ACTA MYCOLOGICA
Vol. 45 (2): 133–144
2010

Dedicated to Professor Barbara Gumińska on the occasion of her eighty-fifth birthday

Octaviania asterosperma (hypogeous Basidiomycota) Recent data to ecology and distribution

PIOTR MLECZKO[1], MACIEJ KOZAK[1]
MARIA ŁAWRYNOWICZ[2] and GRZEGORZ DUBIEL[3]

[1]Institute of Botany, Jagiellonian University, Lubicz 46, PL-31-512, Kraków, ubmleczk@cyf-kr.edu.pl
[2]Department of Mycology, Łódź University, Banacha 12/16, PL-90-237 Łódź, miklaw@biol.uni.lodz.pl
[3]Fałata 2 D/2, PL-43-360 Bystra, gdubiel@o2.pl

Mleczko P., Kozak M., Ławrynowicz M., Dubiel G.: *Octaviania asterosperma* (*hypogeous Basidiomycota). Recent data to ecology and distribution.* Acta Mycol. 45 (2): 133–144, 2010.

Phylogenetic analyses place *Octaviania asterosperma* in the Boletales, with *Leccinum* being the closest relative. Results of the structural investigation of *O. asterosperma* ectomycorrhiza with *Fagus* confirm this systematic position. In Europe the species is an ectomycorrhizal partner of broad-leaved trees, such as *Carpinus, Corylus, Fagus, Quercus* and *Tilia*. This paper aims at presenting the new data to the distribution of *O. asterosperma* in Central Europe. The description of the basidiocarps discovered in Poland in the recent years is also given, together with evidence for the parasitic relationship of *Sepedonium laevigatum* with *O. asterosperma.* We also present the information concerning all known localities of the species in Poland and its distribution map. Data on the ecology, distribution and status of *O. asterosperma* in Europe, and some structural aspects of basidiocarps and spores, are also summarized.

Key words: hypogeous fungi, ectomycorrhizal fungi, Boletales, *Sepedonium laevigatum*

INTRODUCTION

Taxonomical position of *Octaviania asterosperma* Vittad. has been differently interpreted by particular authors. Jülich (1984) in his monograph of European non-gilled macrofungi placed *O. asterosperma* between seven species of the genus *Octaviania* Vittad., known in Europe. Astier (1993) published description of a new species, *Octaviania olida* Malençon et Astier, increasing the number of known species to eight. However, in their work on European hypogeous fungi, Montecchi and Sarasini (2000) concluded that most species known from Europe should be regarded as the synonyms of *Octaviania asterosperma* Vittad. The differences between *Octaviania* species mentioned by Jülich (1984) were rather morphological, and included:

presence of exuded latex, colour changes of the peridium after exposure to air (no colour changes, greenish or reddish colour change), presence of sterile base, number of spores produced by single basidium (2, 2-4 or mostly 4), colour and form of gleba (diameter of cavities) and (in lesser extend) characteristics of spores (diameter range, number of spines). All those differences, however, could be connected with different stages of basidiocarp development, or different local conditions of their growth, and may be regarded as intraspecific variation (Montecchi, Sarasini 2000). *Octaviania olida* was not mentioned in the monograph of Montecchi and Sarasini (2000), but this species seems to be separate from *O. asterosperma* because of the yellowish colour of peridium and ellipsoid rather than round spores with flattened spines (Astier 1993). Thus, in most recent literature *O. asterosperma* is treated in the broad sense (of Montecchi and Sarasini 2000), and we follow this view in the present paper.

Two variants of the species name exist in the literature: *Octaviania asterosperma* Vittad. and *Octavianina asterosperma* (Vittad.) O. Kuntze, and these two names were used by different authors. David and Pegler (1995) proposed to conserve the name *Octavianina* (Vittad) O. Kuntze versus *Octaviania* Vittad., but this was not followed by Gams (1999), who found the former name only the orthographic version, and thus recommended *Octaviania* as the proper one.

Apart from Europe, the genus *Octaviania* is known from North America, Africa, Asia, Australia and New Zealand, from where a few species have been described (e.g., *O. tasmanica* (Kalchbr. ex Massee) Lloyd, *O. cyanescens* Trappe & Castellano, *Octaviania lamingtonensis* (J.W. Cribb) Pegler & T.W.K. Young, *Octaviania malaiensis* (Corner & Hawker) Trappe, T. Lebel & Castellano, *Octaviania ivoryana* Castellano, Verbeken & Thoen) (Pegler, Young 1979; Beaton et al. 1985; Castellano et al. 2000; Trappe, Castellano 2000; Trappe et al. 2002).

Taxonomical position of *Octaviania* was not certain for a long time. Together with *Sclerogaster* R. Hesse and *Wakefieldia* Corner & Hawker, the genus was placed in the family *Octavianiaceae* within Hymenogastrales (Jülich 1984) or Cortinariales (Jülich 1981; Pegler et al. 1993; Montecchi, Sarasini 2000). Close relationship of *Octaviania* with *Russula* Pers. and *Lactarius* Pers. was also suggested (Singer, Smith 1960; Hawker 1974). Phylogenetic studies, however, have proved very close affinities of *Octaviania* with boletoid genera, and now the genus is included within the family *Boletaceae*, with *Leccinum* Gray being most probably the closest epigeous relative (Binder, Hibbett 2006; Orihara et al. 2010). Indeed, the features of ectomycorrhizae formed by *O. asterosperma* and beech (Mleczko, unpublished) confirm this taxonomic position. The ectomycorrhizae closely resemble those formed by other members of *Boletaceae*. Emanating hyphae and hyphae of plectenchymatous mantle and rhizomorphs are smooth-walled and clampless. Rhizomorphs are typical boletoid, with nodia, backwardly growing hyphae and centrally arranged vessel-like hyphae. Middle mantle hyphae form ring-like pattern. Additionally, yellowish pigment can be found within hyphal cells. Characteristic features of *Octaviania asterosperma* ectomycorrhizae are swollen, cystidia-like tips of emanating hyphae, similar to those found, e.g., in ectomycorrhizae of some *Boletus* species.

In the paper we present a description of collected specimens and distribution of *Octaviania asterosperma* in Poland, and briefly discuss its ecology and status in Europe.

MATERIAL AND METHODS

Description of the basidiocarps is based on fresh and dry material. The measurements of microscopical features were taken on dry material mounted in water and 3% KOH. The information on the dimensions of spores and other structures is based on 25-30 measurements. The observations were carried out using NIKON E80i light microscope equipped with digital camera coupled with LUCIA image analysis system.

For observations in scanning electron microscope (SEM) air dried spores were covered with gold and analyzed using Hitachi S-4700 microscope (Department of Electron Microscopy, Institute of Zoology, Jagiellonian University, Kraków).

Distribution map of localities follows system adapted in Ochyra and Szmajda (1992), Cieśliński and Fałtynowicz (1993), Wojewoda (2000). Each locality was assigned to the 10 × 10 km ATPOL grid square. Geographical regions are given after Kondracki (2002).

The specimens are deposited in the mycological collection of the Institute of Botany Herbarium of the Jagiellonian University in Kraków (KRA), and in Herbarium of the Łódź University (LOD F).

RESULTS

Description of collected specimens Figs 1–18

Basidiocarps (Figs 1-4) oblong, rarely subglobose when young, mostly flattened, tuberculate to lobed, up to 2.5 cm wide and 3.5 cm long, white rhizomorphs present at base, young and mature but fresh specimens white, turning pinkish, pink-red and vinaceous red in places when touched and exposed to air, then discolouring dirty ochraceous to brownish, dull grey brown and blackish brown, surface smooth, opaque, felty in mature specimens, glabrescent in old basidiocarps, sometimes cracked in mature specimens, gleba soft, wet and "juicy", not bearing latex but in some specimens with watery exudate, whitish, yellowish white when not mature, becoming yellowish ochraceous, brownish and finally fuscous brown and dark brown at maturity, in some specimens with greenish hue in central part of the basidiocarp, marbled with white dissepiments that vary in thickness, gleba chambers in section irregular in shape, rarely round, ellipsoid or elongated, peridium 0.1-0.2 mm thick, white, discolouring pinkish red and vinaceous when cut, sterile bases mostly evident in mature specimens but reduced, sometimes extending to very short columella.

Peridium (Figs 9-10, 15) single-layered, not or hardly separable from gleba, composed of elongated, intermixed hyphae, growing paralelly to the basidiocarp surface, 3-12.5 μm in diameter, terminal elements 20-60 μm long and 4-15 μm in diameter (mean 36.4 and 6.0, respectively), mostly tapering at apex, hyphae without encrustations, yellowish to brownish, some with intracellular yellow pigment, with simple septa.

Basidia (Fig. 17a) clavate, with 1-4 sterigmata, without basal clamp, 21-28 × 10-15 μm, mean 12.3 × 24.1 μm, colourless.

Sterile elements (Figs 17b, 18) pyriform, 15-26 × 10-15 μm, mean 20.7 × 12.5 μm.

Subhymenium hyphae (Figs 13-14, 17b, 18) short-celled**,** hyphal elements swollen, 5-7 μm in diameter.

Spores (Figs 5-7) colourless when young, then yellowish, yellow, finally yellowish-brown, ellipsoid when very young, then round in outline, with appr. 1.5-2 μm thick, dextrinoid wall bearing ornamentation in form of crowded, coarse, widely conical to pyramidal, sometimes irregular spines with acute or blunt tips that may be bent, short pedicell present in some spores, spore diameter 13-18 μm (including ornamentation), mean 15.8 μm, without ornamentation 6-9 μm, mean 7.5 μm, 12-15 spines in optical cross-section (some spines adhering at their apices can be seen).

Dissepiments (Figs 11-12, 16) made of thin-walled, smooth, elongated hyphae with simple septa, 2-7 μm in diameter, growing in parallel and interwoven, mixed with distinctly swollen hyphal elements, up to 12 μm in diameter, and pigment-filled hyphae, immersed in matrix.

Aleurioconidia of *Sepedonium laevigatum* Sahr & Ammer, infecting *Octaviania asterosperma* from Gorce Mts and Beskid Sądecki Mts (Fig. 8). Spores yellow, 21-26.5 μm in diameter, mean 22.7 μm, with wall 1.7-3.5 μm thick (including ornamentation), very densely covered with tuberculate warts up to 1.2 μm high.

Localities. The fruitbodies were found in twenty two localities in Poland (Fig. 19).

Specimens indicated by asterisk (*) have not been examined by the authors.
PM – Piotr Mleczko, MK – Maciej Kozak, MŁ – Maria Ławrynowicz, GD – Grzegorz Dubiel

Eb-48 Niziny Środkowopolskie lowlands, **Pradolina Wrocławska spillway:** Wrocław Pilczyce, 120 m a.s.l. (Schröter 1889)*.

Ed-78 Wyżyna Małopolska upland, **Niecka Włoszczowska basin:** Dębowiec forest reserve near Maluszyn (Łódź province), 220 m a.s.l., in the *Tilio-Carpinetum* association, under *Quercus, Carpinus, Tilia, Corylus,* 3.08.1970, leg. MŁ, LOD F-22030.

Ee-84 Wyżyna Małopolska upland, **Góry Świętokrzyskie Mts:** Bilcza near Kielce (Świętokrzyskie province), hornbeam thicket with *Pinus*, *Quercus*, *Tilia* and *Corylus*, on calcalerous/dolomite bedrock, 14.07.2007, leg. Marcin Fałdziński (det. Tomasz Krzyszczyk) (GREJ 2010)*.

Fd-93 Outer Western Carpathians, **Beskid Śląski Mts:** Bystra near Bielsko-Biała (Śląskie province), above sanatorium buildings, 480 m a.s.l., in the *Dentario glandulosae-Fagetum* association, under *Fagus, Quercus, Picea* and *Larix,* 21.09.2005, leg. GD, LOD F-22038.

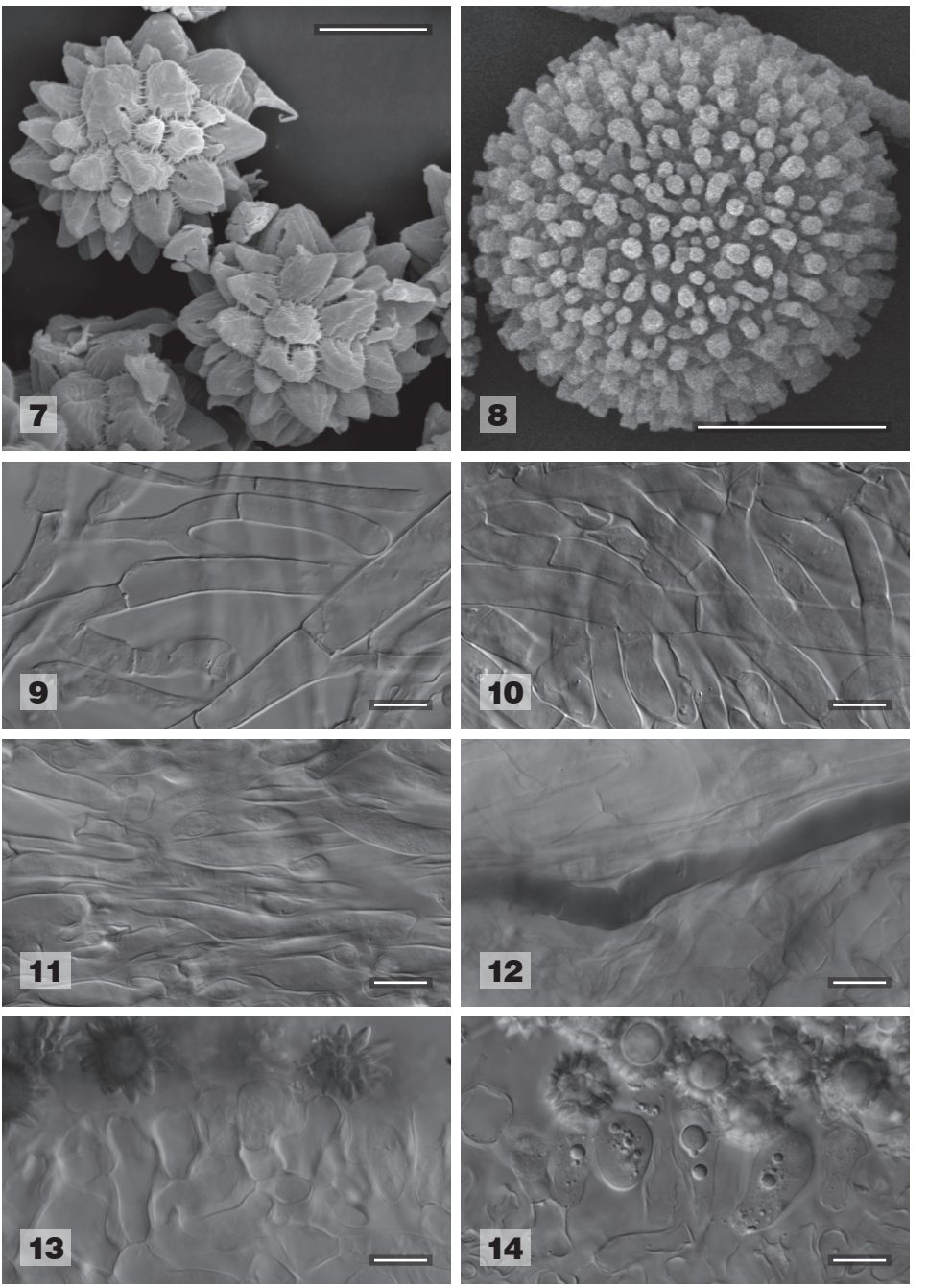
Fd-94 Outer Western Carpathians, **Beskid Mały Mts:** Żar Mt., near Przełęcz Kocierska pass, by the forest path towards Góry Maleckie Mts, 800 m a.s.l., under *Fagus sylvatica* and *Abies alba*, 06.09.2006, leg. MŁ, LOD F-22040.

Ge-20 Outer Western Carpathians, **Gorce Mts:** Koninki valley, 730 m a.s.l., slope by the main stream, under *Fagus sylvatica*, 27.08.2008, leg. PM & MK, KRA F-2008-5.

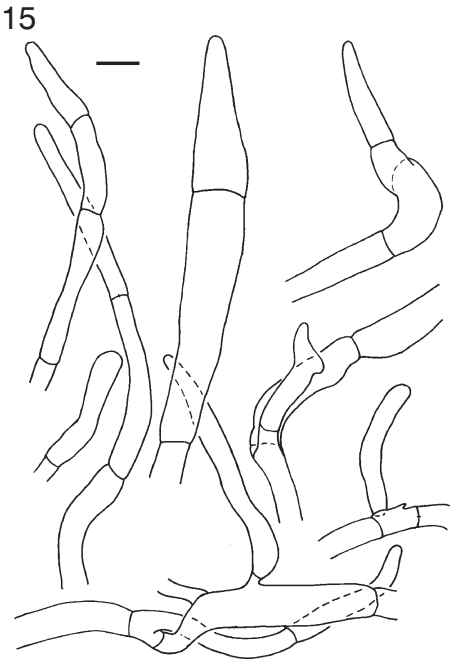
Ge-21 Outer Western Carpathians, **Gorce Mts:** Jamne valley (upper part), found on 2 localities:
(1) 900 m a.s.l., by the forest road, under *Fagus sylvatica*, 30.08.2007, leg. PM & MK, KRA F-2007-16;
(2) 970 m a.s.l. (49°33'04''N; 20°13'43''E), by the forest road, under *Fagus sylvatica*, 31.08.2007, leg. PM & MK, KRA F-2007-1;

Gorce Mts: Forędówki valley (orographic left slope), found on 3 localities:
(1) middle part of the valley, 900 m a.s.l. (49°31'17''N; 20°11'03''E), steep slope by the stream, in the *Dentario glandulosae-Fagetum* association, 9.08.2007, leg. PM & MK, KRA F- 2007-15;
(2) middle part of the valley, 830 m a.s.l., (49°31'10''N; 20°11'22''E), steep slope by the forest road, in the *Dentario glandulosae-Fagetum* association, 26.08.2007, leg. PM & MK, KRA F-2007-19;

Figs. 1-6. *Octaviania asterosperma*. 1. Mature specimen after exposure to air. 2. Basidiocarps in situ. 3. Section through mature basidiocarp. 4. Basidiocarp infected by *Sepedonium laevigatum*. 5. Spores in surface view. 6. Spores in optical section. Scale bars: for Figs 1–4 = 1 cm, for Figs 5–6 = 10 μm.



Figs. 7-14. *Octaviania asterosperma*. 7. Spores as seen in scanning electron microscope (SEM). 8. Aleurioconidium of *Sepedonium laevigatum* infecting *Octaviania asterosperma* as seen in scanning electron microscope (SEM). 9-10. Hyphae of the peridium in plane view. 11. Dissepiment hyphae. 12. Dissepiment hypha filled with yellow pigment. 13-14. Hymenium and subhymenium of mature basidiocarp. Scale bars: for Figs 7–8 = 5 μm, for Figs 9–14 = 10 μm.



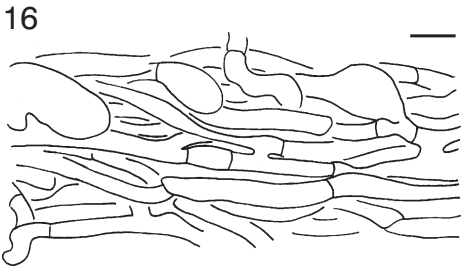
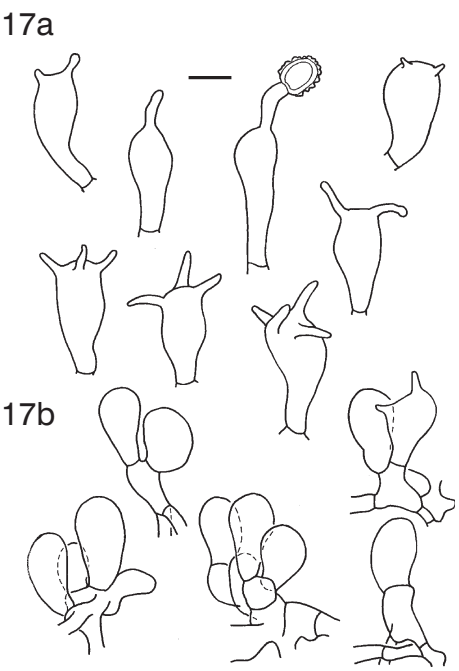


Fig. 15. Terminal elements of the peridium. Scale bar = 10 μm.
Fig. 16. Hyphae of the dissepiment (note some swollen hyphal segments). Scale bar = 10 μm.



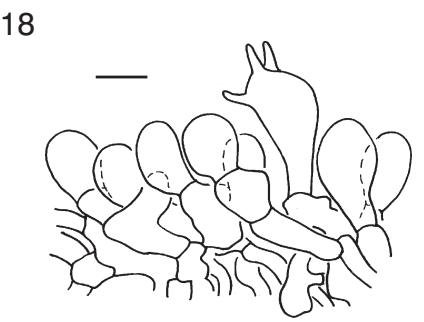


Fig. 17. a. Basidia with 1-4 sterigmata (note one basidium with young spore). b. Sterile elements of the hymenium, with subhymenial hyphal segments. Scale bar = 10 μm.
Fig. 18. Hymenium and subhymenium in section. Scale bar = 10 μm.

(3) lower part of the valley, 750 m a.s.l., (49°30'39''N; 20°12'05''E), steep slope by the stream, in the *Dentario glandulosae-Fagetum* association, 27.08.2007, leg. PM & MK, KRA F-2007-18;

Gorce Mts: Jaszcze valley (orographic right slope), found on 4 localities:

(1) middle part of the valley, by the forest path towards Borsuczyny peak, 760 m a.s.l., (49°31'24''N; 20°12'57''E), in the *Dentario glandulosae-Fagetum* association, 31.08.2007, leg. PM & MK, KRA F-2007-2;

(2) middle part of the valley, by the forest path towards Borsuczyny peak, 850 m a.s.l., in the *Dentario glandulosae-Fagetum* association, 24.08.2008, leg. PM & MK, KRA F-2008-1;

(3) middle part, close to the bottom of the valley, 730 m a.s.l., (49°31'26''N; 20°13'11''E), slope by the forest road, under *Fagus sylvatica*, 25.08.2008, leg. PM & MK, KRA F-2008-2;

(4) upper part of the valley, near the Łonna glade, 840 m a.s.l., by the main stream, in the *Dentario glandulosae-Fagetum* association, 24.08.2008, leg. PM & MK, KRA F-2008-3;

Gorce Mts: Małe Jaszcze valley, found on 2 localities:

(1) middle part, close to the bottom of the valley, 840 m a.s.l., (49°32'24''N; 20°12'52''E), in the *Dentario glandulosae-Fagetum* association, under *Fagus sylvatica* and *Abies alba*, 16.08.2007, leg. PM & MK, KRA F-2007-17;

(2) orographic right slope in the middle part of the valley, 900 m a.s.l., in the *Dentario glandulosae-Fagetum* association, 1.08.2007, leg. PM & MK, KRA F-2007-14;

Gorce Mts: Kamienica valley, below the Bieniowe glade, 900 m a.s.l., slope by the forest road, in the *Dentario glandulosae-Fagetum* association, under *Fagus sylvatica* and *Picea abies*, 10.09.2008, leg. PM & MK, KRA F-2008-10.

Ge-24 Outer Western Carpathians, **Beskid Sądecki Mts:** Roztoka Wielka valley (lower part), near Rytro (Małopolskie province), ca 470 m a.s.l., mixed forest by the stream, under *Fagus sylvatica*, 10.10.2007, leg. MK, KRA F-2007-29.

Ge-26 Outer Western Carpathians, **Beskid Sądecki Mts:** Łabowiec valley (middle part), ca 650 m a.s.l., in the *Dentario glandulosae-Fagetum* association, 10.10.2007, leg. MK, KRA F-2007-30, KRA F-2007-9.

Gf-13 Outer Western Carpathians, **Beskid Niski Mts:** Iwonicz-Zdrój (Podkarpackie province), surroundings of „Excelsior" sanatorium, ca 450 m a.s.l., under old *Fagus sylvatica* trees, 22.08.1936, 6 localities (Teodorowicz 1939)*.

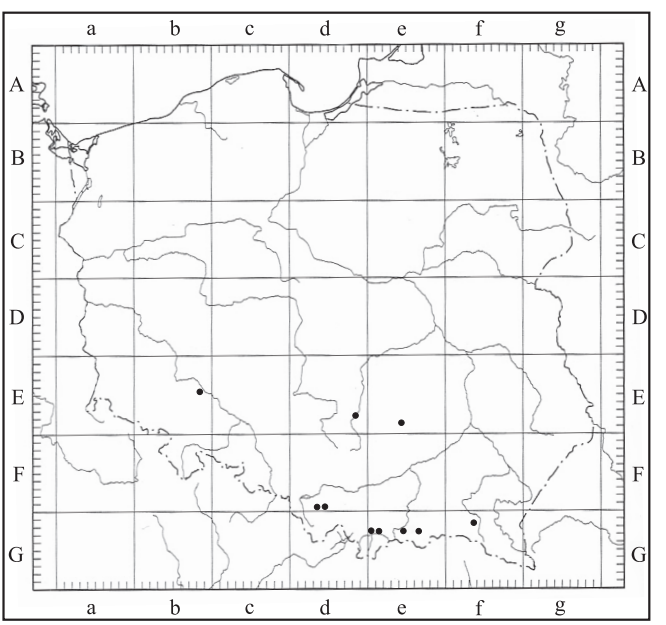


Fig. 19. Distribution of *Octaviania asterosperma* in Poland.

DISCUSSION

The mature specimens of *Octaviania asterosperma* from Gorce Mts and Beskid Sądecki Mts were very frequently colonized by a boleticolous *Sepedonium* Link species, forming yellow (due to abundant production of aleurioconidia), woolly colonies on the surface of basidiomata (Fig. 4). Careful examination of conidia under SEM allowed classification of the parasite to the species *Sepedonium laevigatum* Sahr & Ammer (Sahr et al. 1999). The infection of *Octaviania asterosperma* basidiomata by *Sepedonium chrysospermum* (Bull.) Fr. have been mentioned, e.g., by Hesse (1891), Pilát (1958), Szemere (1965), and Marchina (1985). Orihara and co-workers (2010) found Japanese species of *Octaviania* infected by *Sepedonium chrysospermum* or *S. chlorinum* (Tul. & Tul.) Dämon. This parasitic relationship is regarded as biological evidence for the phylogenetic position of *Octaviania* within Boletales (Orihara et al. 2010).

Octaviania asterosperma is a species widespread in Europe. It was found, e.g., in Austria (Dämon et al. 2008), Belgium (Thoen 1988; Lenne 2005), Bulgaria (Denchev, Assyov 2010), Czech Republic (Pilát 1958; Jülich 1984; Danihelka et al. 2008), Denmark (Lange 1956), France (Jülich 1984), Germany (Jülich 1984; Kreisel 1987; Gminder et al. 2000, Kreisel 2009), Great Britain (Hawker 1974; Pegler et al. 1993), Hungary (Szemere 1965), Ireland (National Biodiveristy Data Centre 2010), Italy (Marchina 1985; Montecchi, Sarasini 2000), Norway (Bendiksen, Molia 2009), Portugal (Calonge, Almeida 1992), Serbia (Lindtner 1935), Spain (Calonge 1990; Moreno et al. 1991; Martín et al. 1993; Rubio et al. 2005), Sweden (Kers 1983; Ingvert 2005), Switzerland (WSL 2010), The Netherlands (Jülich 1984), Ukraine (Kreisel 2001). It was recorded also outside Europe, e.g., in Mexico (Cázares et al. 1992), although this record is rather doubtful because of the clamped hyphae described and illustrated for collected basidiomata (and absent in *O. asterosperma*, according to all other authors, and not found in Polish specimens). *Octaviania* species close to *O. asterosperma* was also recorded in Japan, however, its taxonomical identity needs further investigation (Orihara et al. 2010).

Although *Octaviania asterosperma* is widespread in Europe, in some countries it is placed on red lists of threatened species, e.g., in Bulgaria (category EN – endangered, Gyosheva et al. 2006), Germany (category 3 – endangered, Benkert et al. 1992), Germany, Rheinland-Pfalz (category 3 – endangered, Zehfuß et al. 1999), Germany, Nordrhein-Westfalen (category R – endangered by extreme rarity, Sonneborn et al. 1999), Norway (category NT – near threatened, Brandrud et al. 2006), Sweden (category VU – vulnerable, Gärdenfors 2005), Switzerland (category VU – vulnerable, Senn-Irlet et al. 2007). It has not been placed on the red list of Polish fungi due to insufficient data concerning its distribution in our country (Wojewoda 2003; Wojewoda, Ławrynowicz 2006).

Until recently only three localities of this species were known in Poland, two of them were historical (before 1945; Wojewoda 2003) and one contemporary (GREJ 2010). In the present paper we introduce several new localities of this species in Poland, from Polish Western Carpathians (Gorce Mts, Beskid Sądecki Mts, Beskid Niski Mts, Beskid Śląski Mts), and one from Central Poland

(Małopolska Upland) (Fig. 19). No localities of *Octaviania asterosperma* in northern Poland have been found so far. Usually several (up to 20) basidiocarps were found in all recent localities in central Poland (Bilcza, Świętokrzyskie region; GREJ 2010), and in Gorce Mts (present paper). The collections were found either on calcareous and calcareous-dolomite bedrock (Bilcza, Dębowiec nature reserve) or sandstone bedrock with high contents of calcium (Gorce Mts, Beskid Sądecki Mts). In Carpathians *Octaviania asterosperma* was found associated with *Fagus* L., in beach-fir forest in lower altitudes, whereas in Central Poland it was found under *Quercus* L., *Carpinus* L., *Tilia* L. and *Corylus* L. Gasterocarps were always close to the surface of the soil, beneath litter, in case of old and parasitized by *Sepedonium* specimens frequently partially exposed. These ecological conditions are in accordance with data from other regions in Europe (e.g., Pilát 1958; Szemere 1965; Pegler et al. 1993; Gminder et al. 2000; Montecchi, Sarasini 2000; Lenne 2005).

Spores of *Octaviania asterosperma* have very typical ornamentation in form of large, dense, pyramidal, mostly blunt spines, up to 4 μm high. These become sometimes bent at their apices, and may also coalesce in a small group of 2-4. The study by Orihara and co-workers (2010), with the use of electron transmission microscope (TEM), revealed the structure of the ornamentation. The spines were shown to be produced by exosporium, and frequently have internal cavities. They also lack perisporium, which is one of the features that is shared by *Octaviania* and *Chamonixia* Rolland, but differentiates the genus *Octaviania* from related *Heliogaster* Orihara & Iwase (with one species described from Japan, *Heliogaster columellifer* (Kobayashi) Orihara & Iwase, previously placed within *Octaviania*) (Orihara et al. 2010).

Structural aspects of gasterocarps and the development of spores have been studied with the aid of light microscopy by Martín and co-workers (1993). They concluded that the shape of spores as well as the form of ornamentation changes considerably as the spores mature, which could have led to some erroneous descriptions by some authors (and perhaps distinguishing separate species, see Montecchi, Sarasini 2000) . The shape of the immature spores is ellipsoid but changes to round with age. The ornamentation of young spores is in form of isolated warts that elongate and take the shape of acute spines coalescing in mature spores. The authors also found no evidence for the presence of sphaerocysts in the inner layer of the peridium, reported by some authors (e.g., Montecchi, Lazarri 1988). Martín and et al. (1993) found exclusively bisporic basidia in Spanish specimens, similarly to the observations of, e.g., Pegler and co-workers (1993), whereas in Polish specimens 2-4-spored basidia were noticed. However, tetrasporic basidia were mentioned for *O. asterosperma* also by other authors, e.g., Lange (1956), Pilát (1958), Szemere (1965).

Spiny ornamentation is found in typical *O. asterosperma* form (*O. asterosperma* var. *asterosperma*), however Tulasne and Tulasne (1851) described and illustrated *O. asterosperma* var. *depauperata*, which differs in the shape of spores (ellipsoid rather than round) and form of ornamentation (transverse ridges and small blunt warts). This variety was mentioned, e.g., by Szemere (1965) and Pilát (1958), and was found originally in France. Recently, it was found also in Italy, described and illustrated by Gori (on the web page of A.M.B. Gruppo di Muggia e del Carso).

Spores of *Octaviania* species have frequently been recorded in the fecal pellets of rodents (Bennet, Baxter 1989; Blaschke, Bäumler 1989; McIntire, Carey 1989; Claridge, Lindenmayer 1998). The animals are possibly attracted by the odour produced by gasterocarps, and easy to detect in fresh, cut specimens. Analysis of rodent feces would probably help to detect more localities of *Octaviania asterosperma* in Poland, as broadleaved trees forests growing on calcareous (or at least calcium containing) bedrock, suitable habitat for this species, are frequent in southern and central Poland.

Acknowledgements. The authors wish to thank Marcin Piątek (W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków), and unknown reviewers, for their valuable comments on the manuscript.

REFERENCES

Astier J. 1993. Un Octavianina nouveau *Octavianina olida* Malençon et Astier, sp. nov. Documents Mycologiques 22 (88): 17–20.

Beaton G., Pegler D. N., Young T. W. K. 1985. Gasteroid Basidiomycota of Victoria State, Australia: 8-9. Kew Bulletin 40(4): 827–842.

Bendiksen K., Molia A. 2009. The Norwegian Mycological Database (NMD). Natural History Museum, University of Oslo, [Presented on the web by Einar Timdal] [Retrieved 9.07.2010, from the Database at: http://www.nhm.uio.no/botanisk/sopp/].

Benkert D., Dörfelt H., Hardtke H.-J., Horsch G., Kreisel H., Krieglsteiner G. J., Lüderitz M., Runge A., Schmid H., Schmitt J. A., Winterhoff W., Wöldecke K., Zehfuß H.-D., Einhellinger A., Groß G., Große-Brauckmann H., Nuss I., Wölfel G. 1992. Rote Liste der gefährdeter Großpilze in Deutschland. Deutsche Gesellchaft für Mykologie e.V. Natur Schutzbund Deutschland e.V. (NABU) Eching.

Bennet A. F., Baxter B. J. 1989. Diet of the long-nosed potoroo, Potorous-Tridactylus (Marsupialia, Potoroidae), in southwestern Victoria. Australian Wildlife Research 16 (3): 263–271.

Binder M., Hibbett D. S. 2006. Molecular systematics and biological diversification of Boletales. Mycologia 98 (6): 971–981.

Blaschke H., Bäumler W. 1989. Mycophagy and spore dispersal by small mammals in bavarian forest. Forest Ecology and Management 26 (4): 237–245.

Brandrud T. E., Bendiksen E., Hellik Hofton T., Høiland K., Jordal J. B. 2006. Sopp. Fungi. (In:) J. A. Kålås, Å. Viken, T. Bakken (eds). Norsk Rødliste 2006: 103-128. Artsdatabanken, Trondheim, Norway.

Calonge F. D., Almeida M. G. 1992. Catálogo de los Gasteromycetes de Portugal. Bol.. Soc. Micol. Madrid 16: 73–108.

Calonge F. D. 1990. Algunos Gasteromycetes interesantes de Extremadura. Bol. Soc. Micol. Madrid 14: 191–195.

Castellano M. A., Verbeken A., Walleyn R., Thoen D. 2000 (2001). Some new or interesting sequestrate Basidiomycota from African woodlands. Karstenia 40: 11–21.

Cázares E., García J., Castillo J., Trappe J. M. 1992. Hypogeous fungi from Northern Mexico. Mycologia 84 (3): 341–359.

Cieśliński S, Fałtynowicz W. (eds). 1993. Atlas of the geographical distribution of lichens in Poland. 1. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków.

Claridge A. W., Lindenmayer D. B. 1998. Consumption of hypogaeus fungi by the mountain brushtail (*Trichosurus caninus*) in eastern Australia. Mycological Research 102: 269–272.

Dämon, W., Hausknecht, A., Krisai-Greilhuber I. 2008. Database of fungi in Austria. Austrian Mycological Society [Retrieved 9.07.2010, from http://www.austria.mykodata.net].

Danihelka J., Grulich V., Antonín V., Chytrý M. 2008. Pavlov Hills. Botanical excursion guide. Department of Botany and Zoology, Masaryk University, Brno.

David J. C., Pegler D. N. 1995. (1145) Proposal to conserve *Octavianina* Kuntze against *Octaviania* Vittad. (Fungi). Taxon 44: 99–100.

Denchev C. M., Assyov B. 2010. Checklist of the larger basidiomycetes in Bulgaria. Mycotaxon 111: 279-282.

Gams W. 1999. Proposals to conserve or reject. Report of the Committee for Fungi: 8. Taxon 48: 807-810.

Gärdenfors U. (ed.) 2005. Rödlistade arter i Sverige 2005 - The 2005 redlist of Swedish species. ArtDatabanken, Uppsala, Sweden.

Gminder A., Krieglsteiner G. J., Winterhoff W., Kaiser A. 2000. Die Großpilze Baden-Württembergs. Bd. 2. Verlag Eugen Ulmer, Stuttgart.

Gori L. - A. M. B. Gruppo di Muggia e del Carso - http://www.ambmuggia.it/ipogei2/octavianina_astero_gori.htm [Retrieved: 28.07.2010]

GREJ 2010. *Octaviania asterosperma* Vitt. GREJ – Rejestr Grzybów Chronionych i Zagrożonych, nr 72963. [Retrived 13.07.2010, from http://www.grzyby.pl/gatunki/Octaviania_asterosperma.htm]

Gross G., Runge A., Winterhoff W., unter mitarbeit von Krieglsteiner G. J. 1980. Bauchpilze (Gasteromycetes s. l.) in der Bundesrepublik und Westberlin. Beihefte zur Zeitschrift für Mykologie 2: 1–220.

Gyosheva M. M., Denchev C. M., Dimitrova E. G., Assyov B., Petrova R. D., Stoichev G. T. 2006. Red List of fungi in Bulgaria. Mycologia Balcanica 3 (1): 81–87.

Hawker L.E. 1974. Revised annotated list of British hypogeous fungi. Trans. Brit. Mycol. Soc. 63 (1): 67–76.

Hesse R. 1891. Die Hypogaeen Deutschlands. Band I. Die Hymenogastreen. Verlag von Ludw. Hofstetter, Halle.

Ingvert C. 2005. Skånska ädellövskogar. Svensk Mykologisk Tidskrift 26 (2): 49–60.

Jülich W. 1981. Higher taxa of Basidiomycota. Bibliotheca Mycologica 85: 1–485.

Jülich W. 1984. Die Nichtblätterpilze, Gallertpilze und Buchpilze. Aphyllophorales, Heterobasidiomycetes, Gastromycetes. Kleine Kryptogamenflora Bd. IIb/1. Basidiomyceten. Teil. 1. Gustav Fischer Verlag, Stuttgart, New York.

Kers L.E. 1983. Några svenska fynd av hypogeiska svampar. Svensk Botanisk Tidskrift 77: 259–268.

Kondracki J. 2002. Geografia regionalna Polski. PWN, Warszawa.

Kreisel H. (ed.) 1987. Pilzflora der Deutschen Demokratischen Republik. VEB Gustav Fischer Verlag, Jena.

Kreisel H. 2001. Checklist of the gasteral and secotioid Basidiomycetes of Europe, Africa, and the Middle East. Österreichische Zeitschrift für Pilzkunde 10: 213–313.

Kreisel H. 2009. Beiträge zur Pilzflora von Mecklenburg-Vorpommern und Nordbrandenburg (Deutschland). 7. Folge. Feddes Repertorium 120 (3/4): 250–270.

Krisai-Greilhuber I. 1999. 5. Pilze. Rote Liste gefährdeter Großpilze Österreichs, 2 Fassung. (In:) H. Nikfeld (ed.). Rote Liste gefährdeter Pflanzen Österreichs, 2nd ed. Bundesmisterium für Umwelt, Jugend und Familie, Wien: 229–266.

Lange M. 1956. Danish hypogeous Macromycetes. Dansk Bot. Arkiv 16: 1–84.

Lenne M. 2005. *Octaviania asterosperma*, un champignon hypogé retrouvé au Bois de la Cambre. Revue du Cercle de Mycologie de Bruxelles 5: 55–64.

Lindtner V. 1935. Podzemne gljive u Serbiji. Revue Forestière 1: 15–18.

Lizoň 2001. Červený zoznam húb Slovenska. 3 verzia (December 2001). (In:) D. Balaž, K. Marhold, P. Urban (eds). Červeny zoznam rastlin a živočichov Slovenska. *Ochr. Prir.* 20 (Suppl.): 6–13.

Marchina E. 1985. Una specie singolare: *Octaviania asterosperma*. Bolletino Circolo Micologico "Carini" 10: 7–9.

Martín M. P., Sierra D., Tabarés M. 1993. Anatomical aspects of some hypogeous fungi from Catalonia (NE Spain). *Fol. Bot. Misc.* 9: 5–17.

McIntire P.W., Carey A.B. 1989. A microhistological technique for analysis of food habits of mycophagous rodents. US Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, Oregon, Research Paper PNW-RP-404.

Montecchi A., Lazzari G. 1988. Invito allo studio dei Funghi Ipogei IV. I Gasteromiceti. AMB, XXXI, 1-2, p. 77–92.

Montecchi A., Sarasini M. 2000. Funghi ipogei d`Europa. A.M.B. Fondazione, Centro Studi Micologici, Trento-Vicenza.

Moreno G., Galan R., Montecchi A. 1991. Hypogeous fungi of peninsular Spain II. Mycotaxon 42: 201–238.

National Biodiveristy Data Centre 2010. Irish Records from the Fungal Records Database of Britain and Ireland http://maps.biodiversityireland.ie/maps/Species_Search/SpeciesPage.aspx?taxonId=207817&datasetId=147&entryMode=DATASET_SPECIES_BROWSER_PAGE.

Ochyra R., Szmajda P. (eds). 1992. Atlas of the geographical distribution of mosses in Poland. 8. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków.

Orihara T., Sawada F., Ikeda S., Masahide Y., Chihiro T., Norihiro S., Makoto H., Iwase K. 2010. Taxonomic reconsideration of a sequestrate fungus, *Octaviania columellifera*, with the proposal of a new genus, *Heliogaster*, and its phylogenetic relationships in the Boletales. Mycologia 102 (1): 108–121.

Pegler D. N., Young T. W. K. 1979. The gasteroid Russulales. *Trans. Brit. Mycol. Soc.* 72 (3): 353–388.

Pegler D. N., Spooner B. M., Young T. W. K. 1993. British Truffles. A Revision of British Hypogeous Fungi. Royal Botanic Gardens, Kew.

Pilát A. (ed.) 1958. Gasteromycetes. (In:) Novák F.A. (ed.). Flora ČSR. Československá Akademie Věd, Praha.

Rassi P., Alanen A., Kanerva T., Mannerkoski I. (eds). 2001. The Red List of Finnish Species. Ministry of the Environment & Finnish Environment Institute, Helsinki.

Rubio E., Suárez A., Miranda M. A., Linde J. 2005. Catálogo provisional de los macromicetos (setas) de Asturias: 1–216. [Retrieved 9.07.2010, from http://www.asturnatura.com/articulos/revista/catalogo-hongosast.pdf]

Sahr T., Ammer H., Besl H., Fischer M. 1999. Infrageneric classification of the boleticolous genus *Sepedonium*: species delimitation and phylogenetic relationships. Mycologia 91 (6): 935-943.

Schröter J. 1889. Die Pilze Schlesiens. (In:) F. Cohn (ed.). Kryptogamen-Flora von Schlesien, 3 Band, 1. Hälfte. J. U. Kern's Verl., Breslau.

Senn-Irlet B., Bier G., Egli S. 2007. Rote Liste Grosspilze. Rote Liste der gefährdeten Arten der Schweiz, Ausgabe 2007. Bundesamt für Umwelt (BAFU), Bern Eidgenössische Anstalt für Wald, Schnee und Landschaft (WSL), Birmensdorf ZH.

Singer R., Smith A.H. 1960. Studies on secotiaceous fungi. IX. The Astrogastraceous series. Memoirs of the Torrey Botanical Club 21: 1–112.

Sonneborn I., Sonneborn W., Siepe K. 1999. Rote Liste der gefährdeten Großpilze (Makromyzeten) in Nordrhein-Westfalen, 1. Fassg. (In:) Rote Liste der gefährdeten Pflanzen und Tiere in Nordrhein-Westfalen, 3. Fassg. LÖBF-Schriften 17: 259–294.

Szemere L. 1965. Die unterirdischen Pilze des Karpatenbeckens. Akadémiai Kiadó, Budapest.

Teodorowicz F. 1939. Nowe dla flory polskiej podrzędy, rodziny, rodzaje i gatunki wnętrzniaków (Gasteromycetes). Kosmos 64 (1): 83–107.

Thoen D. 1988. Catalogue des champignons hypogés de Belgique et du Grand Duché de Luxembourg. Dumortiera 41: 4–18.

Trappe J. M., Lebel T., Castellano M. A. 2002. Nomenclatural revisions in the sequestrate russuloid genera. Mycotaxon 81: 195–214.

Trappe J. M., Castellano M. A. 2000. New sequestrate Ascomycota and Basidiomycota covered by the Northwest Forest Plan. Mycotaxon 75:153–179.

Tulasne L. R. , Tulasne C. 1851. Fungi Hypogæi. Réimpression Vaals 1970, A. Asher& Co.NV.

Walleyn R. 2002. Typification of *Octaviania mutabilis*. Sterbeeckia 21/22: 66.

Wojewoda W. 2000. Note from editor. (In:) W. Wojewoda (ed.). Atlas of the geographical distribution of fungi in Poland. Fascicle 1. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków.

Wojewoda W. 2003. Checklist of Polish larger basidiomycetes. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków.

Wojewoda W., Ławrynowicz M. 2006. Red list of the macrofungi in Poland. (In:) Z. Mirek, K. Zarzycki, W. Wojewoda, Z. Szeląg (eds). Red list of plants and fungi in Poland. 3.ed. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków: 53-70.

WSL 2010. Swiss Federal Institute for Forest, Snow and Landscape Research – databank – Fungi. [Retrived 9.07.2010, from http://merkur.wsl.ch/didado/fungusweb.map]

Zehfuß H. D., Ebert H. J., Winterhoff W. 2000. Großpilze. Rote Liste der ausgestorbenen, verschollenen und gefährdeten Großpilze in Rheinland-Pfalz. Ministerium für Umwelt und Forsten, Rheinland-Pfalz.

Octaviania asterosperma (podziemne Basidiomycota) Dane do ekologii i rozmieszczenia

Streszczenie

Rosnące zainteresowanie grzybami podziemnymi sprawia, że odkrywane są nowe stanowiska dawno nie notowanych gatunków. Jednym z nich jest *Octaviania asterosperma*, podziemka gwiaździstozarodnikowa, należąca do podziemnych Basidiomycota. Wyniki analizy filogenetycznej, a także dane na temat mikoryzy *Octaviania*, stanowią argumenty za przynależnością rodzaju do rzędu Boletales. Niniejszy artykuł przedstawia dane na temat nowych oraz znanych z literatury stanowisk *O. asterosperma* wraz z mapą rozmieszczenia gatunku w Polsce. Prezentuje także opis owocników odnalezionych w ostatnich latach w południowej i środkowej części naszego kraju oraz wyniki obserwacji pasożytowania *Sepedonium laevigatum* na owocnikach podziemki gwiaździstozarodnikowej. W artykule podsumowane są również informacje na temat ekologii, rozmieszczenia i statusu gatunku w Europie, a także dane o strukturze i rozwoju owocników oraz zarodników *Octaviania asterosperma*.