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Original Research

A New Location for *Geastrum lageniforme* Vittad. in Poland

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Abstract

Our paper discusses a new location discovered for *Geastrum lageniforme* in Poland, in Las Natoliński Nature Reserve. It provides characteristics of discovered fruitbodies and a description of the habitat in which they were encountered. The location described in the paper is currently the only one of *Geastrum lageniforme* known in Poland. The species is presently considered to be critically endangered with extinction.

Keywords: *Geastrum lageniforme*, Las Natoliński Nature Reserve, Warsaw, central Poland

Introduction

Geastrum Pers. is a cosmopolitan genus, encompassing ca. 50 species, out of which 19 have been recorded in Poland [1-4]. It belongs to the family *Geastraceae* Corda, the order *Geastrales* K. Hosaka & Castellano and the phylum *Basidiomycota* Whittaker ex Moore [5]. All representatives of the genus *Geastrum* in Poland are subject to strict protection [6], and 17 of them are classified as species endangered with extinction [7]. Many of the species that belong to this genus and occur in Europe also are considered threatened with extinction and are featured in Red Lists of such countries as Bulgaria [8], Montenegro [9], Czech Republic [10], Slovakia [11], Switzerland [12], and Sweden [13]. Furthermore, 17 species are also featured in the Red List of Endangered European Macrofungi [14]. In Poland, the endangerment to the genus *Geastrum* has been assessed on the basis of the IUCN guidelines [15]. So far, the presence of *Geastrum lageniforme* has not been recorded in Poland and has been featured neither in the monograph devoted to the whole genus [3] nor in the checklist of the Polish *Basidiomycetes* [4]. So far, the presence of the species in the country has been mentioned solely in Dörfelt's monograph [1], but the location where it was found was not precisely specified.

The aim of the present paper is to describe a contemporary location of *Geastrum lageniforme* discovered in Las Natoliński Nature Reserve.

Material and Methods

Fruitbodies at various stages of development were collected in a single location. After that, fragments of dried fruitbodies that had been soaked for several minutes in 2% KOH were observed under a microscope. Furthermore, Melzer's reagent and Congo red were used in the course of microscopy analyses; observations and measurements were performed with the aid of optical microscopes, applying magnification of x1000. Spore measurements include the surface ornamentation. The collected specimens were deposed in the Fungarium of the Department of Mycology and Forest Phytopathology, Warsaw University of Life Sciences (WAML 612).

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Characteristics of Las Natoliński Nature Reserve

Las Natoliński Nature Reserve is a park founded in a place where natural forest used to grow and is situated within the boundaries of the city of Warsaw. It covers 105 ha. The area of the reserve is fenced and thus not available to the public. Access is possible only after obtaining a pass issued by the institution managing the area, which presently is Natolin European Centre [16]. The estate was named Natolin by count Stanisław Potocki and his wife, Anna de domo Tyszkiewicz, to commemorate the birth of their granddaughter Natalja (original spelling of the name) [17]. Since 1965, the buildings of historical value in the area, as well as the park itself, have been under the care of a conservation officer. Since 1991, the area has been a nature reserve. The park encompasses the area of the Vistula escarpment, which is over a dozen meters high, with ravines cutting through it, and the lower terrace of the Vistula valley, at the foot of the escarpment. The present-day condition of the forest in the area and the degree to which it has retained its natural character are factors distinguishing it from broad-leaved forest communities of the Vistula valley in the middle course of the river. Since the area has been treated as a park to a limited degree only, the natural character of the tree stands has been preserved. Four types of forest communities can be differentiated among the ecosystems that occur within the reserve. Along the watercourses there are ash-alder riparian forests (*Fraxino-Alnetum*), whereas in drier areas *Tilio-Carpinetum* stachyetosum associations dominate; in fresh hardwood forest habitats on top of the terrace a broad-leaved forest with *Tilio-Carpinetum* typicum associations is common, while the escarpment is covered with the broad-leaved forest characterized by the presence of *Tilio-Carpinetum campanuletosum* associations [16]. Many trees in the reserve have the status of natural monuments; the oldest ones are ca. 300-400 years old. The area is remarkable, especially for the presence of very old oak trees [18]. At present, no human activity within the area of the reserve is allowed, apart from removal or trimming of trees posing a threat to people or property, i.e. ones in the proximity of internal roads and paths. However, even such activities require permission from the reserve management.

Fig. 1. The location of *Geastrum lageniforme* in Las Natoliński Nature Reserve.

Characteristics of the Species and Its Location

Geastrum lageniforme Vittad. (Polish name: gwiazdosz butelkowaty – Kujawa et al. [15]) grows in dry areas, sometimes in places devoid of trees and shrubs [1]. According to Sunhede [2], this mushroom species can be encountered on sandy soil in forests with *Robinia* and, less frequently, poplar (*Populus*), as well as on strongly decomposed oak wood (*Quercus*). Additionally, Keizer [19] states that the mushroom in question can also grow on clay and sandy soil in an old deciduous forest with a *Robinia* in its species composition. Fruitbodies appear as early as June, but the peak of their abundance is observed in October [2].

Geastrum lageniforme is a cosmopolitan species. In Europe, it is the most common in the southern and central part of the continent [2]. So far, its presence has been recorded in the Netherlands [20], Great Britain [21, 22], Italy [23], Germany [1, 24], Czech Republic [10], Spain [25], Bulgaria [26], Austria [27], Slovakia [28], Hungary [29], and Greece [30]. It also grows in South America, i.e. in Brazil [31], Bolivia [32], Costa Rica [33], and Mexico [34]. Bates [35] states that it can also be encountered in North America; according to other authors it grows in Africa [36] and Australia [37], as well. In Poland, the species is subject to strict protection, and so is the whole genus *Geastrum* [6]. Since no precise data on the presence of this mushroom species in Poland was available, it was not featured in the national Red List of the Macrofungi [7]. However, in 2006 a single location of *Geastrum lageniforme* was discovered in the southern part of Las Natoliński Nature Reserve (Fig. 1). The presence of this species in Poland had previously been mentioned only by Dörfelt [1], who identified Paechnatz as its discoverer; however, the place and date of mushroom collection was not specified by the author.

Closed fruitbodies of *G. lageniforme* are spherical, with a visible protrusion in the top central part, which makes them onion-shaped or pear-shaped. The surface of fruitbodies is smooth; once it has dried it sometimes becomes wrinkled or cracked, with colors ranging from white-beige to brown. The exoperidium splits at the top, with splits reaching down to the middle of its length and forming 6-9 (5-10) triangular patches (rays) of unequal sizes, thus forming a shape that often resembles a long sack. The rays, which have long and thin ends, often fold themselves underneath the fruitbody. Developed fruitbodies are between 1.5 and 4.6 cm in diameter, while the horizontally oriented rays may reach 8 cm. The colors of the sessile endoperidium range from grey-brown to dark grey; the endoperidium may reach up to 2 cm in diameter. The peristome is conical, slightly apex, and consists of fine fibres; it usually has a clearly separated plate. The columella is either column-shaped or mace-shaped, with colors ranging from whiteish to beige in cross section. Mature spores are spherical, 4-5.5 μm in diameter, light brown, and warty [2].

Two species resembling *G. lageniforme* grow in Poland, namely *G. triplex* Jungh. and *G. saccatum* Fr. However, fruitbodies of *G. triplex* are usually much larger (endoperidium of up to 54 mm in diameter); in addition, they usually have a characteristic collar formed from the stratified fleshy layer of the exoperidium. As for the fruitbodies of *G. saccatum*, their surface is felt-like, characterized by the presence of thick-walled hyphae without clamp connections, between 1.5 and 6 μm wide [2]. A diagnostically important feature of *G. lageniforme*, which distinguishes the species from other similar ones, is the presence of the characteristic ray-shaped splits of the outer layer that uncover the fibrous layer of the exoperidium, and thick-walled capillital threads with the internal channel taking up even 50% of their diameter. In *G. triplex*, the capillitium is thin-walled and the internal channel takes up ca. 50-75% of the diameter of capillital threads, while in *G. saccatum* the capillital threads are thick-walled and the internal channel is narrow, taking up not more than 25% of their diameter [20].

Fig. 2. Area where fruitbodies of *Geastrum lageniforme* were found (Photo by J. Piętka, 29.10.2009).

Fig. 3. Fruitbodies of *Geastrum lageniforme* (Photo by J. Piętka, 11.10.2006).

The location of *G. lageniforme* (N 52º08′ 15″/E 21º04′ 47″) in Las Natoliński is situated in compartment 4r (Fig. 1), in habitat with *Tilio-Carpinetum* stachyetosum association, in the proximity of a decomposing trunk of a fallen deciduous tree (Fig. 2), beside a southern path, near a small bridge (as there is a ditch several metres away, in the westerly direction). In September (13.09.2006) we observed 4 fruitbodies, whereas in October (11.10.2006) 7 were observed (leg. J. Piętka, det. A. Kujawa). The developed fruitbodies in this location (Fig. 3) reached sizes ranging from 2 to 4.5 cm and had exoperidia with 5-8 rays; the diameters of endoperidia ranged from 15 to 19 mm. The spores were spherical, warty and of light brown color, with diameters of ca. 4.0-5.0 µm.

In compartment 4 of the reserve, in the main tree stand a visitor can encounter the following species: *Fraxinus excelsior*, *Ulmus laevis*, *Alnus glutinosa*, single specimens of *Quercus robur*, and *Acer platanoides*. In the undergrowth the following species are common: *F. excelsior*, *Corylus avellana*, *Padus avium*, *Cornus sanguinea*, and *Frangula alnus*.

Conclusions

The location in Las Natoliński is the only area of *Geastrum lageniforme* Vittad. that is currently known in Poland. Due to its location, it is not threatened by any external factors. Fruitbodies of *Geastrum lageniforme* may be mistaken with young fruitbodies of *G. triplex*, or the fruitbodies of *G. saccatum*. It is necessary to conduct further search for *Geastrum lageniforme* Vittad. in Poland. Presently, the species is considered critically endangered with extinction (CR B1a+C2a(ii); D category) [15].

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