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ORIGINAL PAPER

First records of a rare polyporoid fungus, *Odoria alborubescens*, in Poland

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ABSTRACT

Odoria alborubescens (Romell) V. Papp and Dima is a very rare polypore species inhabiting only the wood of *Fagus* spp. It is considered one of the 21 species of indicator fungi in old-growth beech forests. In recent years, four localities of *O. alborubescens* have been found in the *Galio odorati-Fagetum* and *Luzulo pilosae-Fagetum* in the Bukowa Forest in Western Pomerania (ATPOL AB 94 square). Two sites are located in nature reserves (the Osetno reserve and the Źródliskowa Buczyna Nature Reserve in memory of Jerzy Jackowski), and two sites are located in the managed forests of the Gryfino Forest District (*Luzulo pilosae-Fagetum* – natural habitat 9110 Natura 2000). Basidiomata of *O. alborubescens* were found on two standing trees and on two lying logs of *F. sylvatica*. The work characterizes the positions of the basidiomata, presents the macro- and micromorphological characteristics of basidiomata, and compares them with data from the literature. The Polish name porowonniak bukowy of the species was proposed. The identification of the species in relation to the very similar polypore *Pappia fissilis* is discussed. The discovery of *O. alborubescens* for the first time in Poland confirms the presence of well-preserved beech forests in this site, and proves its high natural value. The result of the study documents proves a wider range of the occurrence of *O. alborubescens* in Europe, and draws attention to the occurrence of this species of fungus, not only in beech forests protected for long time in nature reserves, but also in oldgrowth stands of managed beech forests.

KEY WORDS

beech, Bukowa Forest, *Fagus sylvatica*, lignicolous fungi

Introduction

Fungi provide important functions in nature. They are crucial for the existence of ecosystems, particularly for forest ecosystems and the other organisms living in them (Treseder and Lennon, 2015; Zanne *et al*., 2020). About 90% of the known species of fungi are associated with plants or products of plant origin. Fungi growing on dead and living wood constitute an important group among plant-associated fungi. One of the most essential fungi originating from this group are the polyporoid fungi, which, due to the synthesis of numerous ligno- and cellulolytic enzymes,

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decompose the macromolecular components of the wood cell walls (cellulose, hemicelluloses, and lignin), thus enabling the circulation of nutrients in nature (Rayner and Boddy, 1988; Watkinson *et al*., 2015). Conservatively, prior to the period of intensive genetic research, there were approximately 400 species of polyporoid fungi in Europe (Ryvarden *et al*., 2017), and about 250 have been found in Poland so far (Karasiński *et al*., 2015). Most of the representatives of this group are saprotrophs that decompose dead wood, but there are also tree and shrub parasites, and ectomycorrhizal symbionts. Some of these species need specific hosts/substrates for their development, *e.g*., very old trees that are several hundred years old, *e.g*., oaks – *Buglossoporus quercinus* (Schrad.) Kotl. and Pouzar (Szczepkowski *et al*., 2019), or larches – *Laricifomes officinalis* (Vill.) Kotl. and Pouzar (Piętka and Szczepkowski, 2004, 2011).

Another polyporoid fungus, *Odoria alborubescens* (Romell) V. Papp and Dima, is known from only the large dead wood of *Fagus sylvatica* L. and *F. orientalis* Lipsky, and it is considered to be one of 21 fungi indicator species of old-growth beech forests (Christensen *et al*., 2004; Papp and Dima, 2018). According to Dvořák *et al*. (2014), the records on *Populus* wood and *Fraxinus excelsior* L. raise doubts. This species was originally described as *Phaeolus albosordescens* var. *alborubescens* from Fontainebleau Forest in France (Bourdot and Galzin, 1925). *O. alborubescens* has two obligate synonyms, *Aurantiporus alborubescens* (Bourdot and Galzin) H. Jahn, and *Tyromyces alborubescens* (Bourdot and Galzin) Bondartsev (Bernicchia and Gorjón, 2020). It is a very rare species known from only a few countries in Europe, *i.e.* Belgium, Czech Republic, Denmark, England, Germany, Hungary, Italy, Slovakia, and Sweden (Fritz *et al*., 2010; Dvořák *et al*., 2014; Papp and Dima, 2018; The Global, 2023). Outside Europe, the species was reported in Armenia, Iran, and Russian Caucasus (Ryvarden and Gilbertson, 1994; Ghobad-Nejhad, 2011; Ghobad--Nejhad and Bernicchia, 2019). *O. alborubescens* is very rare in the entire range of its occurrence. It has the status 'under assessment' on The Global Fungal Red List Initiative (The Global, 2023). It is included in the red lists of three countries, *i.e*., England: Vulnerable (unofficially VU in 2006) (The Global, 2023), Denmark: Endangered (EN) (Læssøe, 2019), and Sweden: (EN) (SLU Artdatabanken, 2020). Among Polish naturalists and mycologists, *O. alborubescens* seems to be unknown and may be confused with the more widespread *Pappia fissilis* (Berk. & M.A. Curtis) Zmitr.

The aim of the work is to present information about the species new to the mycobiota of Poland, and the characteristics of the localities of this rare polyporoid fungus associated with old, well-preserved beech forests.

Materials and methods

Study area. The Bukowa Forest near Szczecin (NW Poland) is a compact forest complex, occupying most of the Wzgórza Bukowe (Beech Hills) range (about 15 km long and 10 km wide), which has the form of a high moraine embankment (up to 150 m above sea level) with a very varied relief and great differences in relative height. The hills are divided by numerous ravines and gorges, and a dense network of streams that originate in springs bursting out on the slopes of the hills. The Wzgórza Bukowe Hills (Natura 2000 area also have) has very diverse microclimate and soil conditions, which are directly reflected in great species and ecosystem diversity, *e.g*., about 1,100 taxa of fungi have been found there so far (Łyczek and Domian, 2010; G. Domian unpublished data).

The area of Puszcza Bukowa (Bukowa Forest) is unique on a supra-regional scale, primarily due to the large area of very diverse beech forests of natural origin. There is a whole range of forest communities with the dominance of beech in the tree stand, from various forms of *Luzulo pilosae-*

-*Fagetum* W. Mat. et A. Mat. 1973, and phytocoenoses with vegetation typical of acidophilous beech and oak forests, through to poorer variants of *Galio odorati-Fagetum* Rübel 1930 ex Sougnez et Thill 1959 with the massive *Festuca altissima* All., and fertile *Galio odorati-Fagetum*, with a full range of species for habitats of this type, to floristically rich *Mercuriali-Fagetum* Cel. 1962 and oak-hornbeam communities. Fertile and acidophilous beech forests cover an area of nearly 5,500 hectares. At the same time, it is a site where the forest cover has been continuous for hundreds of years (Pajewski, 2010). Although these forests were used economically to varying degrees of intensity, fragments of a primeval nature have survived to this day, especially in nature reserves under protection for over 60 years (Domian and Ziarnek, 2010).

Currently, a significant part of the Wzgórza Bukowe has been under legal protection as the Szczeciński Park Krajobrazowy Puszcza Bukowa (Szczecin Landscape Park Bukowa Forest) since 1991, as the Site of Community Importance, Wzgórza Bukowe PLH320020 since 2004, and as the Natura 2000 Special Habitat Conservation Area, Wzgórza Bukowe PLH320020, since 2007 (Domian and Ziarnek, 2010). There are seven nature reserves in this area, including the Osetno reserve – the only reserve in Poland for which the main protection objective is to preserve many sites of several dozen rare and endangered species of macrofungi (Rozporządzenie, 2008). A total of 546 species were found there, including eight legal protected and 109 from the Red List of fungi in Poland (G. Domian, unpublished).

Methods

Data were collected between 2008 and 2020. Basidiomata from each site were photographed (Digital Camera Fujifilm FinePix HS 30 EXR) in the field, in their natural environment. The collected specimens were identified based on morphological features (Clémençon, 2009), via light microscopy (Nikon Eclipse E-400 with immersion lens, Delta Optical ProteOne with immersion lens, and the DLT-Cam PRO 3MP USB 3.0 microscope camera). The dried material was rehydrated with 5% KOH, and stained with Congo red in ammonia and Melzer reagent. All measurements were performed directly using a light microscope equipped with an oil immersion objective (×100). The spore dimensions were established from the measurements of 50 randomly selected, well-formed spores (deformed or atrophied spores were excluded from the analysis). The 95% population limits for the mean were calculated, and the lower and upper values are given. For other structures, extreme size values were presented, and the dimensions of these structures were obtained after measuring 25 elements. Q represents the length (L) – width (W) ratio of individual spores; Q av is the average of these measurements. Specimens were identified using the following monographs: Ryvarden *et al.* (2017), Bernicchia and Gorjón (2020), and Rivoire (2020). The collected specimens were deposited in the Fungarium of the Department of Forest Protection of the Warsaw University of Life Sciences SGGW (WAML). The names of fungi are cited according to the MycoBank database (Robert *et al.*, 2005). The degree of wood decomposition was determined on a five-point scale according to Maser *et al.* (1979). Forest communities were identified and named following Matuszkiewicz *et al.* (2012), and the plant names were according to Mirek *et al.* (2002).The names of the forest division into compartments and age of stands were according to the Forest Data Bank (2023).

Results

Description of the basidiomata of *Odoria alborubescens*. The basidiomata are annual, pileate, sessile, semi-circular, ungulate, and usually grow in groups (imbricate) and less often singly. The sizes of the basidiomata range from a few centimeters in the initial growth phase to a dozen or so,

and sometimes several dozen centimeters in the maturity phase. The largest basidioma, growing at the base of a thick trunk just above the ground, was 50 cm long, 39 cm wide, and 16 cm thick (site 2). The basidiomata are sappy, and watery to waxy when young, but when they dry out, they become hard, brittle, and dense, and they shrink and become dark. The pileal surface is velutinous, pubescent, warty, and irregularly tuberculate, with small tufts of hypha, almost smooth when old. The pileus color changes with age, from white, flesh-colored, and cream, through pinkish-burgundy to brown. Pores ranging from round and oval to angular and elongated, 3-4 per mm, beige. Tube layer, concolorous with pore surface, is whitish, yellowish, to rusty, up to 2.4 cm. The context is whitish-fleshy to pinkish in color, initially quite compact, zoned, and loosening radially as the basidioma grows, up to 3.2 cm thick. Flesh turns burgundy with 5% KOH (Fig. 1e). This reaction is also observed in the context of dried basidiomata. Basidiomata have an intense, pleasant, sweetish-fruity aroma, reminiscent of the smell of apricots, which persists (with less intensity) also after drying. Hyphal system monomitic, generative hyphae in the context (are) hyaline with clamps, thick-walled, and branched 3-7 µm wide, often with a jelly-like substance, and clustered together (Fig. 2a, 2b); hyphae of the tube layer, thin-walled, clamped, 2.5-4.5 µm wide (Fig. 2c, 2d). Basidia, 24.1-35 × 5.6-7.4 µm, club-shaped, with basal clamp and four sterigmata (Fig. 2f). Basidiospores 5.0-8.0 × 3.6-5.8 µm (av. 6.1-6.6 × 4.4-4.7 µm), Q=1.1-1.7 (Q av.=1.4) (Table 1), ellipsoidal, hyaline, and thick-walled, often with drops (Fig. 2e).

Table 1.

Comparison of basic microfeatures of *Odoria alborubescens* of examined specimens with selected descriptions

References	Features					
	Basidiospores L × W [µm]			Basidia [µm]	Width of contextual hyphae [µm]	Width of tramal hyphae [µm]
	Range	Average	Q [Q av]			
Present study WAML 1156	5.3-7 × 3.7-5.2	6.1 × 4.4	1.2-1.6 [1.4]	(-24.1)25.1-31 (-34.7) × 5.6-7.4	4.0-6.2	2.5-3.8
Present study WAML 1155	5.3-7.5 × 3.6-5.3	6.2 × 4.5	1.2-1.7 [1.4]	–	(3.5-)4-5(-6)	(2.5-)3-4(-4.5)
Present study WAML 1153	5-7.5(-8.0) × (3.5) 4.0-5.0	6.4 × 4.4	1.2-1.7 [1.4]	25-35 × 6-7	3-6	2.5-4.0
Present study WAML 1157	5.6-7.1(-7.9) × 3.9-5.2	6.2 × 4.6	1.1-1.6 [1,4]	–	3-7	(2.5-)3-4(-4.5)
Present study WAML 1154	6.0-7.4 × 4.1-5.8	6.6 × 4.7	1.3-1.6 [1.4]	–	3-7	2.5-4.0
Hansen and Knudsen, 1997	5-7.5 × 4-5	–	–	–	–	–
Dvořák *et al*., 2014	5-6.5 × 3.8-4.8	5.8 × 4.3	1.2-1.5 [1.35]	25-28 × 7-8	4-6	3-4
Ryvarden *et al*., 2017	5-7.5 × 4-5	–	–	27-40 × 6-8	4-6	–
Papp and Dima, 2018	(5.9)6.0-6.3(6.6) × (4.0)4.2-4.5(4.8)	6.14 × 4.3	(1.34)1.38-1.43(1.5) [1.4]	25-29 × 6-8	4-6	3-4
Bernicchia and Gorjón, 2020	5-6.5(-7) × 4-5	–	–	25-40 × 7-8	4-6	3-4
Rivoire, 2020	5.5-7.1 × 4.1-4.9	6.2 × 4.6	–	25-30 × 6-7	(2.5-)3-5(-7)	(2-) 2.5-3.5(-4.5)

Fig. 1.

Macroscopic characters of *Odoria alborubescens*

a – basidiomata on the trunk of a broken *Fagus sylvatica* together with *Fomes fomentarius* in the subcomp. 37b (18.10.2014); b – group of basidiomata on the trunk of a live *F. sylvatica* in the subcomp. 347g (14.03.2009); c – basidioma on the log of *F. sylvatica* in subcomp. 145b (7.02.2016); d – basidiomata on the log of *F. sylvatica* in the subcomp. 231a (1.11.2018); e – cross-section through the basidioma with a visible change of context color with KOH (Photo. G. Domian)

Odoria alborubescens sites. All the stands and basidiomata presented in this paper were found and collected in the Bukowa Forest, in the State Treasury forests managed by the Gryfino Forest District (West Pomeranian Voivodeship, Gryfino County).

Site 1 – Kołowo forest subdistrict, subcompartment 347g (reference ecosystem); N 53.3181, E 14.6655; 80 m above sea level; in the *Luzulo pilosae-Fagetum* (natural habitat 9110), with a 153--year-old tree stand, on the slope of a north-facing lake basin; first basidiomata were observed on 27 August 2008 on the trunk of a dying *F. sylvatica* (in the second decay stage). A dozen or so stacked basidiomata grew from a fissured hollow on the north side of the trunk (WAML 1156; Fig. 1b). Basidiomata were observed several times until May 20, 2010 (fresh ones grew up between the old ones). During the inspection on November 28, 2010, the tree was found to have been

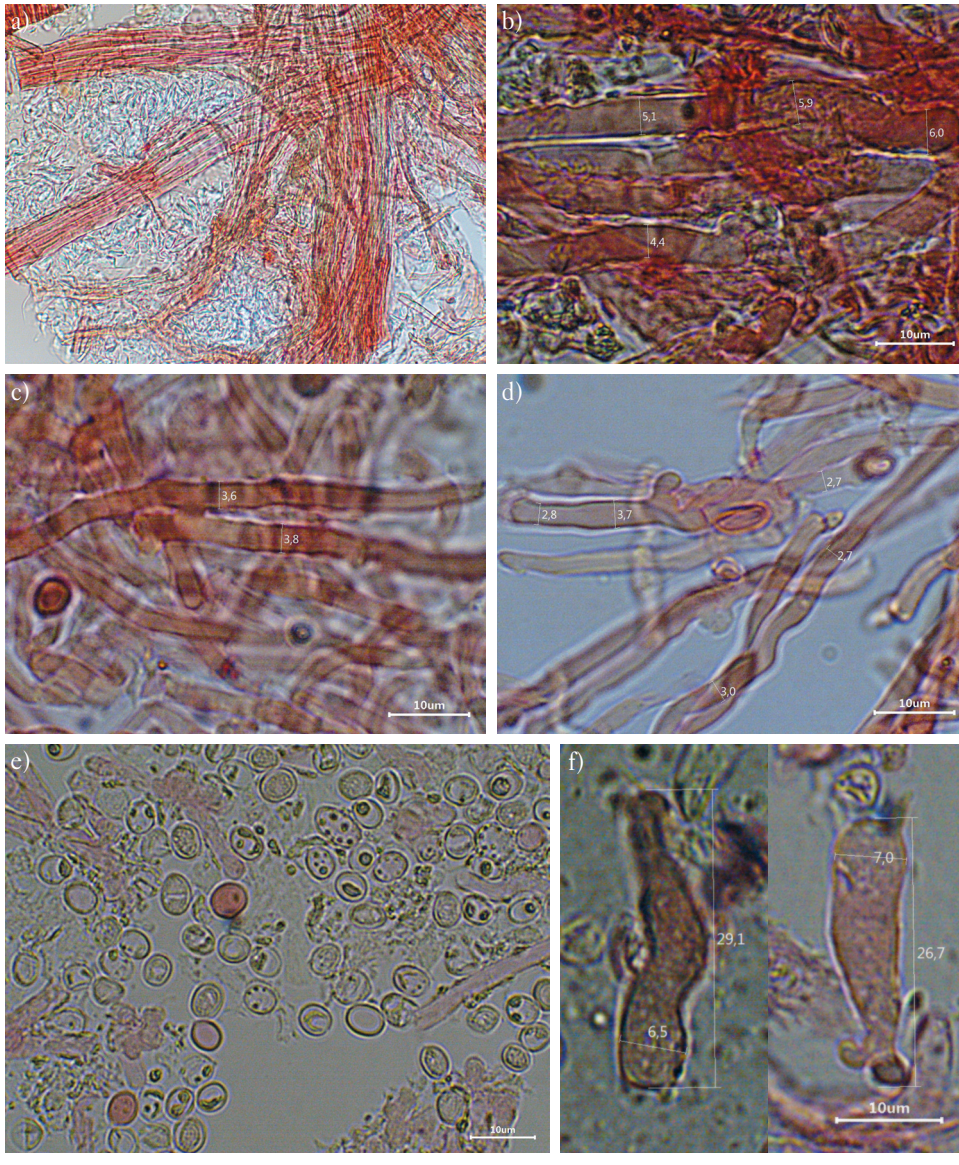

Fig. 2.

Microscopic characters of *Odoria alborubescens*

a – hyphae agglutinated in bundles in the context; b – contextual hyphae; c – hyphae in tubular trama; d – clamped hyphae of trama; e – basidiospores; f – basidia (Photo. G. Domian)

cut down. After six consecutive years without any basidiomata observed, one basidioma was observed on December 4, 2016, on the stump remaining from the felled trunk and also on the north side (WAML 1155).

Site 2 – Osetno nature reserve, Glinna forest subdistrict, subcompartment 37b; N 53.3109, E 14.7717; 68 m above sea level; in the fertile *Galio odorati-Fagetum* (natural habitat 9130) with a 143-year-old stand, on the standing trunk of a dead and broken *F. sylvatica* in the third decay stage. Eight basidiomata were found for the first time on September 28, 2013. They grew from the trunk

on its north, east, and south sides (WAML 1153; Fig. 1a). The site was also monitored in subsequent years, observing the emergence of young basidiomata on June 28, 2014; September 17, 2015; July 7, 2016; August 2, 2017; and June 3, 2018. In later years (2019-2022), the fungus stopped fruiting, although the trunk was still standing. Basidiomata of other species were also observed on the same trunk: *Fomes fomentarius* (L.) Fr., *Ischnoderma resinosum* (Schrad.) P. Karst., *Phleogena faginea* (Fr. and Palmquist) Link, *Clitopilus hobsonii* (Berk. and Broome) P.D Orton (on the basidioma of. *F. fomentarius*), and on the broken part of the same beech trunk lying on the ground, sporocaps of *F. fomentarius*, *P. faginea*, *Oudemansiella mucida* (Schrad.) Höhn., *Xylodon paradoxus* (Schrad.) Chevall., *Trametes hirsuta* (Wulfen) Lloyd, and *Hypoxylon* sp. were observed.

Site 3 – Klęskowo forest subdistrict, subcompartment 145b (managed stand); N 53.3452, E 14.6956; 65 m above sea level; in the *Luzulo pilosae-Fagetum* (natural habitat 9110) with a dominant beech stand aged about 30-40 years, coming from natural regeneration and with residual trees at the age of about 170 years; on a decaying log of *F. sylvatica* (in the fourth decay stage), two basidiomata found on February 7, 2016, grew on the northern face of the log (WAML 1157; Fig. 1c). At the opposite end of the same log, the basidiomata of *Cerrena unicolor* (Bull.) Murrill and *Mycoacia nothofagi* (G. Cunn.) Ryvarden occurred.

Site 4 – Źródliskowa Buczyna Nature Reserve in memory of Jerzy Jackowski, Glinna forest subdistrict, subcompartment 231a; N 53.2952, E 14.7121; 62 m above sea level; in the *Galio odorati-Fagetum* (natural habitat 9130) with a 184-year-old stand; on a heavily decomposed log of *F. sylvatica* (in the fourth decay stage); several fused basidiomata were found on November 1, 2018, and they grew from the southwestern face of the log (WAML 1154; Fig. 1d). Once again, the basidiomata were observed on February 1, 2020. The basidiomata of *F. fomentarius* were observed on the same log.

Discussion

Odoria alborubescens is an interesting, rare species associated with old beech forests, whose biology and ecology were recently discussed by Papp and Dima (2018). It is known from less than 200 localities worldwide and is restricted to lowland old-growth beech stands in Europe and the Caucasus (The Global, 2023).

In Poland, *Fagus sylvatica* is one of the main deciduous forest-forming species. It occurs both in the lowlands and in the foothills and mountains, and forests with dominance of beech as the occupy 578,000 hectares, which is 6.2% of the Polish forest area (Statistics Poland, 2022). Many valuable beech forests are protected within national parks, where they occupy 25.6% of the forest area, or have been placed under reserve protection (Statistics Poland, 2022). In nature reserves located within the State Forests, the area occupied by forests with the dominant beech equals 11.68% (Referowska-Chodak, 2006). Recently, the share of overmature beech stands in managed forests has also been increasing (Kłapeć *et al*., 2009). Our recent discovery of four localities of this fungus in one ATPOL square (10×10 km; AB 94) on four beech trees is more than published locations in France, Belgium, Slovakia, Hungary (one locality each), and the Czech Republic, where the fungus is known is from two sites, one of which is located in forests with a relatively short history of spontaneous development, *i.e.,* in a nature reserve established in 1975 (Dvořák *et al*., 2014). From two localities, it is also recorded in Sweden (The Global, 2023). However, it cannot be ruled out, that this fungus already occurs in a greater number of sites in the above-mentioned countries. The two localities of the fungus that we found are in nature reserves. One of them, the Osetno reserve, with a much shorter history than the one cited above in the Czech Republic, was established in 2008 on an area of 112.22 ha (for the most part, it had already been protected since 1982 as protection zones for birds of prey). It is characterized by a very high

diversity of lignicolous fungi (Domian and Ziarnek, 2010). The second reserve, the Źródliskowa Buczyna Nature Reserve in memory of Jerzy Jackowski, was established almost 70 years ago (in 1956), on an area of 155.44 ha, in order to preserve beautiful fragments of beech forests (including wet oak beech forest with orchids), riparian forests, and swamp alder forests (Zarządzenie, 2017). The Źródliskowa Buczyna reserve is under strict protection, while the Osetno reserve is under active protection, without forest stands thinning cuttings. In other countries (for example, the Czech Republic, France, Sweden, and Hungary), the localities of this fungus were usually found in protected forests or forests planned to be protected (Fritz *et al.*, 2010; Dvořák *et al.*, 2014; Papp and Dima, 2018).

The other two Polish sites of *O. alborubescens* lie in managed forests, in natural habitat 9110, which is protected in the area of Beech Hills Natura 2000, and it is subject to forest management restrictions under the Protective Task Plan (Zarządzenie, 2014). It can be said that these two places are an obvious example of the positive impacts of foresters' protective measures (*e.g.* leaving old residual trees, old-growth clumps) on the occurrence of valuable mycobiota species. The condition of the beech forests and the presence of the fungus in question in forests with a relatively short history of spontaneous development suggests that the population of this species may be much more numerous and richer in terms of the number of localities in Poland. On the other hand, in countries where the natural diversity of beech forests is much more highly recognized than in Poland, *O. alborubescens* is recorded from only a few (Germany) to several dozen sites (approx. 24 sites for approx. 50 trees in England, and approx. 35 sites in Denmark) (The Global, 2023). The sites of *O. alborubescens* discovered in north-western Poland confirm the views on the distribution of this species in Europe, that indicate that this species prefers lowland beech forests in (sub)ocean areas. Therefore, in Poland *O. alborubescens* should be expected to occur mainly in the beech forests of Baltic coastal area. Despite in recent years several sites far from the sea have been discovered (in Czech Republic, Slovakia and Hungary) (Dvořák *et al.*, 2014), the extensive Carpathian beech forests in Poland (*e.g.* in the Bieszczady Mts.) seem to be less favourable for this species, probably due to harsher climatic conditions.

O. alborubescens inhabits old, probably still living beech trees, and continues its development on dead trees and on fallen logs, causing a white type of wood decay in the central, near-core part of the trunk (Christensen *et al.*, 2004; Ryvarden *et al.*, 2017). In our research, the basidiomata were found on a broken tree trunk (DBH 73 cm), on a living tree trunk with the first symptoms of dying (DBH of approx. 70 cm), and on two logs in an advanced stage of decomposition, with diameters of approx. 40 and 50 cm in places where basidiomata grew. Similar (60 cm) dimensions of beeches inhabited by *O. alborubescens* are given by *e.g.*, Dvořák *et al.* (2014). On the trunks of still-standing trees, we found basidiomata from the base of the trunk to a height of about 2 m. In Sweden, it has been recorded up to 2.9 m (Fritz *et al.*, 2010). On the trunks of trees felled by the wind, basidiomata grew on the side surface of the log. Many of the basidiomata were fused together. The dimensions of the basidiomata were generally within the limits reported in the literature, *e.g.*, up to 36 cm long, 12 cm wide, and 14 cm thick (Dvořák *et al.*, 2014); 13 × 4 × 3-7 cm (Ryvarden *et al.*, 2017) and 5-14 × 2-7 × up to 6 cm (Papp and Dima, 2018). Noteworthy, however, is one very large, single basidioma at site 2, whose dimensions (50 cm long, 39 cm wide, and 16 cm thick) clearly exceeded the sizes given in the literature, which may indicate favorable conditions for the development of the fungus. The values of micro-traits in the analyzed basidiomata were within the ranges of values reported by other authors. In the specimens collected in winter, the hymenium was collapsed and therefore basidia dimensions were not given (Table 1). The appearance of basidiomata on the same tree was observed for the longest period of six consecutive years (2013-2018) at site 2. In the next three years (2019-2022), we did not find basidiomata.

Perhaps this was due to the drying of the trunk due to insufficient rainfall during the long-term drought in Western Pomerania (Statistical Office in Szczecin, 2022), and/or the abundance of species (eight) of fungi competing for the substrate (Heilmann-Clausen and Christensen, 2005). On beeches inhabited by *O. alborubescens*, we found the co-occurrence of one taxon of the ascomycete (*Hypoxylon* sp.) and nine species of basidiomycetes (*Cerrena unicolor*, *Clitopilus hobsonii*, *Fomes fomentarius*, *Ischnoderma resinosum*, *Mycoacia nothofagi*, *Oudemansiella mucida*, *Phleogena faginea*, *Trametes hirsuta*, and *Xylodon paradoxus*). One coexisting species of *O. alborubescens* was mentioned in the literature: it was *F. fomentarius* (Fritz *et al*., 2010; Dvořák *et al*., 2014). The Polish name porowonniak bukowy of the species is proposed.

Pappia fissilis is widespread, although not common (Ryvarden and Gilbertson, 1994), also in Poland (Piątek, 1999; Szczepkowski, 2007; Neubauer and Szczepkowski, 2012), and it is morphologically the most similar to *Odoria alborubescens*, but the latter differs in terms of a strong sweet smell, a more hirsute pileus, the pinkish context of young basidiomata, the remarkable maroon to reddish reaction with KOH, the absence of chlamydospores in the context, and the larger basidia and basidiospores. In addition, *O. alborubescens* is exclusively associated with beech forests, and grows only on *Fagus* spp. This is not like *P. fissilis*, which grows in a variety of forest types, as well as in synanthropic habitats (*e.g.*, parks, avenues, and woodlots in cities, and in orchards of fruit trees), and has a wide spectrum of host trees.

Conclusions

The discovery of *O. alborubescens* for the first time in Poland, in the Bukowa Forest (NW Poland), confirms the presence of well-preserved beech forests in this site, and proves its high natural value.

In order to estimate the population of *O. alborubescens* in Poland, it is necessary to carry out an inventory of beech forests – in the first place, those with a long history of spontaneous development in terms of the occurrence of this fungus.

The result of the study is the documentation of a wider range of the occurrence of *O. alborubescens* in Europe, and drawing attention to the occurrence of this species of fungus, not only in beech forests with a long history of passive protection, but also in the most valuable parts of managed beech forests.

Authors' contributions

GD – research concept, field research, specimen identification, writing of the manuscript, photographic documentation; AS – research concept, specimen identification, writing of the manuscript.

Conflict of interests

The authors declare no conflicts of interest.

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STRESZCZENIE

Pierwsze stwierdzenia rzadkiego grzyba poliporoidalnego *Odoria alborubescens* w Polsce

Odoria alborubescens (Romell) V. Papp & Dima jest bardzo rzadko notowanym gatunkiem grzyba poliporoidalnego, znanym dotychczas z mniej niż 200 stanowisk zlokalizowanych na terenie 9 krajów Europy: Belgii, Czech, Danii, Anglii, Niemiec, Węgier, Włoch, Słowacji i Szwecji (Fritz i in. 2010; Dvorak i in. 2014; Paap i Dima 2018), a poza Europą w Armenii, Iranie i rosyjskim Kaukazie (Ryvarden i Gilbertson 1994; Ghobad-Nejhad 2011; Ghobad-Nejhad i Bernicchia 2019). Zasiedla wyłącznie drewno starych buków i jest uznawany za jeden z 21 gatunków grzybów wskaźnikowych dobrze zachowanych lasów bukowych (Christensen i in. 2004).

W latach 2008-2020 stwierdzono *O. alborubescens* także w Polsce: w Puszczy Bukowej koło Szczecina, objętej w całości ochroną jako Szczeciński Park Krajobrazowy „Puszcza Bukowa" i zarazem jako obszar Natura 2000 Wzgórza Bukowe PLH320020. Tutejsze lasy zarządzane są przez Nadleśnictwo Gryfino i na przeważającej powierzchni podlegają użytkowaniu gospodarczemu. Puszcza Bukowa jest obiektem przyrodniczym unikatowym w skali ponadregionalnej, przede wszystkim ze względu na rozległy obszar bardzo zróżnicowanych lasów bukowych o charakterze naturalnym. Żyzne i kwaśne buczyny zajmują tu powierzchnię prawie 5500 ha (w tym w 7 rezer-

watach przyrody). Łącznie na terenie Puszczy Bukowej znaleziono 4 stanowiska *O. alborubescens* – 2 w rezerwatach przyrody (Osetno i Źródliskowa Buczyna im. Jerzego Jackowskiego, w siedlisku przyrodniczym 9130 – żyzne buczyny) i 2 w drzewostanach gospodarczych, w siedlisku przyrodniczym 9110 – kwaśne buczyny (w tym jedno na powierzchni wyłączonej z użytkowania jako powierzchnia referencyjna). Znalezione owocniki wyrastały z pni buków o pierśnicy ok. 70 cm i kłód bukowych o średnicy ok. 40 i 50 cm, w buczynach, które osiągnęły wiek 143-184 lata. W jednym przypadku drzewostan był młodszy (30-40 lat), z przestojami 170-letnich buków.

Znalezione owocniki fotografowano bezpośrednio w ich naturalnym środowisku, a następnie pobierano ich fragmenty do dalszej identyfikacji – przy użyciu standardowych metod mykotaksonomicznych (Clemençon 2009). Zasuszone owocniki zostały zdeponowane w Fungarium Katedry Ochrony Lasu SGGW w Warszawie.

Owocniki *O. alborubescens* są jednoroczne, kapeluszowate, siedzące, półkoliste i kopytowate, wyrastają zazwyczaj w grupach (czasem zrastając się ze sobą), rzadziej pojedynczo (ryc. 1). Rozmiary owocników wahały się od kilku centymetrów w początkowej fazie wzrostu do kilkunastu, a czasem kilkudziesięciu centymetrów w fazie dojrzałości. Powierzchnia kapeluszy może być aksamitna, owłosiona, brodawkowata, nieregularnie guzowata, z małymi kępkami strzępek i prawie gładka, gdy stara. Kolor kapeluszy zmienia się z wiekiem: od białego, cielistego, kremowego, przez różowawo-bordowy, do brunatnego. Hymenofor rurkowaty, z porami od okrągłych i owalnych do kanciastych i wydłużonych, zwykle 3-4/mm. Miąższ gruby, barwy białawo-cielistej do różowawej, początkowo dość zwarty, strefowany, rozluźniający się promieniście w miarę wzrostu owocnika. Pod wpływem KOH przebarwia się na bordowy kolor (ryc. 1e). Reakcja ta jest obserwowana także w miąższu wysuszonych owocników. Zapach dość intensywny, przyjemny, słodkawo-owocowy, kojarzący się z zapachem moreli, utrzymujący się (z mniejszą intensywnością) również po wysuszeniu owocników. Najważniejsze cechy mikroskopijne zestawiono w tab. 1 i zaprezentowano na ryc. 2, porównując ich wymiary z danymi wykazanymi w literaturze. Zaproponowano polską nazwę gatunku – porowonniak bukowy.

Gatunkiem tworzącym podobne owocniki jest *Pappia fissilis*, który różni się od omawianego brakiem silnego słodkiego zapachu, mniej owłosionym kapeluszem, brakiem różowawego kontekstu u młodych owocników, brakiem intensywnej reakcji pod wpływem KOH (bordowej do czerwonawej), obecnością chlamydospor w kontekście oraz mniejszymi podstawkami i zarodnikami. Ponadto *P. fissilis* rośnie w różnych typach lasów, a także w siedliskach synantropijnych (np. parkach, alejach i zadrzewieniach miejskich oraz w sadach drzew owocowych) i ma szerokie spektrum żywicieli. *O. alborubescens* jest natomiast związany wyłącznie z lasami bukowymi i rośnie tylko na *Fagus sylvatica* i *F. orientalis*.

Stanowiska *O. alborubescens* odkryte w północno-zachodniej Polsce potwierdzają poglądy dotyczące charakteru rozmieszczenia tego gatunku w Europie, gdzie preferuje on nizinne buczyny na obszarach (sub)oceanicznych. Dlatego też w Polsce należ spodziewać się występowania *O. alborubescens* przede wszystkim w buczynach Pobrzeża Południowobałtyckiego i Pobrzeża Wschodniobałtyckiego. Mimo że w ostatnich latach odkryto kilka stanowisk znacznie oddalonych od morza (w Czechach, Słowacji i na Węgrzech), to rozległe buczyny karpackie w Polsce (m.in. w Bieszczadach) wydają się być dla tego gatunku mniej korzystne, m.in. z powodu surowszych warunków klimatycznych.

Efektem badań jest udokumentowanie szerszego niż dotychczas publikowano zasięgu występowania *O. alborubescens* w Europie oraz zwrócenie uwagi na występowanie tego gatunku grzyba nie tylko w lasach bukowych o długiej historii ochrony biernej, ale także w najcenniejszych fragmentach buczyn użytkowanych gospodarczo. Odkrycie po raz pierwszy w Polsce *O. alborubescens*

w Puszczy Bukowej potwierdza obecność dobrze zachowanych fragmentów buczyn w tym kompleksie leśnym i świadczy o jego wysokiej wartości przyrodniczej. W celu oszacowania populacji *O. alborubescens* w Polsce konieczna jest inwentaryzacja lasów bukowych (w pierwszej kolejności tych o długiej historii spontanicznego rozwoju) pod kątem występowania tego gatunku.