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ORIGINAL RESEARCH PAPER

Armillaria ectypa, a rare fungus of mire in Poland

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Szczecin, Poland* Email: stasinsk@univ.szczecin.pl**Abstract**

Armillaria ectypa is a saprotroph that occurs on active raised bogs and alkaline fens, as well as Aapa mires and transitional bogs. It is a very rare and threatened Eurasian species and one of the 33 fungal species proposed for inclusion into the Bern Convention. Its distribution in Poland, ecological notes and morphology of basidiocarp based on Polish specimens are presented.

Keywords

Basidiomycota; Physalacriaceae; distribution; ecology

This issue of Acta Mycologica is dedicated to Professor Maria Lisiewska and Professor Anna Bujakiewicz on the occasion of their 80th and 75th birthday, respectively.

Introduction

The genus *Armillaria* (Fr.) Staude (Agaricales, Physalacriaceae; honey fungi) is represented worldwide by about 35 species. Generally, they are widespread fungi, occurring nearly on all continents as saprotrophs or parasites, many of them cause serious root disease in woody plants, some form orchidaceous mycorrhiza [1]. In Poland the occurrence of seven species of honey fungus has been documented [2,3]. Five of them (*Armillaria borealis* Marxm. & Korhonen, *A. cepistipes* Velen., *A. gallica* Marxm. & Romagn., *A. mellea* (Vahl) P. Kumm. (sensu stricto) and *A. ostoyae* (Romagn.) Herink) have fruiting bodies with a ring on stem and constitute *Armillaria mellea* complex. The remaining ones: *A. ectypa* (Fr.) Lamoure and *A. tabescens* (Scop.) Emel are characterized by the lack of such a ring [3,4]. Geographical distribution of the species of the genus *Armillaria* in Poland is quite diverse. For example, *A. cepistipes*, *A. gallica* and *A. ostoyae*, are encountered all over the country, whereas *A. borealis* was found only in its northern and central parts [3,5]. Among the species extremely rarely noted in Poland is marsh honey fungus – *Armillaria ectypa*, which has been under strict protection since 2014 [6]. *Armillaria ectypa* is ranked as threatened and rare not only in Poland but also in many other European countries [7,8] It is one of 33 fungi proposed for inclusion into the Bern Convention [9,10]. The purpose of this paper is to present the basidiocarp morphology, ecological notes and distribution of *A. ectypa* in Poland.

Material and methods

The description of macroscopic and microscopic features is based on fresh and dried specimens, collected in Żuromino (the Kaszuby Lakeland). The microscopic structures

were observed and measured using Olympus BX53 light microscope (LM) equipped with a Olympus DP26 digital camera. Basidia and spore measurements in the descriptions are based on 30–40 measurements. Dimensions of the basidia and the spores are given as follows: (minimum value–)1st decile–9th decile(–maximum value). Spore length to width ratios are reported as Q. Micrographs taken with a scanning electron microscope Zeiss EVO LS10 (SEM) in the Center for Molecular Biology and Biotechnology, Environmental Testing Laboratory, University of Szczecin (Poland). The specimens were identified by examining their macroscopic and microscopic features, using references by Termorshuizen [11] and Vesterholt [12].

Distribution of species in Poland (Fig. 1) was mapped according to the ATPOL grid square system as used by Wojewoda [13]. The general distribution of species and ecological notes are based on original material, supplemented by information from the literature. The fungal nomenclature and its synonyms are given according to Index Fungorum database [14]. The nomenclature of vascular plants follows Mirek et al. [15] and that of plant communities follows Matuszkiewicz [16]. The collection studied are deposited in the Herbarium of the Department of Botany and Nature Conservation, Szczecin University (SZUB), Poland.

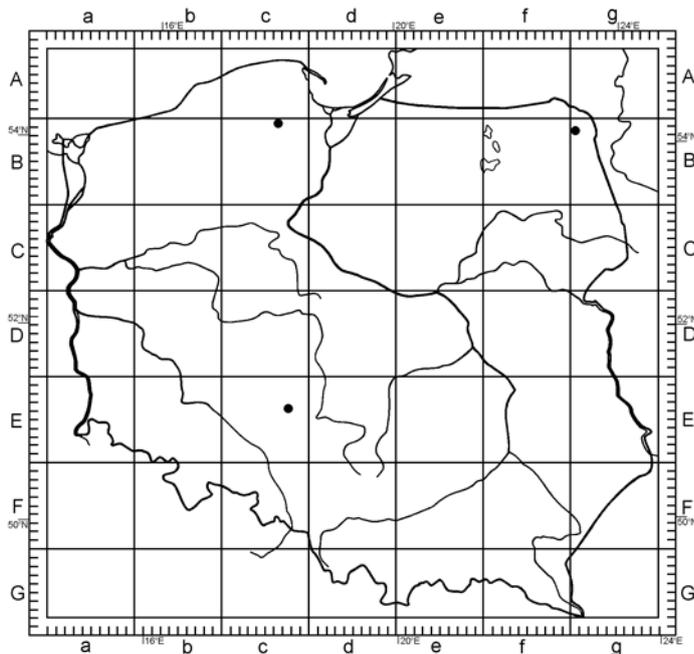


Fig. 1 Distribution of *Armillaria ectypa* in Poland, in ATPOL grid square systems [13].



Fig. 2 Fruit body of *Armillaria ectypa* recorded in Żuromino (photo: M. Stasińska).

Results

Species description

Armillaria ectypa (Fr.) Lamoure, *Compt. Rend. hebdom. Séanc. Acad. Sci.*, Paris 260: 4562 (1965) – Physalacriaceae, Agaricales, Agaricomycetidae, Agaricomycetes, Agaricomycotina, Basidiomycota, Fungi [1].

Syn.: *Agaricus ectypus* Fr., *Armillaria ectypa* (Fr.) Herink; *Armillariella ectypa* (Fr.) Singer; *Clitocybe ectypa* (Fr.) Gillet; *Omphalia ectypa* (Fr.) Quél.; for other synonymies see Index Fungorum [14].

Pileus 25–60(100) mm in diameter, convex to plano-convex, later explanate, sometime with small obtuse umbo or depressed center with age, with slightly curved or wavy margin, hygrophanous, brown, yellowish brown or ochraceous brown to pale cream-brown at margin, with dark brown scales at center, margin translucently striated (Fig. 2); lamellae decurrent, rather narrow, first whitish then pale cream, ochraceous to pinkish; stipe 50–100 × 5–11(13) mm, cylindrical to subclavate, slightly thickened at base, without ring, fibrillose, of the same color as the pileus; context thin, white; without rhizomorphs; spore print whitish or creamish; smell fungoid; taste mild. Spores (6.5)7.0–8.5(9.0) × (5.0)5.5–6.5(7.0) μm, Q = 1.2–1.5, broadly ellipsoid to ellipsoid; basidia 30–40 × 7.0–8.0(9.0) μm, clavate, mostly with 4 sterigmata (Fig. 3a,b).

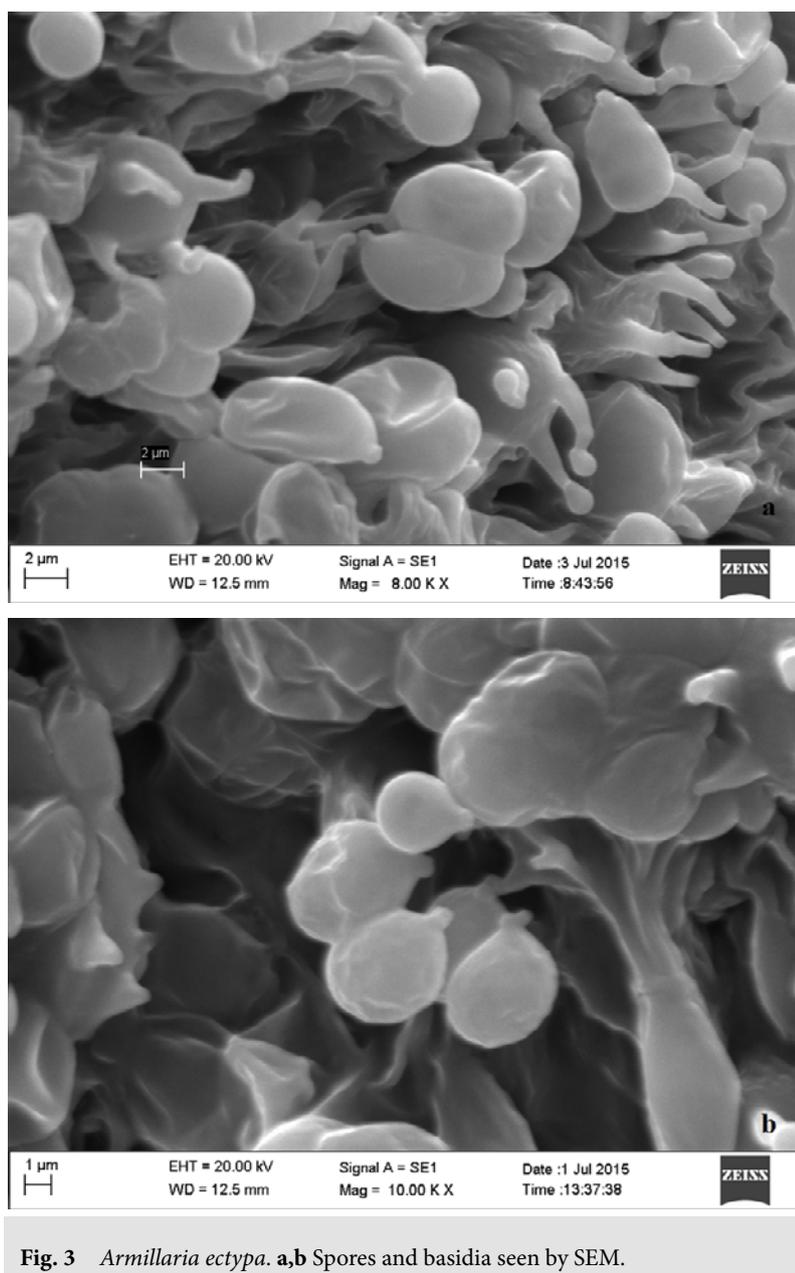


Fig. 3 *Armillaria ectypa*. **a,b** Spores and basidia seen by SEM.

Habitat and distribution

Armillaria ectypa is a saprotrophic species, growing on wet ground, peat, usually among *Sphagnum* spp. and herbaceous plants (e.g., *Carex* spp., *Drosera* spp., *Eriophorum* spp., *Phragmites australis*) as well as on tufts of decaying sedges, e.g., *Carex rostrata*. It occurs on waterlogged habitats, active raised bogs and alkaline fens [9] and Aapa mires, transitional and low [11,12,17–19].

Marsh honey fungus is an Eurasian species of boreal-mountain range and possibly continental [19]. It is known in 14 European countries, i.e., Austria, Switzerland [10], the Czech Republic [8], Denmark, Sweden [12], Finland [19], France [17], Germany [20], Great Britain [18,21–23], the Netherlands [11], Russia [24] and Slovakia [25]. In addition, it was reported from China [26] (cited in [27]), Japan [28] and Turkey [29].

In Poland, *A. ectypa* was recorded first in *Leucobryo-Pinetum* W. Mat. (1962) 1973, in the Laski Forest District [30]. The second site, discovered in September 2007, is located within the Kaszubry Lakeland, in the vicinity of Żuromino [31]. *Armillaria ectypa* was found on a small transitional bog, surrounded with a lagg zone filled with water, situated in a land depression among arable fields. Fruiting bodies of marsh honey fungus were observed at a few places, singly or in small clusters, mainly on the margin of the peat bog, among *Sphagnum* spp. (e.g., *Sph. cuspidatum* and *Sph. fallax*) and vascular plants (e.g., *Andromeda polifolia*, *Carex lasiocarpa*, *C. rostrata*, *Comarum palustre*, *Drosera rotundifolia*, *Eriophorum angustifolium*, *Menyanthes trifoliata*, *Oxycoccus palustris* and *Viola palustris*). The third stand of *Armillaria ectypa*, is located in the Wigry National Park [32]. Fruiting bodies were found in the community *Scheuchzerietalia palustris* Nordh. 1937, among *Sphagnum* spp. and on the remnants of *Sphagnum* mosses.

Localities in Poland

Specimens indicated by asterisk (“*”) have not been examined by the author. **Bc-06** – Południowobałtyckie Lakelands: Żuromino; transitional bog, among *Sphagnum* spp. (e.g., *Sph. cuspidatum* and *Sph. fallax*) and vascular plants (e.g., *Carex rostrata*, *Comarum palustre*, *Drosera rotundifolia*, *Eriophorum angustifolium* and *Menyanthes trifoliata*), 20 September 2007, leg. et det. M. Stasińska, SZUB [31]. **Bg-10** – Wschodniobałtyckie Lakelands: Wigry National Park; in community of the order *Scheuchzerietalia palustris*, rests of *Sphagnum* mosses, among *Sphagnum* spp., 30 September 2009, leg. et det. M. Halama, MH-2009-0120 [32]*. **Ec-37** – Środkowopolskie Lowlands: Laski (Dobrygość) Forest District, forest section No. 29h; *Leucobryo-Pinetum molinietosum* [30]*.

Discussion and conclusions

Armillaria ectypa, has been recorded in Poland only on three stands, although one of them, in *Leucobryo-Pinetum* [30], seems to be doubtful. This species is first of all encountered in very wet places, mostly on different kinds of peatland [11,12,17–19,22], therefore, it is unlikely to occur on such distinctly different stand as pine forest [30]. The other two stands, where it was recorded, are on transitional bogs, the habitats typical of this species [31,32]. According to Ohenoja [19] *A. ectypa* is a good indicator of the mesotrophic mire habitats.

Apart from a high water availability and fertile microhabitat, a low nitrogen content in the soil is probably an essential factor determining the occurrence of *A. ectypa* [33]. This is probably why fruiting bodies of *A. ectypa* has not been found on the transitional bog near Żuromino (despite the search in 2010 and 2012) strongly influenced by the great amount of biogenic compounds, including nitrogen from the surrounding arable lands.

Observed for many years all over the world, drainage and degradation of waterlogged areas, swamps and peatland [34–36] cause, that *A. ectypa* is a threatened species all over Europe [9], and probably critically endangered since in some countries it has not been recorded for many years, e.g., in Germany [37,38] and Switzerland [39]. In many countries it is a rare species, recorded on a single or few stands [9]. Only in Finland it was found on over 30 stands [19]. In 11 out of 17 countries, where *A. ectypa* is known, it was included into the red list of fungi, e.g., in the Czech Republic (critically endangered CR [40]), Denmark (endangered EN [7]), Great Britain (endangered B [41]), Germany [category 1 (critically endangered CR) [38]] and Russia – Tula region (category 2, [24]). The species is also included in the preliminary European fungal red list [33].

In Poland, *A. ectypa* belongs to an extremely rare species as it can be seen from the number of recorded stands. Moreover, it is a threatened taxon due to its occurrence in the habitats strongly saturated with water such as different peatlands, which have been undergoing fast and unfavorable alterations for many years [36]. Therefore, taking into account the above reasons, marsh honey like some other taxons [42] is warrant being placed on the red list of macrofungi [43].

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