



Agaricus chionodermus Pilát, a species new to Bulgaria

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Abstract

The article presents the first record of *Agaricus chionoderma* Pilát in Bulgaria. Basidiomata of the species were found on June 2004, September 2010, and September 2011 in the Thracian Lowland floristic region. The article brings closer taxonomic profile, ecological requirements and distribution pattern of the species. Differences from similar species are discussed. It also describes macroscopic and microscopic characteristics of the discovered specimens and presents the specification of habitat the fungus concerned. The species are described and illustrated by photographs of macroscopic and microscopic features on the basis of Bulgarian specimens.

Keywords: Agaricomycetes; *Agaricus* sect. *Arvenses*; Bulgarian mycobiota; fungal diversity; taxonomy

Introduction

The genus *Agaricus* comprises a diverse, cosmopolitan saprotrophic agarics occurring in a variety of ecosystems. Most of them, however, are confined to grasslands [1–4].

There are ca. 200 described *Agaricus* species worldwide and approximately 60 of them occurring in Europe [4–8]. There have been reported 54 species of the genus from Bulgaria so far [9–17]. Five of the agarics are included in the “Red list of fungi in Bulgaria” [18].

In the course of studies of the diversity of genus *Agaricus* in Bulgaria, *A. chionodermus* was found by the author for the first time. It is presumably a rare species for many countries of Europe and yet not well known. Therefore in this paper a detailed description and illustrations are presented including features that distinguish *A. chionodermus* from similar species.

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This work adds a new species to the Bulgarian agarics, namely *A. chionodermus* Pilát, one of the about seventy “European” species which, according to Cappelli [4], belong to *Agaricus* sect. *Arvenses*.

Material and methods

Air-dried studied specimens of the fungus are kept in the mycological collection of the Agricultural University-Plovdiv (SOA). Basidiomata of species were photographed with SONY Cyber-shot.

Description of morphological characters of basidiomata is based on fresh and dried specimens. Micromorphological features were observed and measured in fresh and dry fragments of tissues dehydrated in water, under an Amplival ML light microscope, with magnification $\times 1000$. Microphotographs were taken on Amplival ML. Drawings were made with the aid of a drawing tube under an oil-immersion objective. Spores were examined in Melzer's reagent and were taken from the spore print for measurements. Calculated values are based on 50 measurements. The obtained data for length and width of microstructures were examined by standard statistic methods [19,20] and are presented in the text in the following way: (min–) mean $\pm 1\sigma$ (–max), $n = 50$, ($1/w_{\min\text{-max}}$); of the basidia and cheilocystidia: min–max.

Schäeffler reaction was tested by aniline and 65% HNO_3 acid on dried samples [21].

The abbreviations of the author names of fungal species are given according to Kirk and Ansell [22]. Nomenclature of species follows Kirk et al. [8]. The taxonomic and nomenclature decisions in the article have been made in conformity with the most appropriate taxonomic monographs of the *Agaricus* genera [4,23,24].

The chorological map of the occurrence of the *A. chionodermus* in the country, have been depicted using the program software dSOA [25].

Results and discussion

Agaricus chionodermus Pilát has never been previously found in Bulgaria [12,26].

The occurrence of first *A. chionodermus* basidiomata was discovered on 7th June 2004 in Thracian Lowland, Plovdiv distr., above Stryama village (Fig. 1). The area where the fungus occurred is situated along the watercourse of Stryama River and is surrounded by farmland, as well as meadows and pastures. The dominant species of the tree layer at the plant community where basidiomata of *A. chionodermus* has been found were: *Acer campestre*, *Fraxinus angustifolia*, *Populus canescens* and *Tilia cordata*. The shrub layer includes mainly: *Populus tremula*, *Salix caprea*, *Corylus avellana* and *Sambucus nigra*. The herb layer was dominated by cereal grasses, e.g. *Carex caryophyllea*, *Poa pratensis*, etc.

In the course of the field trial only three specimens of *A. chionodermus* were found. The basidiomata of the agarics were revealed in grassy vegetation, close to *P. canescens* (Ait.) Sm. The next finding of basidiomata *A. chionodermus* was done in the same place in September 2010 and September 2011. The location of the species has been carefully marked and will be monitored in the future.



Fig. 1 Distribution of *Agaricus chionodermus* in Bulgaria.

Species description

Agaricus chionodermus Pilát (Fig. 2, Fig. 3), Acta Mus. Nat. Prag., VII B, 1: 134, 1951.

Icons: Pilat (1951: Fig. 60; Tab. 3, Tab. 14–16), Pilat (1953: Fig. 22), Cappelli (1984: Tab. 48).

MACROSCOPIC AND MICROSCOPIC FEATURES. Pileus up to 7.5–12(–15) cm in diameter, thick-fleshed, initially hemispherical, subsequently convex to plano-convex, seldom flat or slightly depressed, silky finely fibrillose, sometimes cracked dry in the center, snow-white, white, sometimes greyish white in the center, slightly yellowish towards the margin. Margin undulate, initially involute, thin, with whitish silky fibrillose scales, 5–7 mm thick, finally with remnants of the partial veil. Pileipellis consisting of whitish thick-walled cylindrical hyphae, with clamps, 5–10 μm in diameter. Gills free, thin, crowded, narrowing toward the margin of pileus, long, with an even edge, whitish-pink, subsequently light pink, gray-pink to dark-brown, with light, sterile edge. Hymenophoral trama in young basidiomata initially regular, latter irregular, consisting of cylindrical, thin-walled hyphae, 5–12 μm in diam. Stipe up to 8–15 \times 1.5–3 cm, central, cylindrical, with or without slightly bulbous base, initially white, subsequently \pm white, smooth to silky-fibrillose, yellowish at touch. Flesh whitish, on cutting becoming lemon-yellow in the base of the stipe. Ring wide apical, fleecy, free standing, whitish, with touch upper layer yellowish tinge and thick, delicate, sericeous, bottom layer. Context in pileus and stipe fragile, whitish. Smell non-distinctive, very faint, non of almonds. Taste non-distinctive. Spores 7.5–(4.2 \pm 0.02)–10 \times 4.5–(4.1 \pm 0.02)–6 μm , ($n = 50$), ellipsoid to ovoid, brown, not ornamented, with fluorescent spots, with an apical germ pore. Spore print dark brown. Basidia 20–28 \times 8.5–10.5 μm , clavate, hyaline, 4-sterigmate. Sterigmata 2–3 μm long. Cheilocystidia 17–30 \times 6.5–10.5 μm , crowded, clavate to cylindrical, lageniform, thin-walled, hyaline. Macrochemical reactions: cross reaction with Schaeffer's reagent: positive.



Fig. 2 Basidiomata of *Agaricus chionodermus* at different stages of development in situ from Bulgaria (photos: M. Lacheva).

SPECIMENS EXAMINED. Bulgaria, Thracian Lowland, Plovdiv distr., above Stryama village, right slope, alt. 240 m a.s.l., on mown meadow close to *Populus canescens* (Ait.) Sm. and *Salix caprea* L., along the watercourse of Stryama River, near by the bridge to the river, on basic soil, 7 June 2004, coll. & det. M. Lacheva (SOA 60 00292); *ibid.*, on sandy soil, 30 September 2010 (SOA 60 00293), 14 September 2011, coll. & det. M. Lacheva (SOA 60 00367).

TAXONOMICAL REMARKS. Nearly identical basidiomata produces *A. arvensis* Schäffer known to be common in Europe, which can be separated with certainty from *A. chionodermus* by the cap being generally snow-white, wide sericeous ring and the slightly larger spores [1,4,23], but mainly on the base of microscopic characters. As emphasized by Cappelli [4], *A. chionodermus* in contrast to, *A. arvensis* has round and conspicuous cheilocystidia. Moreover, there is an ecological difference between the two species, i.e. *A. chionodermus* grows on periphery of deciduous and coniferous forest, or forest meadows, on calcareous and sandy soils, while *A. arvensis* occurs on humus rich soil, mainly among grasses. *Agaricus nivescens* (F.H. Møller) F.H. Møller also resembles *A. chionodermus*, from which it mainly differs by habitat (terrestrial fungus occurs mainly in grasslands on calcareous soil), almonds and fungoid smell, indeterminate taste, and smaller size of spores and basidiomata [4,27].

Metric and macroscopic data of Bulgarian specimens of *A. chionodermus* agree with the descriptions of [4] and [23].

According to this investigation, *A. chionodermus* should be considered as a species developing in grassy vegetation on forest meadows at lower elevation, close to poplar, possibly also under other broadleaved tree species. The observations are in accordance with the literature data that *A. chionodermus* should be considered as species developing mostly on basic to neutral or sandy soil [4].

HABITAT, ECOLOGY, PHENOLOGY, EDIBILITY STATUS. Basidiomata of *A. chionodermus* almost exclusively appears in summer to early fall season (May–October), solitary, in periphery of deciduous forest or forest meadows and grassy vegetation, 200–700 m alt. Humus saprotroph, mostly on basic to neutral or sandy soil. There are some information that this species is edible without gastrointestinal problems [4,28]. There

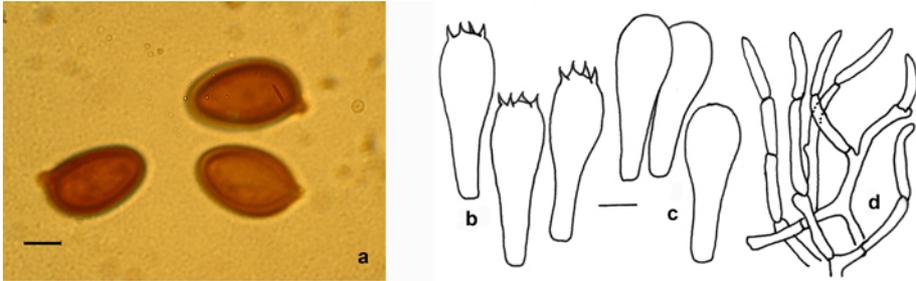


Fig. 3 Microscopic features of *Agaricus chionodermus* from Bulgaria: basidiospores (a), basidia (b), cheilocystidia (c), generative hyphae of the pileipellis with terminal elements (d). Photos and drawings: M. Lacheva. Scale bars: 2.5 μm (a), 5 μm (b–d).

is so far no indication in Bulgaria that its edibility is known and presently the fungus is unlikely to be collected for food, beside if not be confused with other similar species.

GENERAL DISTRIBUTION. *Agaricus chionodermus* has a relatively wide distribution. The species has been recorded in many European countries, but in some regions it is regarded as rare. In Europe, *A. chionodermus* is reported from Czech Republic [23,29], France [27,30], Italy [4,31], Spain [32,33] and Ukraine [1]. In Asia the species has been recorded in Turkey [34–36].

Conclusion

Agaricus chionodermus should be especially sought after in plains and lowlands regions of the country, but its presence in other parts of Bulgaria cannot be excluded. Basidiomata of this fungus might have been misidentified because of its resemblance to other similar *Agaricus* species from section *Arvenses*, especially if a spore print was not available.

This new finding contributes to the diversity of Bulgarian mycobiota, by adding new *Agaricus* records and might be useful for creating a database of the Bulgarian sabulicolous *Agaricus* species.

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