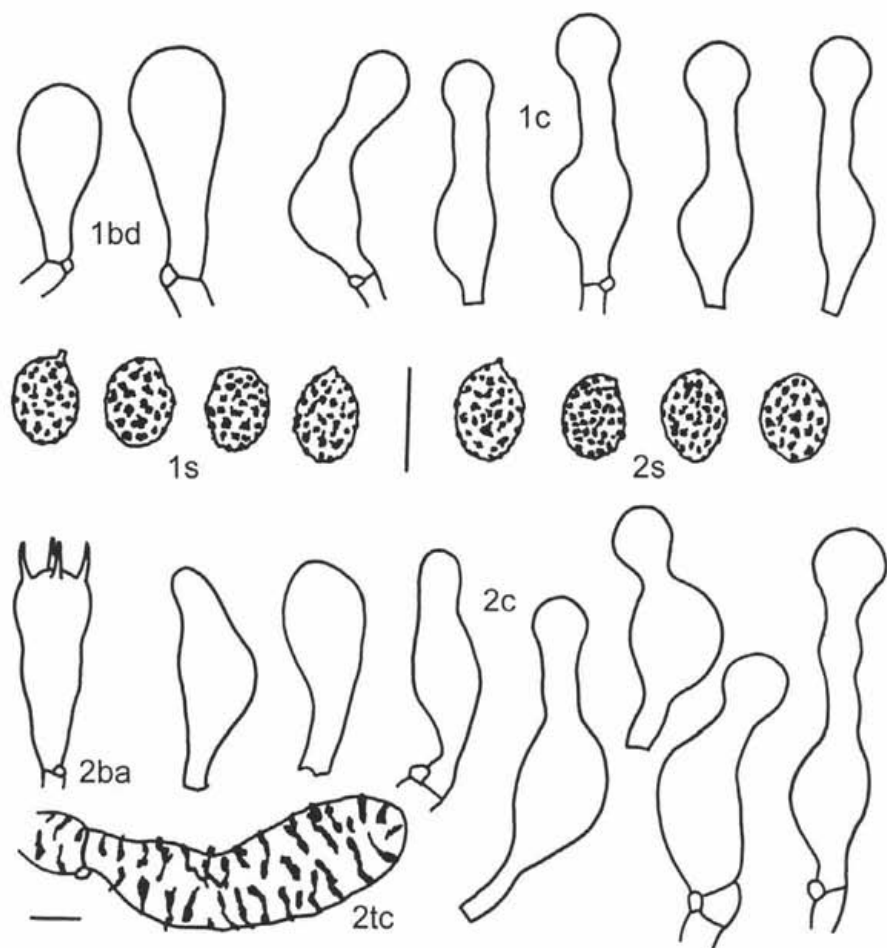


Fig. 5. *Gymnopilus igniculus*, Czech Republic, Ostrava-Radvanice, microcharacters. 1: collection from 24 April 1999 (BRNM 686264), 2: collection from 1 May 1999 (PRM 900986); ba: basidia, bd: basidioles, c: cheilocystidia, s: spores, tc: terminal cells of hyphae from upper layer of pileus cuticle. Scale bars = 10 μ m. Del. J. Holec.

PAM 01120901: fruitbodies not formally designated as isotype, but originating from the 30 original fruitbodies from which the holotype deposited in BR was selected; all these specimens were collected on the same surface having about 20 m²).

DISCUSSION

Gymnopilus igniculus and its variability

The fruitbodies found at Ostrava-Radvanice in the Czech Republic in agree in most essential characters with those of *Gymnopilus igniculus* described from Belgium (some differences are discussed below). This also concerns the habitat. In both countries the species grows in a unique artificial habitat – burning coal dumps, the surface of which is warm even in winter and spring (Belgium: 40 °C on surface, see Bon and Roux 2002: 16, Czech Republic: 45 °C). The conspecificity was also confirmed by a study of microcharacters of the original material of *G. igniculus* from Belgium (see Collections studied).

The most important characters of finds of *G. igniculus* from the Czech Republic are the purplish to vinaceous or reddish brown colour of the pileus covering (which is tomentose-fibrillose when young and fibrillose-squamulose to distinctly scaly at maturity, especially at centre), the yellow pileus ground, the absence of any ring, the whitish veil, the stipe distinctly longitudinally purplish brown fibrillose on a dirty white or slightly violaceous ground, the context yellowish with reddish-violaceous tinge and fungoid smell, relatively large spores (8.0–9.5(-11) × 6.0–6.8(-7.2) μm) with rough verrucose to verrucose-rugulose ornamentation, the variable shape of its cheilocystidia and the absence of pleurocystidia.

However, there are also differences in macrocharacters between the fruitbodies from Belgium and the Czech Republic. According to P.-A. Moreau, who saw the Belgian population in the field, the fruitbodies from Belgium are slender and possess small purplish scales on a yellow ground, and are not completely purple-fibrillose like the fruitbodies from Ostrava. All the collections Y. Deneyer made in the two localities mentioned in the original description of *G. igniculus* (at least 10 times) were similar. At first view, the fruitbodies from the two countries are different. However, when the descriptions are compared, the differences with the original *G. igniculus* are only quantitative: the Belgian fruitbodies have a pileus cuticle thin and soon differentiated into scales, with very few fibrils; those from the Czech Republic have a thicker pileus cuticle which dissociates into scales less or only with age. When the young fruitbodies are compared, they are almost identical. Possibly, Deneyer et al. (2002) described in fact local populations with smaller and slender fruitbodies with an underdeveloped pileus cuticle, whilst the material from the Czech Republic represents robust and more coloured fruitbodies. In addition, such more robust fruitbodies were also found in France (burning dump Pinchonvalles, Avion, Pas-de-Calais) by J. Vast and R. Courtecuisse (see note by R. Courtecuisse at the end of the paper by Deneyer et al. 2002: p. 16). In this case, the pileus surface was also fibrillose but later divided (broken) into appressed scales (we saw a photograph kindly provided by R. Courtecuisse). Maybe this aspect was caused by insolation, as the fruitbodies were collected in June.

The fruitbodies from the Czech Republic and France also differ from the Belgian ones by their smell and taste. The smell of the first ones was not very distinctive while a prominent farinaceous-herbaceous smell and taste was noted in the Belgian material. External conditions (temperature or drought?) may be responsible for this discrepancy, similarly as in the previous case.

A trophic difference can also be pointed out between the original localities and French and Czech sites: all collections from Belgium, small and slender, grow between mosses (*Campylopus*), the mycelium growing from a layer of moss litter. The robust fruitbodies collected by Courtecuisse and Graca are associated with wood remnants, perhaps a more favourable substrate for their development.

This analysis can be concluded from the result that *G. igniculus* obviously has a greater variability of macrocharacters than was observed in the original collecting sites in Belgium. The conspecificity of Belgian and Czech finds is confirmed mainly by agreement in habitat, microcharacters and appearance of young fruitbodies. The more robust forms from the Czech Republic and France having a fibrillose pileus covering which later separates into scales may be somewhat different due to fructification in spring (the Belgian fruitbodies were collected from October to February). In this period the insolation is higher and air humidity lower which may cause a different development of the pileus cuticle.

Remarks on other European finds of *Gymnopilus* with violet colours

All purplish or violet coloured finds of *Gymnopilus* hitherto known from Europe (see Introduction) differ from *Gymnopilus igniculus* in smaller spores mostly measuring $6-8.5 \times 4-6 \mu\text{m}$ ("average" spores without the extremely large ones which are often present in *Gymnopilus*) and in more distinct, mostly erect scales covering the whole pileus surface. Moreover, *Gymnopilus purpuratus* s. Kreisel and Lindequist (1988) differs in the presence of abundant pleurocystidia and in blue to blue-greenish colour changes on the stipe surface and in the context.

No traces of greenish, bluish-greenish or grey-blue were observed on fruitbodies of *Gymnopilus igniculus* from both Belgium and the Czech Republic. Such colour changes are known in *Gymnopilus purpuratus* s. Kreisel and Lindequist (1988), and Ludwig (2000, 2001) from Germany, especially in context and lower part of stipe. Kreisel and Lindequist (1988) and Gartz (1989) proved that this coloration is caused by the alkaloids psilocybin, psilocin and baeocystin. As green or blue colours are neither described nor depicted by Cooke (1883, 1881-1891: pl. 964) in *Gymnopilus purpuratus*, it is rather problematic whether the German finds are conspecific with the original *G. purpuratus* of Cooke and Masee. We tried to loan the type of *G. purpuratus* from Kew for comparison, but, unfortunately, it has been sent on loan abroad. However, in our opinion, the name *G. purpuratus* seems to be inapplicable to the German material for the reasons mentioned above.

Bon and Roux (2002: 4, 14) consider *Gymnopilus purpuratus* an invalid name. This is not true as the basionym (*Agaricus purpuratus* Cooke et Masee 1890) fulfil all conditions for valid publication and its combination into *Gymnopilus* made by Singer (1951: 561) is valid as well. They use the name *Gymnopilus peliolepis* (Speg.) Singer for *G. purpuratus* s. Ludwig, i.e. for the German finds discussed above. This is also debatable as no greenish or bluish-greenish tinges are mentioned by Spegazzini or Hesler (1969) in *G. peliolepis*. However, we cannot solve this problem at the moment. A thorough study based on fresh collections of violet coloured *Gymnopilus* species (both from the tropics and Europe) as well as type studies of *G. purpuratus* and *G. peliolepis* would be desirable to judge the identity of these species.

Gymnopilus purpuratus s. Breitenbach and Kränzlin (2000) found on peat in the tropical greenhouse of the Botanical Garden in Zürich is obviously not identical with *G. purpuratus* s. Kreisel and Lindequist (1988) and Ludwig (2000, 2001) as it has no pleurocystidia and no traces of bluish or blue-greenish colours. However, its conspecificity with the original *G. purpuratus* by Cooke and Masee is also debatable. The habitat is similar in both cases (tropical greenhouses), but the original *G. purpuratus* has a completely purple or purple-brown pileus covered with minute floccose scales of the same colour, whereas the find from Zürich is characterised by a yellow pileus background covered with wine-red to red-violet scales. This is such a distinct difference (compare e.g. plate 964 by Cooke 1881–1891 with photo no. 148 by Breitenbach and Kränzlin 2000) that the two finds can hardly be conspecific. A type study of *G. purpuratus* could help to prove this opinion more exactly, but, as shown above, the type was not accessible during our study. Bon and Roux (2002) are of the opinion that the find from Zürich is conspecific with the American species *Gymnopilus luteifolius* (Peck) Singer (a name also known under the grammatically incorrect form *G. luteofolius*). However, the original *G. luteifolius* also has some characters different from *G. purpuratus* s. Breitenbach and Kränzlin (2000): presence of pleurocystidia, context at first reddish (*G. purpuratus* s. Breitenbach and Kränzlin: no pleurocystidia, context yellow). However, the discussion is rather problematic without knowledge of the variability of both taxa and without a type study. What seems to be clear is the identity of *G. purpuratus* s. Breitenbach and Kränzlin (2000) and the find from Sicily named *G. luteifolius* by Bon and Roux (2002: p. 3, 15–16, plate 1-A). The finds are identical in most microcharacters and in the appearance of the fruitbodies. According to Roberts in Henrici (2002: 30), these collections might belong to *G. dilepis* (Berk. et Broome) Singer. Roberts studied types of both *G. dilepis* and *G. purpuratus* housed in Kew and found that the species are undoubtedly not identical. The recent British material identified as *G. dilepis* (Watling 1998, Henrici 2002) really agrees with the type of *G. dilepis* (Roberts in Henrici 2002: 30).

The discussion on violet-coloured species of *Gymnopilus* in Europe clearly shows how poor our knowledge of this group in Europe is and how difficult it is to identify the finds. The reasons are the rarity of such finds, evident tropical or subtropical origin of collections from indoor or greenhouses and the difficulty to judge the variability of European records with respect to species described from other continents. A thorough world-wide study based on good knowledge of the variability of fresh material and on type studies would be desirable to clear up the taxonomy of this group.

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