

Short note

Pluteus fenzlii (Pluteaceae, Agaricales) Rediscovered in the Balkan Peninsula after over 150 Years Gap

Boris Assyov^{1*}, **Dimitar Dimitrov²**

¹Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences,
2 Gagarin Str., 1113 Sofia, BULGARIA

²Primary School "Sveti Kliment Ohridski",
2 Vasil Levski Str., 9940 Pet Mogili Village, BULGARIA

*Corresponding author: contact@boletales.com

Abstract. The authors present a Bulgarian collection of *Pluteus fenzlii*, a species described by Stephan Schulzer von Müggensburg over one and a half century ago on material from Serbia and never seen in the Balkan Peninsula ever since. Condensed description and illustrations of the Bulgarian specimen are provided.

Key words: biogeography, Bulgarian mycota, pink-spored agarics, Southeastern Europe.

Introduction

Pluteus fenzlii (Schulzer) Corriol & P.-A. Moreau is an uncommon member of the genus, rarely featured in mycological literature as evident from the accounts in Corriol & Moreau (2007), Malysheva et al. (2007) and Holec et al. (2018). A rare species in Europe, this fungus was evaluated as "vulnerable" for the IUCN Red List of Threatened Species (Brandrud, Krisai-Greilhuber & Kunca, 2019). It was described in 1866 as *Agaricus fenzlii* Schulzer (Schulzer von Müggensburg et al., 1866) on specimens from Serbia and never recorded later either in this country or in the rest of the Balkan Peninsula. In 2018 and 2019 one of us observed and collected the species in Northeastern Bulgaria after over 150 years gap after Schulzer's discovery. In this paper the authors aim to document those collections, providing description and illustrations.

Material and Methods

The specimens were documented at the time of collection and are deposited in air-dried state in the Mycological Collection of the Institute of Biodiversity and Ecosystem Research (SOMF). The colours in the description below refer as closely as possible to the Flora of British Fungi Colour Identification Chart (Royal Botanic Garden, 1969). The microscopic study was held with an AmScope T360B light microscope, equipped with AmScope MU900 digital camera. The microscopic observations were held on slides from dried material after rehydration with 5% KOH for 2 min., staining in Congo red in ammonia for 2 min. and final mounting in 5% KOH. Spores were observed in preparations with mixture of 5% KOH and Congo red in ammonia (50:50, v/v). Of each studied collection 30 random, normally developed, mature basidiospores

were assessed. In the description the spore measurements are presented by the minimum and maximum values of length, width and quotient (Q), followed by the average values for spore length (L_{av}), width (W_{av}) and quotient (Q_{av}). All measurements of microscopic structures were obtained from digital photographs with the aid of "Piximètre" software v. 5.10 (©A. Henriot & J.-L. Cheype). The background relief map was generated on "Maps-for-Free".

Results and Discussion

Pluteus fenzlii (Schulzer) Corriol & P.-A. Moreau, *Persoonia* 19(2): 248 (2007); Bas.: *Agaricus fenzlii* Schulzer, in Schulzer, Kanitz & Knapp, *Verh. Zool.-Bot. Ges. Wien* 16(Abh.): 49 (1866); Syn.: *Annularia fenzlii* (Schulzer) Schulzer, in Kalchbrenner, *Icon. Sel. Hymenomyc. Hung.*: tab. 10, fig. 1 (1874); *Chamaeota fenzlii* (Schulzer) Singer, *Sydowia* 31(1-6): 198 (1979); *Pluteus fenzlii* (Schulzer) E. Malysheva, Morozova & Zvyagina, *Acta Mycol.* 42(2): 155 (2007) [an isonym without nomenclatural status under ICNAPF, art. 6.3, note 2, *vide* Borovička, 2008]; Fig. 1.

Macroscopic features. Pileus up to 45 mm across, obtuse-conical, campanulate to convex or irregularly convex, with broad umbo, sulfur yellow, lemon yellow to lemon chrome, in overmature specimens discolouring to pale buff, at the margin inconspicuously striate, dry, radially fibrillose and finely squamulose; squamules concolorous with the background, more or less erect towards the centre to appressed elsewhere. Stipe up to 60 × 8 mm, cylindrical or subcylindrical, usually more or less curved, smooth to fibrillose, in the upper part whitish or yellowish, in the lower part whitish to lemon yellow, with lemon yellow floccons and concolorous, flocculose, evanescent annulus. Lamellae free, more or less crowded, whitish to cream-coloured with pinkish hues in young basidiomata, in maturity pinkish; lamellulae present. Odour inconspicuous; taste not recorded.

Microscopic features. Basidiospores 5.3–7.8 × 4.7–6.3 μm, Q=1.0–1.3 (L_{av} =6.2–6.3 μm,

W_{av} =5.3–5.4 μm, Q_{av} =1.2), broadly ellipsoid to subglobose, with one large central guttule, smooth, thin-walled, with inconspicuous apiculus. Basidia 4-spored, 18.3–29.9 × 5.1–8 μm clavate, thin-walled. Cheilocystidia 40.6–93.5 × 8.3–20.6 μm, abundant, covering the lamellar edge, clavate, narrowly fusoid to clavate-ventricose, fusoid-ventricose or broadly lageniform, with somewhat lengthened necks, narrow at base, thin-walled or occasionally thick-walled, sometimes with granular yellowish content. Pleurocystidia 33.7–103.5 × 14.3–27.6 μm, common, lageniform or fusoid-ventricose, often strongly inflated, with shorter or longer necks, narrowed towards the base, sometimes ampuliform, with rounded or acute apex, thin-walled. Pileipellis a trichodermium of periclinaly arranged, septate, cylindrical hyphae 3–5 μm wide, bundles of hyphae protruding in places from the main surface (corresponding to pileal scales). Clamp connections not seen in any tissue.

Specimen examined. Bulgaria, Shumen distr., in the vicinity of Pet Mogili village (*cf.* Fig. 2), 43°33'10.0"N, 27°20'56.0"E, elev. ca 285 m a. s. l., 05.06.2018, leg. D. Dimitrov (SOMF 30432); *idem*, 43°32'56.0"N, 27°20'43.0"E, 29.10.2019, leg. D. Dimitrov (SOMF 30433).

Pluteus fenzlii is a striking species, readily recognized in the field, due to the presence of annulus on stipe. The only other annulate taxon in the genus in Europe is *P. aurantiorugosus* var. *aurantiovelatus* Vizzini, nesting together with *P. fenzlii* in section *Celluloderma* Fayod (Vizzini & Ercole, 2011). The latter could be separated macroscopically by the presence of orange tinges in pileus colour, orange red floccons in the annular zone, as well as microscopically by the structure of the pileipellis, which is hymeniderm-epithelium of clavate, vesiculose, pyriform and sphaeropedunculate elements (Vizzini & Ercole, 2011), obviously distinct from the hyphal trichodermium in the species described here.

Schulzer provided a very brief diagnosis of his *Agaricus fenzi*, which nevertheless accounts the most important distinguishing characters of the species – vivid yellow coloured fruitbodies, stipe with an annulus and pink lamellae (Schulzer von Müggensburg et al., 1866). Schulzer's collection was said to have been found on rotting stumps of *Tilia* sp. No illustration of the fungus was included in the protologue, but such appeared for the first time six years later in Kalchbrenner (1873), along with more detailed description, based on Schulzer's original materials. The morphological features of the Bulgarian collection are consistent with the original description (Schulzer von Müggensburg et al., 1866), the redescription based on Schulzer's materials and ascribed to Schulzer (Kalchbrenner, 1873), as well as to the macroscopic and microscopic features accounted in recent works (Corriol & Moreau, 2007; Malysheva et al., 2007; Holec et al., 2018).

The species was described by Schulzer (Schulzer von Müggensburg et al., 1866) from the area of "Kamenitzer Wald" (nowadays in Frushka Gora National Park, Sremska Kamenica) in Serbia (Fig. 2). No further collections have been found since in any of the Balkan countries and for the moment in Eurasia the species is known from findings in France, Poland, Serbia, Slovakia, Hungary, Russia, Georgia, and Japan (cf. Holec et al., 2018). The Bulgarian specimen studied by us is thus the first occurrence of *P. fenzi* in the Balkans after a gap of over one and a half century. The new locality is situated approximately 600 km from the *locus classicus* in Serbia, which is the closest site of occurrence so far known. It is also one of the southernmost documented in Europe, surpassed only by the French sightings in the Pyrenees (Corriol & Moreau, 2007). Further on, it extends the range of the species close to the shores of the Black Sea, which fact coupled with the so far known geographic range suggests the fungus may

be looked for in other countries, e. g. Romania and Ukraine. *Pluteus fenzi* is apparently widespread, but uncommon in Europe. According to the account in Holec et al. (2018) to date the largest number of records is known from Slovakia (10 sites) and Hungary (5 localities), while in the remaining European countries only solitary findings are documented.

The Bulgarian collections were all found in a single artificial forest massif in the northeastern part of the country. The dominant tree in the stand is *Tilia* sp. (over 60% presence) and accompanying woody species are *Quercus* spp. (incl. *Q. rubra* L.), and *Acer campestre* L. It is notable that all findings of *P. fenzi* occurred on fallen stumps of lime trees in advanced stages of decay, similarly to the first finding of the species in Serbia (Schulzer von Müggensburg et al., 1866), although throughout its documented range it is known to occur on different broadleaf trees; particularly in Central Europe it is most commonly encountered on wood of *Quercus cerris* L., and certain variance is known between different parts of the continent (for extensive discussion on this topic consult Holec et al., 2018). The species occurred in four spots in the forest patch. *Pluteus fenzi* apparently has wide temporal range of production of basidiomata, which occur from the end of May to the last days of November, but seems more common in the beginning of the summer. The precise dates of observations of fruitings were 25.05.2018 (43°33'10.0"N, 27°20'56.0"E), 05.06.2018 (43°33'10.0"N, 27°20'56.0"E), 30.05.2019 (43°33'10.0"N, 27°20'56.0"E), 04.06.2019 (43°33'08.0"N, 27°20'56.0"E), and 29.10.2019 (43°32'56.0"N, 27°20'43.0"E).

The genus *Pluteus* Fr. is a species rich group of pink-spored agarics, attracting much attention in the last decades, with previously undescribed species being introduced continuously from Europe (see e. g. Justo et al., 2014; Ferisin & Dovana, 2019; Ferisin et al., 2019; Ševčíková et al., 2020;

Kaysuguz et al., 2021a). It is apparently insufficiently studied in Bulgaria, where merely 18 species are recorded up to date, a number of them known by single findings (Denchev & Assyov, 2010; Assyov & Stoykov, 2011). For comparison, Orton (1986) recognized some 43 species in Britain, while 33 were listed in other southern locales like the Iberian Peninsula and the Balearic Islands (Justo & Castro, 2007), and 35 species are presently known in neighboring Turkey (Kaysuguz et al., 2019, 2021a, b). The

finding of such striking and easily recognized species as *P. fenzlii* in Bulgaria confirms that the genus is worthy of further attention and deserves targeted studies in this country.

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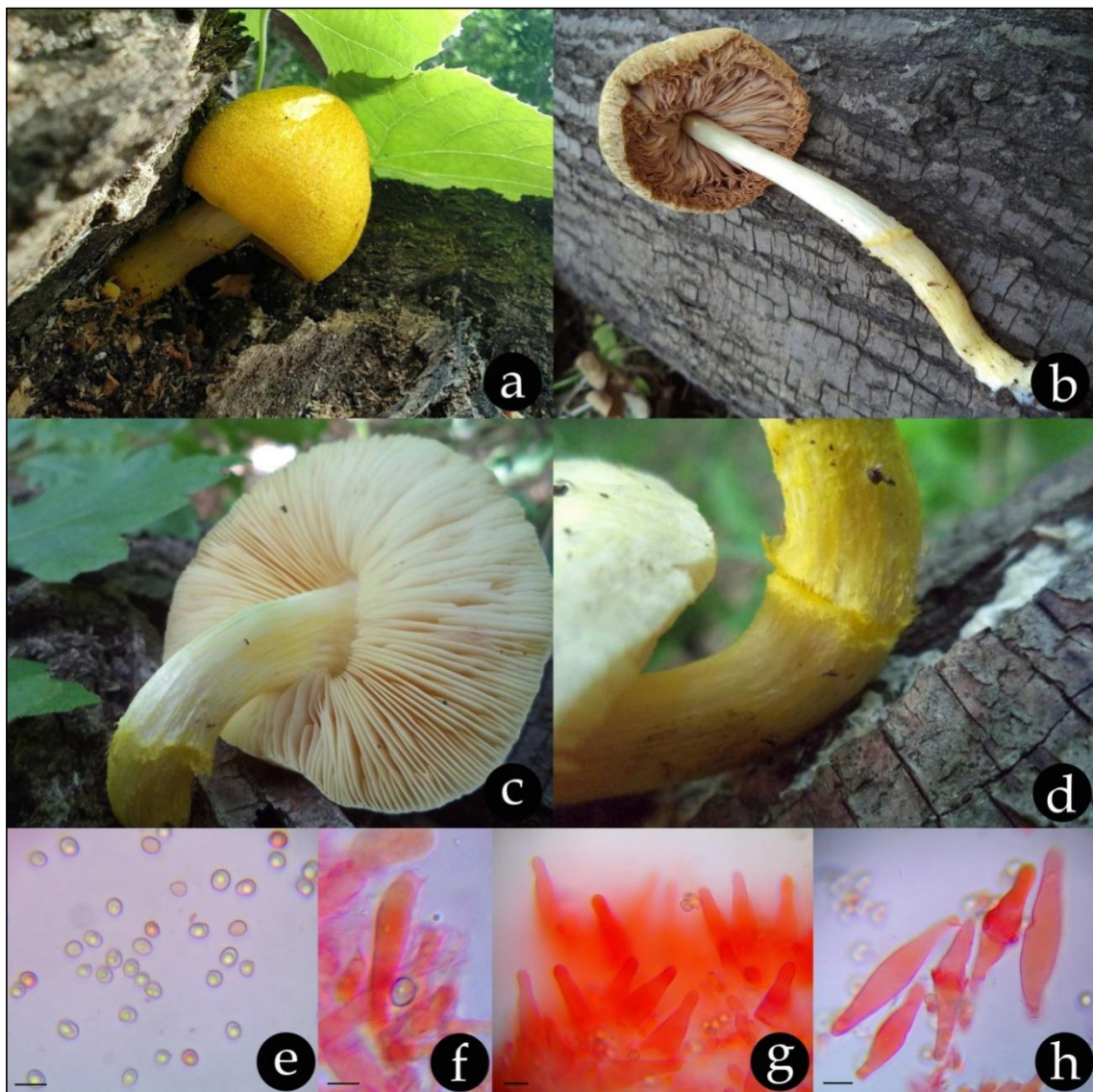


Fig. 1. Morphological features of *Pluteus fenzlii*: A,B,C,D - macromorphology of basidiomata, E - basidiospores, F - basidium, G,H - cheilocystidia. Scale bars = 10 μ m (A-D not to scale).



Fig. 2. Records of *Pluteus fenzlíi* in the Balkan Peninsula. Black dot marks the *locus classicus* (historical occurrence) and red dot shows the locality reported in this paper.

References

- Assyov, B. & Stoykov, D.Y. (2011). *Pluteus salicinus* (Pluteaceae) in Bulgaria. In: Denchev, C.M. (Ed.). New records of fungi, fungus-like organisms, and slime moulds from Europe and Asia: 20–27. *Mycologia Balcanica*, 7, 177–123. doi: [10.5281/zenodo.2550322](https://doi.org/10.5281/zenodo.2550322).
- Borovička, J. (2008). The correct author citation of the recently published name *Pluteus fenzlíi*. *Czech Mycology*, 60(1), 123–124. doi: [10.33585/cmy.60112](https://doi.org/10.33585/cmy.60112).
- Brandrud, T.E., Krisai-Greilhuber, I. & Kunca, V. (2019). *Pluteus fenzlíi*. The IUCN Red List of Threatened Species 2019: e.T147440380A148036540. doi: [10.2305/IUCN.UK.2019-2.RLTS.T147440380A148036540.en](https://doi.org/10.2305/IUCN.UK.2019-2.RLTS.T147440380A148036540.en).
- Corriol, G. & Moreau, P.A. (2007). *Agaricus (Annularia) fenzlíi* redécouvert dans les Pyrénées. Notes sur le genre *Chamaeota* en Europe. *Persoonia*, 19(2), 233–250.
- Denchev, C.M., & Assyov, B. (2010). Checklist of the larger basidiomycetes in Bulgaria. *Mycotaxon*, 111(1), 279–282. doi: [10.5248/111.279](https://doi.org/10.5248/111.279).
- Ferisin, G. & Dovana, F. (2019). Il genere *Pluteus*, sezione *Hispidoderma*. *Rivista Micologica Romana*, 106, 23–51.
- Ferisin, G., Dovana, F. & Justo, A. (2019). *Pluteus biziá* (Agaricales, Pluteaceae), a new species from Italy. *Phytotaxa*, 408(2), 99–108. doi: [10.11646/phytotaxa.408.2.2](https://doi.org/10.11646/phytotaxa.408.2.2).
- Holec, J., Kunca, V., Ševčíková, H., Dima, B., Kríž, M. & Kučera, T. (2018). *Pluteus fenzlíi* (Agaricales, Pluteaceae)–taxonomy, ecology and distribution of a rare and iconic species. *Sydowia*, 70, 11–26. doi: [10.12905/0380.sydowia70-2018-0011](https://doi.org/10.12905/0380.sydowia70-2018-0011).
- Justo, A. & Castro, M.L. (2007). An annotated checklist of *Pluteus* in the Iberian Peninsula and Balearic Islands. *Mycotaxon* 102, 231–234.
- Justo, A., Malysheva, E., Bulyonkova, T., Vellinga, E.C., Cobian, G., Nguyen, N., Minnis, A.M. & Hibbett, D.S. (2014). Molecular phylogeny and phylogeography of Holarctic species of *Pluteus* section *Pluteus* (Agaricales: Pluteaceae), with description of twelve new species. *Phytotaxa*, 180(1), 1–85. doi: [10.11646/phytotaxa.180.1.1](https://doi.org/10.11646/phytotaxa.180.1.1).

- Kalchbrenner, C. (1873). *Icones selectae hymenomycetum Hungariae per Stephanum Schulzer et Carolum Kalchbrenner observatorum et delineatorum* Vol. 1. Typis Athenaei, Pestini.
- Kaysuguz, O., Knudsen, H., Menoli Jr., N. & Türkekul, I. (2021a). *Pluteus anaticus* (Pluteaceae, Agaricales): a new species of *Pluteus* sect. *Celluloderma* from Turkey based on both morphological and molecular evidence. *Phytotaxa*, 482(3), 240-250. doi: [10.11646/phytotaxa.482.3.2](https://doi.org/10.11646/phytotaxa.482.3.2).
- Kaysuguz, O., Türkekul, I., Knudsen, H. & Çolak, Ö.F. (2019). New records of *Pluteus* section *Hispidoderma* in Turkey based on morphological characteristics and molecular data. *Phytotaxa*, 413(3), 175-206. doi: [10.11646/phytotaxa.413.3.1](https://doi.org/10.11646/phytotaxa.413.3.1).
- Kaysuguz, O., Türkekul, I., Knudsen, H. & Menolli Jr, N. (2021b). *Volvopluteus* and *Pluteus* section *Pluteus* (Agaricales: Pluteaceae) in Turkey based on morphological and molecular data. *Turkish Journal of Botany*, 45(3), 224-242.
- Malysheva, E., Morozowa, O. & Zvyagina, E. (2007). New records of the annulate *Pluteus* in European and Asian Russia. *Acta Mycologica*, 42(2), 153-160.
- Orton, P.D. (1986). Pluteaceae (*Pluteus* & *Volvariella*). In Henderson, D.M., Orton, P.D. & Watling, R. (Eds.). *British Fungus Flora Agarics and Boleti*. (Vol. 4, pp. 1-99). Edinburgh, UK: Royal Botanic Garden Edinburgh.
- Royal Botanic Garden. (1969). *Flora of British fungi: colour identification chart*. HM Stationery Office, Edinburgh.
- Schulzer von Müggensburg, S., Kanitz, A. & Knapp, J.A. (1866). Die bisher bekannten Pflanzen Slavoniens. Ein Versuch. *Verhandlungen der Kaiserlich-Königlichen Zoologisch-Botanischen Gesellschaft in Wien*, 16(Abh.), 3-172.
- Ševčíková, H., Moreau, P.A. & Borovička, J. (2020). *Pluteus keselakii* (Pluteaceae, Agaricales), a new species in section *Celluloderma*. *Phytotaxa*, 432(2), 81-189. doi: [10.11646/phytotaxa.432.2.7](https://doi.org/10.11646/phytotaxa.432.2.7).
- Vizzini, A. & Ercole, E. (2011). A new annulate *Pluteus* variety from Italy. *Mycologia*, 103(4), 904-911. doi: [10.3852/10-382](https://doi.org/10.3852/10-382).

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