

# New and rare Bulgarian boletes

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**Abstract.** The paper provides information about the first findings in Bulgaria of four rare and noteworthy taxa of *Boletus*. A new combination, *B. persicolor*, is proposed for the accommodation of *Xerocomus persicolor* into *Boletus*. *Boletus depilatus*, *B. luteocupreus*, *B. permagnificus*, and *B. persicolor* are described and illustrated. In addition a second locality in Bulgaria is reported for *B. dupainii*, which is one of the candidates for inclusion of the Appendix I of the Bern Convention. The potential conservation status of the five species is briefly discussed.

**Key words:** Basidiomycetes, Boletales, Bulgaria, fungal diversity, rare fungi

## Introduction

Boletales in Bulgaria are still poorly known, though a preliminary checklist of the order has recently been published (Assyov & Denchev 2004). During the studies in 2004 four rare and insufficiently known species of *Boletus* were identified and recorded for the first time in the country, i.e. *B. depilatus* Redeuilh, *B. luteocupreus* Bertèa & Estadès, *B. permagnificus* Pöder, and *B. persicolor* (Engel, Klofac, H. Grünert & R. Grünert) Assyov. *Boletus luteocupreus* and *B. permagnificus* are new records for the mycota of the Balkan Peninsula, as well.

## Materials and Methods

Air dried specimens are preserved in the Mycological Collection of the Institute of Botany, Bulgarian Academy of Sciences (SOMF); their accession numbers are given in parentheses after each record. The specimens were collected by the author, unless otherwise stated. Each sample is documented with color photograph and concise description. In the descriptions of the findings, the color nomenclature of Kornerup & Wanscher (1978) is used as far as possible. Microscopic features were observed and measured in water; 50 basidiospores, 30 basidia and pileipellis hyphae, and 15 cystidia were measured of each mature specimen. Measurement values are presented below in the following manner: (min–)

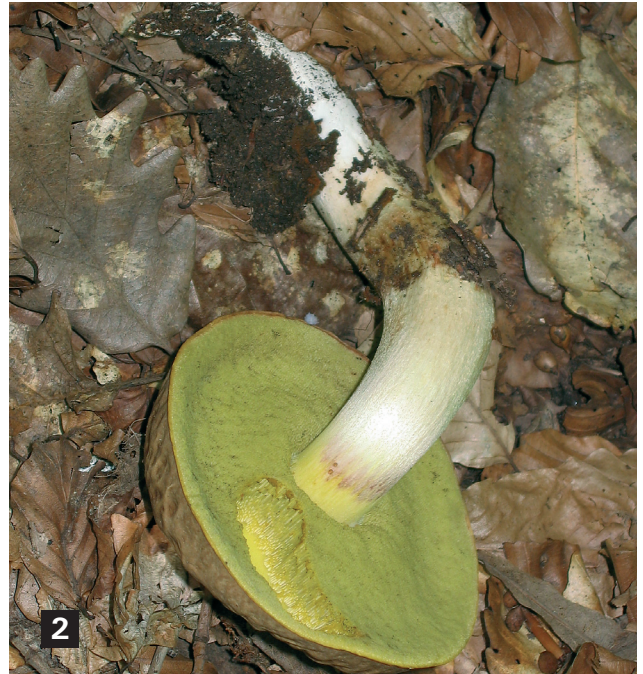
mean (–max). Spore volume ( $V_m$ ) is calculated according to the formula  $V_m = 4/3\pi \cdot (1/2Sw)^2 \cdot 1/2Sl$ ;  $Sl$  – spore length,  $Sw$  – spore width, and the result is estimated to an integer number (Breitenbach & Kränzlin 1991). Iodine reaction was performed by Melzer's solution (Kirk *et al.* 2001) on dried samples. Species were identified using the works of Engel *et al.* (1983, 1996), Alessio (1985, 1991), Galli (1998), Lannoy & Estadès (2001), Ladurner & Simonini (2003), and Estadès & Lannoy (2004). Names of the host trees are given after Tutin *et al.* (1993). The evaluation of the threat status of the species is according to the Red List criteria of IUCN (2001).

## Survey of taxa

*Boletus depilatus* Redeuilh, Bull. Soc. Mycol. France 101: 389, 1985. (Figs 1–3, 11)

**Pileus** up to 8 cm diam, convex to flat-convex, wrinkled, light brown, brick red 7D(6–8), 7E(7–8), fading in places to orange white (5–6)A(2–3); cap margin slightly appendiculate. **Stipe** up to 12 × 2 cm, tapering or spindle-shaped, curved and deeply buried in the substrate, fibrillose, white to dingy white, at the base and at the apex pale yellow 1A(3–5), below the tubes with reddish band. **Flesh** white, in the stem base and above the tubes yellowish white or pale yellow (1–2)A(2–3), unchanging after exposure to the air, or slowly reddening above the tubes. **Tubes** up to 1.5 cm





Figs 1-6. Fruit bodies of: 1 – *Boletus depilatus* (SOMF 25 422), photo L. Georgiev; 2-3 – *B. depilatus* (SOMF 25 423); 4 – *B. dupainii* (SOMF 25 436), photo L. Georgiev; 5-6 – *B. luteocupreus* (SOMF 25 424)





Figs 7-10. Fruit bodies of: 7-8 – *Boletus permagnificus* (SOMF 25 428 – 25 433); 9 – *B. persicolor* (SOMF 25 434); 10 – *B. persicolor* (SOMF 25 437)



long, adnate or notched, pale yellow, pastel yellow to greyish yellow 1A(3-4), 1C(5-7), unchanging. **Pores** concolorous, unchanging when bruised. **Smell** not distinctive. **Taste** mild. **Basidiospores** (12–) 12.4–12.5 (–14) × (4.5–) 5.3 (–5.4)  $\mu\text{m}$ , ratio (2.2–) 2.3–2.4 (–2.7), spore volume (115–) 184–188 (–212)  $\mu\text{m}^3$ , with 1–2 large oil drops. **Basidia** 4-spored, (25–) 29.0 (–33.5) × (8.5–) 10.5 (–13)  $\mu\text{m}$ . **Cystidia** (35.5–) 43.8 (–56) × (7.5–) 8.9 (–11)  $\mu\text{m}$ . **Suprapellis** hymeniform, composed of hyphae of spherocysts and cylindrocysts, terminal cells (16.5–) 25.9–28.4 (–44) × (8.5–) 10.1–19.7 (–30)  $\mu\text{m}$ , ratio (1–) 1.4–2.5 (–4.5). **Macrochemical reactions**:  $\text{NH}_4\text{OH}$  10% with the pileipellis and the flesh of the pileus pinkish. **Microchemical reactions**: no reaction observed with Melzer's reagent.

Habitat – thermophilous broadleaved woods, under *Carpinus* spp. and *Ostrya carpinifolia* Scop., considered to be more frequent on warm calcareous soils.

Western Stara Planina Mts: Sofia distr., nearly the waterfall of Skaklja above the village of Bov, under *Caprinus orientalis* Miller, 1 Aug 2004, leg. H. Pedashenko & R. Vassilev, det. B. Assyov (25 422).

Belasitsa Mt: Petrich distr., in the vicinity of the chalet of Belasitsa, ca 750 m, under *Ostrya carpinifolia*, 14 Aug 2004 (25 423).

Distribution: Austria, Belgium, Bulgaria, Corsica, Croatia, former Czechoslovakia, France, Italy, Spain, Switzerland (Breitenbach & Kränzlin 1991; Courtecuisse & Duhem 1995; Galli 1998; Muñoz Sánchez & Cadiñanos 2001; Ladurner & Simonini 2003; Tkalčec & Mešić 2003).

*Boletus depilatus* is however similar to *B. impolitus* and even if the “hammered-like” pileal surface and the relatively long curved stipe are considered to be important characters of *B. depilatus*, examination of the microscopic features (especially of the structure of the pileipellis) is always required for the proper determination. It might be supposed that *B. depilatus* has been previously overlooked and attention should be paid in future to clarify the distribution of both species in Bulgaria. The revision of the samples of *B. impolitus* did not reveal older misidentified collections of *B. depilatus* from Bulgaria. Thus, two sites are currently known of this species in the country and threat category “endangered” (EN B1ab(iii)) should apply to it.

*Boletus dupainii* Boud. (Figs 4, 12)

**Pileus** up to 9 cm, hemispherical, later flat-convex to convex, shiny, somewhat slightly viscid, vivid red, madder red, crayfish red, coral red 9(A-B)(7-8), discoloring orange red 8(A-B)(7-8), reddish orange 7A(7-8) or pale or pastel red 7A(3-4) to greyish red or grayish orange (3-4)B3, bluing strongly when bruised. **Stipe** up to 9 × 3.5 cm, cylindrical club-shaped, club-shaped to swollen, yellowish white (1-2)A2, more bright yellow nearly the apex, covered throughout with fine light orange, orange 6A(5-6), pastel red, reddish orange 7A(5-6) or pastel red 10A(4-5) granulations; surface bluing when bruised or handled. **Flesh** lemon yellow, strongly bluing when exposed to the air. **Tubes** lemon yellow, bluing when injured. **Pores** bright red, orange to yellow nearly the

cap margin, blue-black when bruised. **Smell** not distinctive. **Taste** mild. **Basidiospores** (11–) 11.6 (–12) × (4.5–) 5.1 (–5.5)  $\mu\text{m}$ , ratio (2–) 2.2 (–2.7), spore volume (105–) 162 (–180)  $\mu\text{m}^3$ . **Basidia** 4-spored, (21.5–) 25.4 (–32) × (7.5–) 9.4 (–12)  $\mu\text{m}$ . **Cystidia** (27–) 30.8 (–34.5) × (6.5–) 8.4 (–11)  $\mu\text{m}$ . **Suprapellis** a trichoderm of interwoven branched septate hyphae. **Microchemical reactions**: no reaction observed with Melzer's reagent.

Habitat – thermophilous broadleaved oak forests.

Eastern Stara Planina Mts: Varna distr., Emine cape, between Emona village and l.d. Irakli, under *Quercus* sp., ca 80 m, 21 Aug 2004, leg. R. Vassilev, det. B. Assyov (25 436).

Distribution: Austria, Bulgaria, Croatia, Germany, France, Greece, Hungary, Italy, Russia, Serbia and Montenegro, Slovakia, Slovenia, Spain, Switzerland, Turkey (Breitenbach & Kränzlin 1991; Courtecuisse & Duhem 1995; Galli 1998; Boeva 2002; Zervakis *et al.* 2002; Dahlberg & Kroneborg 2003; Tkalčec & Mešić 2003; Sesli & Denchev 2005).

This is the second finding of this south-occurring species in Bulgaria. For the first time it was reported by Boeva (2002), but no additional data were provided for this finding. This species should be considered as “endangered” in Bulgaria (EN B1ab(iii)).

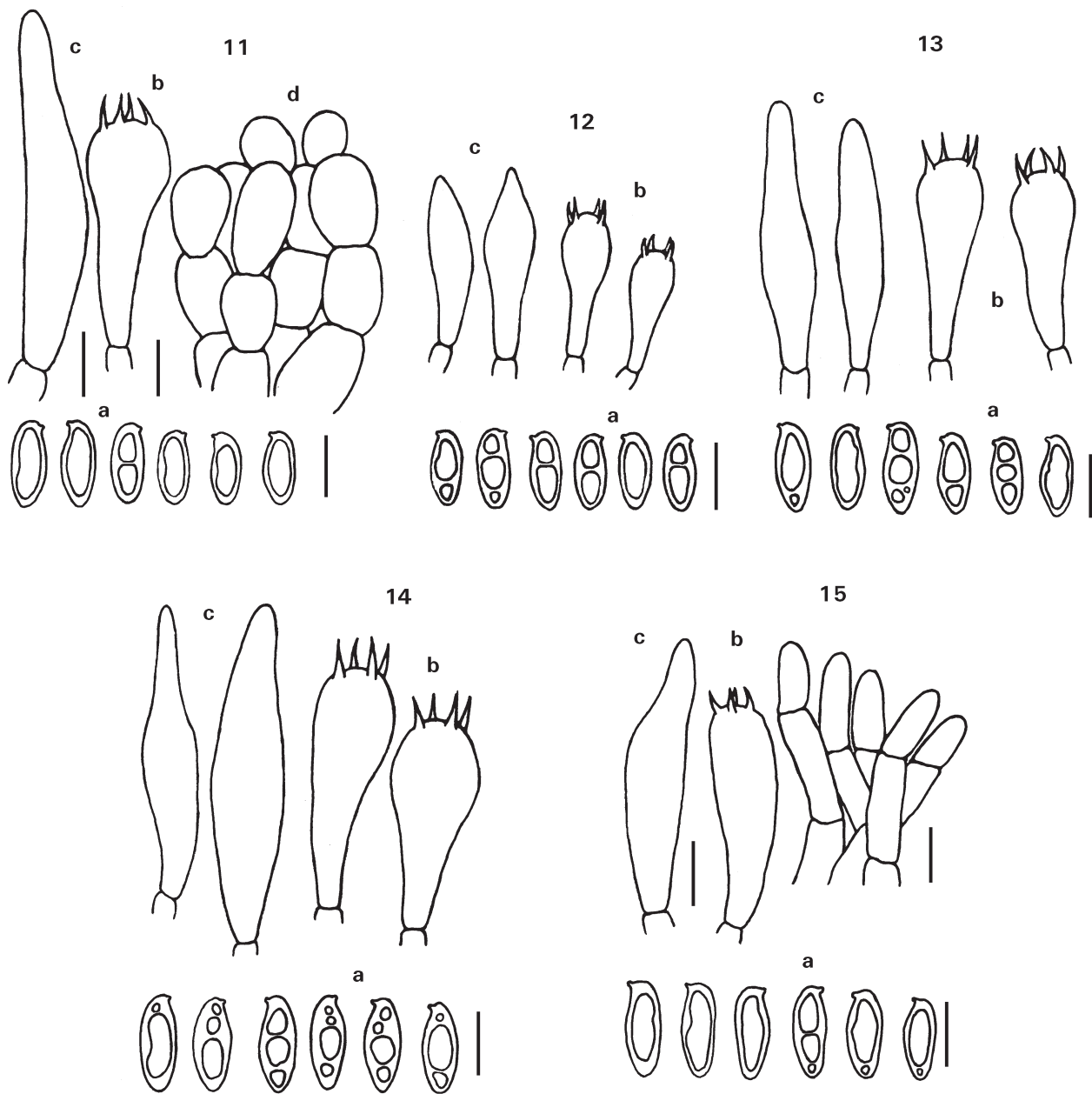
*Boletus luteocupreus* Bertèa & Estadés, Docum. Mycol. 78: 10, 1990. (Figs 5, 6, 13)

**Pileus** up to 12 cm diam, at first hemispherical, later convex, pastel yellow, light yellow 3A(4-5), pale yellow 4A3 to orange white or pale orange 6A(2-3), spotted light orange, orange, Persian orange, deep orange or reddish orange 6A(5-8), 7A(6-8), velvety then ± smooth, strongly bluing when bruised, cap margin slightly appendiculate. **Stipe** up to 9 × 5 cm, swollen or obese, pastel yellow, light yellow to vivid yellow 3A(4-8), covered with dense very fine orange red, madder red or scarlet red (8-9)A-B(7-8) reticulum. **Stipe** surface bluing strongly at the slightest touch. **Flesh** firm and very dense, lemon yellow, sometimes red in the stipe base, bluing instantly when exposed to the air then fading in half an hour and then changing to dingy orange red. **Tubes** up to 1 cm long, yellow, bluing when injured. **Pores** bright red, occasionally orange red nearly the cap margin, blue-black when bruised. **Smell** not distinctive. **Taste** rather acid. **Basidiospores** (12–) 12.3–14.3 (–18.5) × 5.5  $\mu\text{m}$ , ratio (2.2–) 2.3–2.6 (–3.5), spore volume (180–) 188–219 (–278)  $\mu\text{m}^3$ , with 1–3 large oil drops. **Basidia** 4-spored, (22.5–) 30.4 (–40) × (7.5–) 9.3–9.7 (–12)  $\mu\text{m}$ . **Cystidia** (35.5–) 41.7 (–48.5) × (7.5–) 8.3 (–11)  $\mu\text{m}$ . **Suprapellis** a trichoderm of septate hyphae. **Macrochemical reactions**:  $\text{FeSO}_4$  with the flesh of the pileus slowly (5–10 min) greyish violet. **Microchemical reactions**: no reaction observed with Melzer's reagent.

Habitat – thermophilous broadleaved woods, under *Castanea*.

Belasitsa Mt: Petrich distr., above Belasitsa village, under *Castanea sativa* Miller, 14 Aug 2004 (25 424); in the vicinity of the chalet of Belasitsa, ca 720 m, under *C. sativa*, 14 Aug 2004 (25 425, 25 426); idem, 15 Aug 2004 (25 427).





Figs 11-15. Microscopic features (a – basidiospores, b – basidia, c – cystidia, d – suprapellis hyphae) of: 11 – *Boletus depilatus* (SOMF 25 423); 12 – *B. dupainii* (SOMF 25 436); 13 – *B. luteocupreus* (SOMF 25 427); 14 – *B. permagnificus* (SOMF 25 428); 15 – *B. persicolor* (SOMF 25 437). Scale bars = 10  $\mu$ m

Distribution: Bulgaria, Corsica, France, Germany, Italy, Spain, probably Switzerland (Breitenbach & Kränzlin 1991, as *B. torosus* Fr.; Courtecuisse & Duhem 1995; Schreiner 1997; Galli 1998).

*Boletus luteocupreus* is a well distinguished species within the section *Luridi*. It resembles *B. rhodopurpureus* Smotl. but it is easily separated by the yellow and orange colors, which preveil. It is sometimes confused by *B. torosus* Fr. and probably might be also with *B. xanthocyaneus* Romain ex Romagnesi, but these are well separated by the persistent yellow color of

the pores, while in *B. luteocupreus* pores are uniformly vivid red even in young basidiocarps.

*Boletus luteocupreus* is a south-occurring species found mainly in the Mediterranean area and its occurrence in Bulgaria is an interesting fact. It seems fairly possible that the species might occur elsewhere in the Balkans, and especially in the neighbouring regions of Macedonia and Greece. In Bulgaria *B. luteocupreus* appears to be extremely rare and it will be proposed for inclusion in the Red List of Bulgarian fungi (in prep.) under the category “critically endangered” (CR B1ab(iii)).



*Boletus permagnificus* Pöder, Sydowia 34: 151, 1981. (Figs 7, 8, 14)

**Pileus** up to 8 cm diam, convex to flat-convex, felted or smooth, vivid red, lake red, madder red to coral red 9A-B7, 9A-C8, bluing strongly when bruised, cap margin irregularly undulate. **Stipe** up to 6 × 3 cm, cylindrical, swollen or tapering, ± rooting, light yellow or yellow (2-3)A(5-6), downwards redish white to pale red 7A(2-3), cardinal red or violet brown 10D-E8 at the same base, with well developed red 9A-B(7-8) reticulum, stipe surface quickly and strongly bluing at the slightest touch. **Flesh** yellowish, bluing strongly when exposed to the air, then fading to dingy, finally (a few hours after cutting) reddening. **Tubes** up to 1 cm long, adnate or decurrent, yellow, bluing when injured. **Pores** orange red or orange yellow, paler at the cap margin, bluing when bruised. **Smell** not distinctive. **Taste** acid. **Basidiospores** (13–) 14.3-14.8 (–16) × (5.5–) 5.6-5.7 (–6.5) μm, ratio (2.2–) 2.6 (–3.0), spore volume (196–) 237-250 (–353) μm<sup>3</sup>, with 1-3 large oil drops. **Basidia** 4-spored, (30–) 35.6-36.9 (–45) × (8.5–) 11.2-12.6 (–15) μm. **Cystidia** scarce, (51.5–) 60.4 (–81) × (7.5–) 10.2 (–13) μm. **Suprapellis** a trichoderm of interwoven branched septate hyphae of loosely connected cells. **Microchemical reactions:** Melzer's solution with the hyphae of the pileus and the pileipellis reddish brown (dextrinoid).

Habitat – tufted in thermophilous oak woods.

Northern Black Sea coast: Varna distr., ca 2 km northern of Shkorpilovtsi village, ca 40 m, thermophilous oak woods under *Quercus cerris* L., 25 Aug 2004 (25 428-25 433).

Distribution: Bulgaria, Corsica, Italy, Sardinia, Spain, and probably Russia (Pöder 1981; Engel *et al.* 1983; Alessio 1985, as *B. siculus* Inzenga; Courtecuisse & Duhem 1995; Galli 1998; Muñoz Sánchez & Cadiñanos 2001; Mariangela & Pietro 2004).

*Boletus permagnificus* seems to be one of the most rare European boletes. Until now it was known to present a restricted distribution mainly in the Mediterranean region. This new find appears to be the first one from the Balkan Peninsula. It is also the easternmost one and it is indicative of the probable occurrence of the species elsewhere in the Balkans. It is most probably extremely rare in Bulgaria and it will be proposed for inclusion in the Red List of Bulgarian fungi (in prep.) under category “critically endangered” (CR B1ab(iii)).

Lannoy & Estadès (2001) have pointed out that *B. permagnificus* shows positive amyloid reaction (“Iode ++”) which statement does not agree both with the original and with other descriptions of this species as well (Pöder 1981; Engel *et al.* 1983; Muñoz Sánchez & Cadiñanos 2001). This might be a result of using of a different procedure for testing the amyloidity of the fungal tissues (Baral 1987).

*Boletus permagnificus* is an easily recognizable species among the European boletes of section *Luridi* due to its macroscopic, microscopic, and microchemical features. From the similar *B. luridus* Schaeff. : Fr. it is easily separated by the different habitus and the different colors of the basidiocarps, by the

yellow (and not red or orange) flesh under the tubes, by the negative amyloid reaction, as well as by the structure of the pileipellis.

*Boletus persicolor* (Engel, Klofac, H. Grünert & R. Grünert) Assyov, **comb. nov.**

Bas.: *Xerocomus persicolor* Engel, Klofac, H. Grünert & R. Grünert in Engel, Dermek, Klofac, Ludwig & Brückner, Schmier- und Filzröhrlinge s.l. in Europa, p. 176, 1996. (Figs 9, 10, 15)

**Pileus** 5 cm diam, hemisphaerical, then convex, finally flat-convex, finely tomentose, orange white, pale orange 6A(2-3), pinkish white, pale red, pastel red, peach color, shell pink (7-8)A(2-3), (7-8)A4, blueing when bruised. **Stipe** up to 6.5 × 2.5 cm, tapering or spindle-shaped, somewhat radiating, sulphur yellow, primrose yellow, light yellow, pastel yellow 1A(5-7), (2-4)A(4-5), downwards light orange, orange, apricot, salmon 5A(5-7), 6A(4-6), pastel red to reddish orange or greyish red 7A-B(5-7); stipe surface blueing after handling. Reticulum absent or occasionally present in the uppermost (ca 5 mm) part of the stipe. **Flesh** yellowish in the cap, lemon yellow in the upper part of the stipe, downwards gradually bright yellow to orange yellow or apricot (persisting in dry specimens), bluing in the cap and in the stipe apex. **Tubes** very short, up to 0.5 cm long, adnate or subdecurrent, lemon yellow, bluing when injured; **pores** concolorous, bluing when bruised. **Smell** not distinctive. **Taste** mild. **Basidiospores** (11–) 11.9-13.6 (–15) × (4.5–) 4.8-5.2 (–5.5) μm, ratio (2–) 2.5-2.7 (–3.5), spore volume (105–) 143-197 (–229) μm<sup>3</sup>, with 1-2 large oil drops. **Basidia** generally 4-spored (2- and 3-spored basidia also occur), (24–) 32.3-35.4 (–41) × (8.5–) 10.4-11.4 (–13) μm. **Cystidia** (38–) 47.5 (–55) × (7.5–) 9.2 (–11) μm. Hymenophoral trama hyphae finely incrustated (Congo red). **Suprapellis** a trichoderm of septate incrustated hyphae, terminal cells (21.5–) 30.1-31.5 (–43) × (11–) 11.4-11.7 (–14) μm, ratio (2–) 2.6-2.7 (–4). **Microchemical reactions:** no reaction observed with Melzer's solution.

Habitat – thermophilous broadleaved forests usually on sandy soil.

Northern Black Sea coast: Varna distr., ca 1 km northern of Shkorpilovtsi village, thermophilous oak woods at the sea coast, ca 10 m, under *Quercus cerris*, 25 Aug 2004 (25 434).

Vitosha region: Plana Mt, in the vicinity of the village of Zheleznitsa at the road between the hot springs and the Krustatia Dub locality, under *Fagus sylvatica* L., ca 1000 m, 28 Aug 2002 (25 437).

Distribution: Bulgaria, Croatia, Greece, Italy, Spain (Engel *et al.* 1996; Galli 1998; Hahn 1999; Muñoz Sánchez & Cadiñanos 2001; Ladurner & Simonini 2003).

The separation of *Xerocomus* Quél. has always been critical and the morphological characters used for this delimitation are generally variable ones. According to Kirk *et al.* (2001) the species of *Xerocomus* are placed into *Boletus* Fr. and recently additional arguments appeared to support this (Watling & Hills 2004). Following this approach a new combination is proposed here. This transfer was already suggested as probably



needed by Estadès (in Lannoy & Estadès 2001) but this combination was not published formally until now.

*Boletus persicolor* is similar to *B. armeniacus* Qué. and attention should be paid to avoid confusion. Macroscopically *B. persicolor* is distinguished by the orange yellow or apricot flesh in the lower parts of the stipe (the color persists in dried specimens). Microscopically both species are very similar and the main difference between them are the congophilous plaques, that are abundant in the suprapellis hyphae of *B. armeniacus*, and absent or are exceptionally seen in *B. persicolor*.

*Boletus persicolor* is a rare species with a limited distribution; it is currently known to occur in the Mediterranean area of Europe. Thereby its occurrence in Bulgaria is very interesting since it widens its known distribution to the east. Currently, two sites are known in the country and the threat category “endangered” (EN B1ab(iii)) at regional level seems to be applicable.

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