

TWO SABULICOLOUS SPECIES OF THE GENUS  
*AGARICUS* (*AGARICOMYCETES*) NEW  
TO BULGARIA AND THE BALKAN PENINSULA

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**Abstract**

Two sabulicolous species *Agaricus devoniensis* and *A. menieri* are recorded for the first time in Bulgaria and the Balkan Peninsula. A detailed macro- and microscopic description is given and differences from similar species are briefly discussed. The species are described and illustrated with colour photographs on the basis of collected Bulgarian specimens.

**Key words:** *Agaricus*, Balkan Peninsula, fungal diversity, taxonomy

**Introduction.** Contemporary knowledge on the diversity of Bulgarian *Agaricus* species is based on years of purposeful field and laboratory investigations made by [1–5].

The article contains new data about species compositions of Bulgarian *Agaricus* species. Two species new for the country — *A. devoniensis* and *A. menieri*, were reported. They are considered presumably to be rare species in many states of Europe, therefore a detailed description and illustrations are presented.

**Material and methods.** Air-dried studied specimens of the fungi are kept in the Mycological collection of the Agricultural University of Plovdiv (SOA). The samples are documented with colour photographs and detailed description. Fruiting bodies of both species were photographed with SONY Cyber-shot 5.1 Mpix and CANON PowerShot A460 5.0 Mpix in standard JPEG format. Microscopic features are observed and measured in lactophenol under *Amplival* LM, with magnification  $\times 1000$ . Measurement values for basidiospores are presented below as follows: min-(mean $\pm 1\sigma$ )-max.

The taxonomic decisions in the article have been made in conformity with the research of [2,6-13]. The nomenclature of species follows [14].

#### **Description of the species.**

*Agaricus devoniensis* P. D. Orton, Trans. Brit. Mycol. Soc., **43**, 1960, No 2, p. 173 (Fig. 1).

*Psalliota arenicola* Wakef. & A. Pearson, in Pearson, Trans. Brit. Mycol. Soc., **29**, 1946, No 4, p. 205.

*Pileus* up to 3-5 cm in diameter, thick-fleshy, initially hemispherical, subsequently applanate or slightly umbonate to flat, whitish, subsequently pale-straw-yellow, dry, smooth, silky-fibrillose. Margin long, inrolled, nearly always covered with grains of sand.

*Gills* free, thin, whitish-pink, subsequently pale red to red-brown, with pale, sterile edge. Gill trama in young carpophores initially regular, latter irregular. *Stipe* 5-7  $\times$  1-1.5 cm, central, cylindrical, initially white, latter pale yellow, smooth to silky-fibrillose. *Ring* with two thin peronate rings, the outer one leaving only hardly visible traces or utterly disappears. *Flesh* white, on cutting at the base of the stipe becoming slightly pale-reddish. *Smell* non-distinctive. *Taste* non-distinctive. *Basidiospores* 5.5- (5.8  $\pm$  0.02) -7  $\times$  5- (5.3 $\pm$ 0.02) -5.5  $\mu\text{m}$ ,  $n = 50$ , ovoid to spherical, brownish, smooth. Spore print brownish. *Basidia* 20-25  $\times$  9-15  $\mu\text{m}$ , 4-sterigmate, clavate. *Sterigmata* 2  $\mu\text{m}$  long. *Cheilocystidia* 20-38(-40)  $\times$  7.5-12  $\mu\text{m}$ , clavate, numerous. *Macrochemical reactions*: Cross reaction with Schaeffer's reagent negative.

*Habitats.* On sandy soil, coastal dunes and grasses in coastal areas. Strictly sabulicolous species, fruiting on sandy soil and coastal dunes [10]. The species should be considered as a strictly psammophilous species referred to the *Ephedro fragilis-Juniperetum macrocarpae*. The basidiomata, single or connate, are not easily observable, apart from the pileus, since they are deeply burrowed in the substrata [15].

Humus saprotroph, rare, inedible. May–October.

*General distribution.* In Europe known from Austria, British Isles, Denmark [16], France, Germany, Hungary, Italy [10,15,17,18], Poland and Spain [19]; Belgium [20]; Sweden [21]; in Asia the species has been recorded in Turkey [22].

*Specimens examined.* Thracian Lowlands, in sandy soil along the watercourse of Stryama River, near the bridge over the river, above Stryama village, 27.05.2010, leg. & det. *M. Lacheva* (SOA 60 00288).

*Distribution in Bulgaria.* Thracian Lowlands.

**Note.** Metric and macroscopic data of the Bulgarian specimens of *A. devoniensis* agree with the descriptions of [23] and [10].

Our observations are in conformity with the literature data that *A. devoniensis* should be considered as a sabulicolous species developing in sandy soil along watercourse [10,15].

*Agaricus menieri* Bon, Doc. Mycol., **11**, 1981, No 44, p. 28 (Fig. 2).

*Psalliota ammophila* Menier, Bull. Soc. Sci. Nat. de l'Ouest, **3**, 1893, No 2, p. 67; *Psathyrella ammophila* (Durieu & Lév.) P. D. Orton, Trans. Brit. Mycol. Soc., **43**, 1960, No 2, p. 180; *Agaricus ammophilus* (Menier) Sacc., Syll. Fungorum, **11**, 1895, p. 69, nom. illeg. (Art. 53.1) non *A. ammophilus* Durieu & Lév., in Durieu, Expl. Sci. Alg., Bot., Atlas, **14**, 1868, p. 31.

*Pileus* up to 6–10(–13) cm in diameter, thick-fleshy, initially hemispherical, subsequently applanate or slightly umbonate, dry, smooth, fibrillose or finely cracked, whitish, pale yellowish with a grey-pink shade, eventually pale ochraceous. Margin even, on drying undulate, often with remnants of the veil.

*Gills* free, thin, whitish-pink, subsequently pale greyish pink to red-brown, with pale, sterile edge. Gill trama in young carpophores initially regular, latter irregular. *Stipe* 7–10 × 2–3 cm, central, equal, tightly, cylindrical to slightly spindle-shaped, with or without bulbously expanded at the base, white, at first pale yellow, subsequently brownish, silky-fibrillose. *Ring* broad apical, free standing, double for a collar-like shape on the underside. *Flesh* white, on cutting at the base of the stipe becoming chrome-yellow. *Smell* initially slightly of anise, subsequently of carbolic acid. *Taste* slight bitter. *Basidiospores* 6–(7.3±0.01)–10 × 5–(5.6±0.01)–6.5 μm, *n* = 50, broadly ellipsoid, brownish, smooth, relatively large. Spore print brownish. *Basidia* 20–25 × 8–10 μm, 4-sterigmate, clavate. *Sterigmata* 2–2.5 μm long. *Cheilocystidia* 8–20 × 8–10 μm, oval or pyriform, numerous. *Macrochemical reactions*: Cross reaction with Schaeffer's reagent negative.

*Habitats.* Strictly sabulicolous species, fruiting on sandy soil and coastal dunes. Basidiomata often completely covered with sand (in association with *Helichrysetum* or *Ammophiletum*) [10], high dunes, on sand, close to plants of *Ammophiletum australis* and *Medicagini marinae-Ammophiletum australis* [13,15]. Humus saprotroph, rare, inedible. June–October.

*General distribution.* In Europe described in France [7], Germany, Hungary, Italy [10,15]; in Asia the species has been recorded in Israel [13] and Turkey [22].

*Specimens examined.* Black Sea Coast, sandy coastal dunes in the vicinity of Pomorie, 14.10.2008, leg. *D. Stoykov*, det. *M. Lacheva* (SOA 60 00289).

*Distribution in Bulgaria.* Black Sea Coast.

**Note.** The Bulgarian specimens of *A. menieri* agree macroscopically with the descriptions of [7,9,10,13].

Metric data of the Bulgarian specimen are close to those reported in the literature, except for the maximum values of the cheilocystidia in our material, which is bigger than the pointed one (18 µm) in the original description of the species in [7].

According to our investigation, *A. menieri* should be considered as a strictly psammophilous species [10,13,15] – it was almost covered by the sand, when the sample was collected.

**Comments.** *A. devoniensis* and *A. menieri* are the first sabulicolous species reported in Bulgaria.

*Agaricus devoniensis* P. D. Orton is closely related to the common in Europe *A. pseudoprattensis* (Bohus) Wasser var. *niveus* Bohus, which sometimes also occurs on sandy soils. It differs in the cap being generally snow-white to pale-cream, single ring and the slightly larger spores [2,8,10].

*Agaricus menieri* Bon is similar to *A. pilatianus* Bohus, known to be common in Europe, which differs in the cap being generally sooty-brownish, ±fibrillose-squamulose and by having smaller spores [2,10,13].

At present, the known diversity of the genus *Agaricus* in our country is considered to include fifty species in total [2–5]. These two new findings contribute to the diversity of Bulgarian mycota, by adding new records of *Agaricus*. Finally, *A. devoniensis* and *A. menieri* exceed the total number of *Agaricus* species recorded in Bulgaria to fifty-two.

We hope that this study will be useful for creating a database of the Bulgarian *Agaricus* species.

## REFERENCES

- [1] LACHEVA M. N., G. T. STOICHEV. Mycol. Balcan., **1**, 2004, No 1, 35–40.
- [2] LACHEVA M. N. Genus *Agaricus* L.: Fr. emend. P. Karst. (mushroom) in Bulgaria: taxonomy, ecology, chorology and economical importance. PhD thesis, Agrarian University, Plovdiv, 2006. (<http://botanica.hit.bg/doc/AgaricusPhDthesis.pdf>) (in Bulgarian).
- [3] LACHEVA M. Mycol. Balcan., **5**, 2008, No 3, 123–128.
- [4] LACHEVA M. Third Nat. Sci. Conf. for Students, PhD and Young Researchers in Plovdiv (Bulgaria), 25 April 2009, 49–53 (in Bulgarian).
- [5] LACHEVA M. Jubilee Nat. Conf. with Internat. Participation “Man and the Universe”, 6–8 October 2011, Smolyan, 2011, 625–632.
- [6] MØLLER F. H. Friesia, **4**, 1952, 135–220.
- [7] BON M. Doc. Mycol., **11**, 1981, No 44, 1–28.
- [8] BOHUS G. Ann. Histor-Nat. Mus. Nat. Hung., **72**, 1980, 91–96.
- [9] CAPPELLI A. Bollettino del Gruppo micologico G. Bresadola, Trento, **26**, 1983, Nos 1–2, 4–38 (in Italian).
- [10] CAPPELLI A. *Agaricus* L.: Fr. ss. Karsten (*Psalliota* Fr.). Saronno, Fungi Europaei. Libreria editrice Biella Giovanna, 1984 (in Italian).
- [11] HANSEN I., H. KNUDSEN. Nordic Macromycetes Polyporales, Boletales, Agaricales, Russulales, **2**, 1992, pp. 474 (p. 209).
- [12] WASSER S. P. Flora Fungorum RSS Ucrainicae, Naukova Dumka, Kiev, 1980 (in Russian).
- [13] WASSER S. P. Biodiversity of Cyanoprocaryotes, Algae and Fungi of Israel. Family *Agaricaceae* (Fr.) Cohn. (*Basidiomycetes*) of Israel Mycobiota. I. Tribe *Agariceae* Pat. A.R.A. Gantner Verlag K.-G. Ruggell, 2002.
- [14] Dictionary of the fungi (eds P. M. Kirk, P. F. Cannon, J. C. David, J. A. Stalpers). 10th ed., Oxon, CAB International, 2008, 771 pp.
- [15] LANTIERI A., M. L. GARGANO, G. VENTURELLA. Mycotaxon, **110**, 2009, 151–154.
- [16] VESTERHOLT J., J. KOCH., J. EILENBERG., J. FRISVAD., U. SØCHTING, S. ROSENDAHL. Svampeliste fra DanBIF-mycology, 2003, 1-108 (<http://www.danbif.dk/Svampe.htm>).
- [17] CONTU M., P. SIGNORELLO. Boll. Accad. Gioenia Sci. Nat. Catania, **32**, 1999, No 356, 31–45.
- [18] SIGNORELLO P., M. CONTU. Boll. Accad. Gioenia Sci. Nat. Catania, **32**, 1999, No 356, 47–52.
- [19] MORENO A., J. REMONDO. Zubía, **17**, 1999, 11–43.

- [<sup>20</sup>] WALLEYN R., E. VANDEVEN. Standaardlijst van Basidiomycota en Myxomycota van Vlaanderen en het Brussels Gewest. Instituut voor Natuur- en Bosonderzoek, Brussel, 2006.
- [<sup>21</sup>] JACOBSSON S., E. LARSSON, A. STRIDVALL. Svensk Mykologisk Tidskrift, **31**, 2010, No 3, 2–4.
- [<sup>22</sup>] SESLI E., C. M. DENCHEV. Mycotaxon, **106**, 2008, 65–67 + online version [2011]: 1–136 (<http://www.mycotaxon.com/resources/checklists/sesli-v106-checklist.pdf>).
- [<sup>23</sup>] ORTON P. D. Trans. Brit. Mycol. Soc., **43**, 1960, 159–439.

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