

New Locations of Threatened and Protected *Gasteromycetes* s.l. in Northwestern Poland

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Abstract

Fifty-two new locations of 18 threatened and protected macromycete species belonging to *Gasteromycetes* s.l. were recorded between 2000 and 2009. Individual species occurred at one to twelve locations in 24 ATPOL grid square units comprising 14 mesoregions and 3 subprovinces. The locations are described and remarks on the occurrence of each species in Poland are given. Location, habitat data, fruiting abundance, and observation dates are provided for each locality.

Keywords: *Gasteromycetes*, rare and threatened macromycetes, distribution, new locations, Poland

Introduction

The threatened and protected species belonging to *Gasteromycetes* s.l. discussed below are morphologically similar. They are angiocarps and have enclosed fruitbodies in which spores are produced. However, these species differ by origin (they belong to different evolutionary lines) and development type. They are at present included in three orders: *Agaricales* (genera: *Mycenastrum*, *Langermannia*, *Lycoperdon*, *Nidularia*), *Boletales* (genus *Pisolithus*), and *Phallales* (genera: *Geastrum*, *Trichaster*, *Phallus*, *Mutinus*) [1]. These fungi are mostly terricolous saprotrophs or, less frequently, lignicolous saprotrophs (*Nidularia*, *Mutinus*). Only *Pisolithus arhizos*, which usually forms symbiosis with *Pinus sylvestris* and deciduous trees, is an ectomycorrhizal fungus [2]. Data on the mycorrhizae of *Geastrum fimbriatum* [3] have not been confirmed, due mostly to the absence of the Hartig net [4]. One species, *Phallus hadriani*, is probably a parasite of roots of grasses and other herbaceous plants.

Gasteromycete species examined here occur in a variety of forest communities, but mostly in synanthropic commu-

nities (in gardens, parks, meadows, and on roadsides). Some grow on fertile soils often rich in nitrogen, others occur on poor, sandy soils. Therefore, many of the species prefer xerothermic and anthropogenic habitats [2]. Mycological studies have not been conducted very often in such habitats [5]. Thus knowledge on the occurrence of these fungi is not full and many of these species are known from only a few locations that do not reflect their actual distribution.

Methods

Systematic and periodic mycological and botanical studies were conducted between 2000 and 2009. Some herbarium material was provided by other researchers or collectors.

As identification characters of the fruitbodies of fungal species were consistent with the descriptions in the keys [6], they are not given here. The nomenclature of the fungi was accepted after Wojewoda [7], threat categories after Wojewoda and Ławrynowicz [8], and protected species after the regulation of the Polish Minister of the Environment [9].

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The name of a respective city (town) or village is used as a point of reference for new locations of threatened and protected gasteromycete species in Poland. Physico-geographic mesoregions [10] and the ATPOL grid system units [11] modified for the purposes of mycology by Wojewoda [12] are specified (Fig. 1).

The information in the descriptions is provided as follows: name of the species, threat and protection category, location data (mesoregion, ATPOL grid square, town or village, administrative district), habitat, substrate, remarks on vegetation, number of fruitbodies, observation date, the names of the collector, and the person identifying the species (only for specimens collected/recorded by a person other than the present author). If a species occurred at a number of new locations, the locations are arranged by square number. Remarks on the distribution in Poland are given for each species.

Results

New locations of 18 species of *Gasteromycetes* s.l. are described. Of them, 15 are listed on the "Red list of the macrofungi in Poland" [8], including eight endangered taxa (E), two vulnerable taxa (V), and five rare taxa (R). Eleven species are protected, of which eight are threatened. The species were recorded at a total of 52 new locations. Individual taxa were observed at between one and twelve

new locations; however, half of the species were recorded only at one location. The highest number of new locations was recorded for *Langermannia gigantea*. The species is under protection to stop its impressive and conspicuous fruitbodies from being destroyed or damaged.

New locations of the species are situated in 24 ATPOL grid squares comprising 14 mesoregions in three sub-provinces. A total of one to seven species were recorded in individual squares (Fig. 1). The greatest number of new locations was recorded in square Ba-73 covering the northern part of Szczecin. The majority of the locations are situated in the Zachodniopomorskie Voivodeship, and only two are in the Wielkopolskie Voivodeship (Puszcza Notecka Forest).

Geastrum coronatum Pers. – V, P

Wzniesienia Szczecińskie Hills, Ba-73, Szczecin, Kasprowicz Park; on the soil; among: *Alliaria petiolata*, *Chelidonium majus*, *Geum urbanum*, *Poa annua*, *Stellaria media*, *Taraxacum officinale*, *Urtica dioica*; under: *Acer platanoides*, *Aesculus hippocastanum*, *Crataegus monogyna*, *Symphoricarpos albus*, *Syringa vulgaris*; 9 fruitbodies; 16.09.2009; leg. U. Banaś-Stankiewicz, det. S. Friedrich.

Geastrum coronatum has ca. 10 locations in Poland, the nearest in Kórnik [7, 13-17].

Geastrum fimbriatum Fr. – R, P

1. Wzniesienia Szczecińskie Hills, Ba-73, Szczecin, Leśny Arkoński Forest Park, Międzyparkowa Street; on the soil, among synanthropic vegetation, under *Pinus sylvestris* and *Picea abies*; 6 fruitbodies; 30.08.2006.
2. Wzniesienia Szczecińskie Hills, Ba-83, Szczecin, Jasne Błonia; lawn in a plane-tree alley, on the soil, under *Platanus acerifolia*; 7 fruitbodies; 15.08.2008.
3. Równina Pyrzycka Plain, Ca-16, Przelewiec, Dendrological Garden (section XXI); on the soil, among ruderal vegetation, under *Ulmus laevis*; 14 fruitbodies; 20.06.2004.

It is the most common *Gaestrum* species in Poland, known from over 60 locations [7, 15, 18, 19].

Geastrum floriforme Vittad. – E, P

Uznam and Wolin, Ba-22, Świnoujście – Warszów, near Ku Morzu Street, in the zone of the dune coast; on the soil, among lichens in tufts of *Festuca ovina*, *Spergulo-Corynephorum* grassland; 4 fruitbodies; 20.09.2009; leg. W. Kowalski, det. S. Friedrich.

In Poland, the species is known only from Poznań [20] and Puszcza Kampinoska Forest [6, 21].

Geastrum quadrifidum Pers.: Pers. – R, P

Uznam and Wolin, Ba-23, Wolin National Park, east of Międzyzdroje, near the tourist trail from Międzyzdroje toward Góra Kawcza; on the soil, in deciduous litter in *Melico-Fagetum*; 2 fruitbodies; 04.09.2008.

It occurs at 25 locations in Poland, the nearest in Słupsk [7].

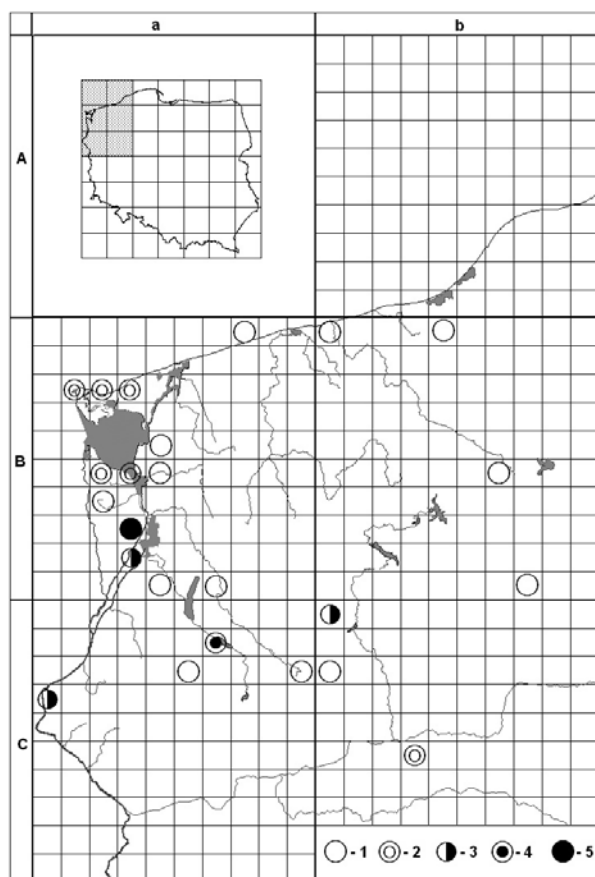


Fig. 1. The number of gasteromycete species at new locations in ATPOL grid squares. 1 – 1 species, 2 – 2 species, 3 – 3 species, 4 – 4 species, 5 – 5 species.

Geastrum rufescens Pers.: Pers. – E, P

1. Wybrzeże Słowińskie Coast, Bb-00, “Ekopark Wschodni” ecological site, E of Kołobrzeg; on a dune under shrubs of *Salix* sp.; 2 fruitbodies; 23.09.2007; leg. A. Mika-Fijałkowska, det. S. Friedrich.
2. Równina Pyrzycka Plain, Ca-16, Przelewice, Dendrological Garden (section IX); on the soil, among *Dryopteris filix-mas* and *Vinca minor*, under *Abies* sp. and *Rhododendron* sp.; 6 fruitbodies; 10.08.2009.

The species has been reported from ca. 25 locations in Poland, the nearest being Puszcza Bukowa Forest near Szczecin, Puszcza Wkrzańska Forest, Bielinek Reserve, the vicinity of Gdańsk, and Poznań [7, 14, 18, 19, 22].

Geastrum striatum DC. – E, P

1. Uznam and Wolin, Ba-21, Świnoujście, the promenade in Żeromskiego Street near the junction with Gierczak Street; on the soil, lawn, under *Taxus baccata*; 8 fruitbodies; 20.07.2008; leg. M. Ziarnek, det. S. Friedrich.
2. Wzniesienia Szczecińskie hills, Ba-73, Szczecin, roadside of Broniewskiego Street; on the soil, among grasses, under *Ulmus laevis*; 7 fruitbodies; 28.08.2007, 29.07.2008.
3. Równina Pyrzycka Plain, Ca-16, Przelewice, Dendrological Garden (sections: IV, VII, XXI); on fertile soil among litter, under: *Fraxinus excelsior*, *Taxus baccata*, *Ulmus laevis*; agglomerations of 12 to 40 fruitbodies; 20.06.2004, 30.08.2006, 18.06.2007, 29.06.2008, 10.08.2009.
4. Pojezierze Choszczeńskie Lake District, Cb-00, Kraśnik (ca 6 km SE of Recz), Recz District; on compost; from 3 to 8 fruitbodies, between 2005 and 2009; leg. A. et L. Wołejko, det. S. Friedrich.

Recorded at ca. 15 locations in Poland, the nearest in Poznań and Toruń [7, 14, 16, 20, 23].

Geastrum triplex Jungh. – E, P

1. Uznam and Wolin, Ba-21, Świnoujście, mixed forest edge on Bałycka Street; on the soil in the litter; 3 fruitbodies; 12.11.2006.
2. Uznam and Wolin, Ba-22, Woliński National Park, west of Zalesie, Międzyzdroje District; roadside of a dirt road, on the soil, under: *Acer platanoides*, *Corylus avellana*, *Crataegus laevigata*, *Sambucus nigra*; 2 fruitbodies; 10.2006; leg. M. Wróbel, det. S. Friedrich.
3. Wzniesienia Szczecińskie Hills, Ba-73, Szczecin, Wojska Polskiego Alley, forest edge by a car park on Lake Głębokie; on the soil in litter, under *Pinus sylvestris* and *Quercus robur*; 3 fruitbodies; 13.08.2006.
4. Pojezierze Myśliborskie Lake District, Ca-30, Bielinek Reserve, Wąwóz Paklonowy Gorge, Cedynia District; on the soil in deciduous litter, under: *Acer campestre*, *Fagus sylvatica*, *Quercus robur*; 12 fruitbodies; 08.09.2007.

Geastrum triplex occurs at ca. 15 locations in Poland, the nearest in Poznań [7, 20].

Trichaster melanocephalus Czern. – E, P

1. Wzniesienia Szczecińskie Hills, Ba-83, Szczecin, Żeromski Park; on the soil, under *Tilia cordata*, among: *Aegopodium podagraria*, *Dactylis glomerata*, *Ficaria verna*, *Gagea lutea*, *Poa annua*, *Poa pratensis*, *Stellaria media*, *Taraxacum officinale*, *Veronica hederifolia*, *Viola* sp.; from 4 to 10 fruitbodies; 28.08.2006, 25.06.2007, 14.07.2008.
2. Wzgórza Bukowe Hills, Ba-94, Binowo, Stare Czarnowo District, escarpment south of the church; on the soil among ruderal vegetation, in *Robinia pseudacacia* and *Acer platanoides* shrubs; 10 fruitbodies; 18.09.2004; leg. K. Ziarnek, det. S. Friedrich.
3. Równina Pyrzycka Plain, Ca-16, Przelewice, Dendrological Garden (sections: XV, XVI, XXI); on fertile soil, under: *Forsythia* sp., *Fraxinus excelsior*, *Lonicera* sp., *Populus tremula*, *Taxus baccata*, *Tilia platyphyllos*; agglomerations of 5 to 35 fruitbodies; 20.06.2004, 30.08.2006, 26.09.2007, 22.10.2008, 08.07.2009.
4. Pojezierze Myśliborskie Lake District, Ca-30, Bielinek Reserve, Wąwóz Storczykowy Gorge, Cedynia District; on the soil, under *Fagus sylvatica*, *Luzulo pilosae-Fagetum* beech grove; 5 fruitbodies; 08.09.2007.
5. Pojezierze Choszczeńskie Lake District, Cb-00, Grądowe Zbocza Reserve, Recz District; on the soil, in the field layer, under *Fraxinus excelsior*, streamside alder-ash forest, *Circaeo-Alnetum*; ca. 40 fruitbodies; 23.08.2005; leg. W. Wołejko, det. M. Łyczek et S. Friedrich.

Trichaster melanocephalus has ca. 20 locations in Poland, including five in Pomerania [7, 15, 22].

Langermannia gigantea (Batsch: Pers.) Rotk. – P

1. Równina Goleniowska Plain, Ba-44, Machowica, Przybiernów District; a peat heap in a pasture, on the soil, among *Urtica dioica*; 7 fruitbodies; 28.09.2000.
2. Równina Goleniowska Plain, Ba-54, Widziensko, Stepnica District, ravine on the Gowienica; on the soil, streamside alder-ash community, under *Ulmus laevis* and *Alnus glutinosa*; 2 fruitbodies; 30.08.2004.
3. Wzniesienia Szczecińskie Hills, Ba-73, Szczecin, Kasprowicz Park; on the soil, in tall-herb vegetation on the Rusalka, under *Symphoricarpos albus*; 2-3 fruitbodies; 26.07.2003, 25.08.2006.
4. Wzniesienia Szczecińskie Hills, Ba-73, Szczecin, Dendrological Garden; on the soil in the litter, under *Fagus sylvatica* and *Quercus robur*; 15 fruitbodies; 25.08.2006.
5. Równina Pyrzycka Plain, Ba-96, Stargard Szczeciński – Giżynek; midfield shelterbelt, on the soil, among synanthropic vegetation; 3 fruitbodies; 14.08.2005; leg. U. Banaś-Stankiewicz.
6. Pojezierze Drawskie Lake District, Bb-56, Nowy Chwalim, Barwice District, forest edge east of the village; on the soil, among nitrophilous vegetation; 5 fruitbodies; 15.07.2001.

7. Równina Pyrzycka Plain, Ca-16, Dendrological Garden in Przelewiec (sections: II, III, VI, VII, VIIa, XV, XVI, XIX, XXI), agglomerations of 3 to 20 fruitbodies; annually in 2004-2009.
 8. Równina Pyrzycka Plain, Ca-25, Krzemlin, Pyrzyce District, park edges; on the soil, among nitrophilous vegetation; 3 fruitbodies; 16.08.2006; leg. W. Kowalski.
 9. Pojezierze Choszczeńskie Lake District, Ca-29, Nowy Klukom, Krzęcin District, edges of a post-manorial park; on the soil, among ruderal vegetation; 10 fruitbodies; 11.09.2007; leg. W. Kowalski.
 10. Pojezierze Myśliborskie Lake District, Ca-30, Bielinek Reserve, Wąwóz Markociński Gorge, Cedynia district, on the border with the Markocin settlement; on the soil, *Luzulo pilosae-Fagetum* beech grove; 13 fruitbodies; 07.09.2007.
 11. Pojezierze Choszczeńskie Lake District, Cb-00, Grądowe Zbocza Reseve, Recz District; on the soil, fringe community on the border with the oak-hornbeam forest *Stellario-Carpinetum* and a community with *Fagus sylvatica*; 6-11 fruitbodies; 19.09.2004 and 28.07.2005; leg. L. Wołejko.
 12. Pojezierze Dobiegniewskie Lake District, Cb-20, Bierzwnik, post-manorial park; on the soil, among anthropogenic vegetation; 4 fruitbodies; 17.08.2008.
- It the most common species of those analyzed here. It occurs at more than 100 scattered throughout Poland [7].

Lycoperdon echinatum Pers.: Pers. – R

1. Równina Wkrzańska Plain, Ba-52, Puszcza Wkrzańska Forest, Pienice Forest Inspectorate, forest section 89, east of Brzózki, Nowe Warpno District; on the soil, mixed forest *Fago-Quercetum petraeae*; 4 fruitbodies; 15.09.2009.
 2. Równina Goleniowska Plain, Ba-53, Puszcza Goleniowska Forest, Goleniów Forest Inspectorate, section 285, near Widzieńsko, Stepnica District; on the soil, *Luzulo pilosae-Fagetum* beech grove; 3 fruitbodies; 10.10.2008.
 3. Równina Walecka Plain, Bb-97, on the Różyca River between lakes Krąpsko Łekawe and Krąpsko Radlino, ca. 15 km NE of Wałcz, Wałcz District; on the soil, in the litter, edge of a pine forest with spruce; 3 fruitbodies; 02.09.2006; leg. A. Wołejko, det. S. Friedrich.
- The species is quite common in Poland, recorded at ca. 40 locations, the nearest in Cedynia Landscape Park [7, 15, 19, 24].

Lycoperdon ericaeum Bonord. – E

Równina Gorzowska Plain, Cb-53, Puszcza Notecka Forest, Potrzebowice Forest Inspectorate, ca. 12 km SE of Krzyż, Wieleń District, verge of a forest road between sections 277 and 238 overgrown with pine greenwoods; on acidic sandy soil, among *Calluna vulgaris*; 6 fruitbodies; 10.10.2007.

In Poland, the species is known only from Tuchola National Park [25] and the vicinity of Olecko [26].

Lycoperdon marginatum Vittad. – E

Równina Gorzowska Plain, Cb-53, Puszcza Notecka Forest, Potrzebowice Forest Inspectorate, section 239, ca. 12 km SE of Krzyż, Wieleń District, edge of a firebreak; on acidic sandy soil, among: *Calluna vulgaris*, *Festuca ovina*, *Vaccinium vitis-idaea*, *Calamagrostis epigeios*; coniferous forest *Peucedano-Pinetum*; 12 fruitbodies; 16.07.2007.

Lycoperdon marginatum has been recorded at seven locations in Poland [6, 7, 27-29], the nearest in Szczecin [30].

Mycenastrum corium (Guers.) Desvaux – V

Wzniesienia Szczecińskie Hills, Szczecin; anthropogenic habitats, roadside and park lawns; on the soil, among: *Achillea millefolium*, *Capsella bursa-pastoris*, *Dactylis glomerata*, *Geranium pusillum*, *Lolium perenne*, *Plantago lanceolata*, *P. major*, *Poa annua*, *Polygonum aviculare*, *Potentilla reptans*, *Stellaria media*, *Taraxacum officinale*, *Trifolium repens*, *Urtica urens*; dog faeces. Rarely reaches full maturity as fruitbodies are often destroyed by people and during mowing.

1. Ba-73, Szczecin, Chopina Street; grassy S-inclined roadside; 3 fruitbodies; 4.06.2007.
2. Ba-73, Szczecin, Sosnowa Street; lawn; from 1 to 5 fruitbodies; 30.07.2005, 24.08.2006, 18.07.2007, 20.07.2009.
3. Ba-73, Szczecin, a square between Asnyka and Kołłątaja; lawn, under *Acer platanoides* and *Quercus rubra*; from 2 to 17 fruitbodies; 25.06.2007, 10.07.2008, 26.06.2009.
4. Ba-73, Szczecin, Słowackiego Street near Żupańskiego Street; lawn; from 2 to 11 fruitbodies; 12.07.2002, 06.07.2007, 25.08.2008, 25.06.2009.
5. Ba-83, Szczecin, Żeromski Park (between Zygmunt Starego and Plantowa streets); lawn; 3 fruitbodies; 25.06.2007.
6. Ba-83, Szczecin, Mickiewicza square; lawn; 3-5 fruitbodies; 22.06.2007, 16.09.2009.

Mycenastrum corium occurs at 17 locations in Poland [31-33], the nearest in Łagów [6].

Nidularia deformis (Willd.: Pers.)

Fr. & Nordholm – R

Równina Wkrzańska Plain, Ba-62, Puszcza Wkrzańska forest, Podymin Forest Inspectorate, section 440, SE of Dobieszczyn, Police district; on litter, coniferous forest *Leucobryo-Pinetum*; 7 fruitbodies; 18.08.2008.

It has ca. 20 locations in Poland, the nearest in Cedynia Landscape Park and Puszcza Notecka Forest [7, 24, 34].

Pisolithus arhizos (Scop.: Pers.) S. Rauschert – R

Równina Wkrzańska Plain, Ba-52, Puszcza Wkrzańska Forest, Myślibórz Forest Inspectorate, on the section line 257/258, Nowe Warpno District; on sand, coniferous forest *Leucobryo-Pinetum*; 3 fruitbodies; 19.09.2009.

It has been recorded at 15 locations in Poland, the nearest in Cedynia Landscape Park and Puszcza Notecka Forest [7, 24, 34].

Phallus duplicatus Bosc – E

Równina Białogardzka Plain, Bb-04, Koszalin, Mt. Góra Chelmska in the eastern part of the city; on the soil, in deciduous litter, *Luzulo pilosae-Fagetum* beech grove; 1 fruitbody; 11.09.2004; leg. A. Bartosik, det. S. Friedrich.

In Poland, it has been recorded at only two locations: Domecko (near Opole) [35] and Puszcza Wkrzańska Forest [18].

Phallus hadriani Vent.: Pers.– P

Wybrzeże Trzebiatowskie Coast, Ba-07, Niechorze, Rewal District, cliff east of the lighthouse; on the soil, lawn under: *Acer platanoides*, *Robinia pseudacacia*, *Betula pendula*; 5 fruitbodies; 04.07.2009.

It occurs at more than 10 locations in Poland, the nearest in Wiselka, Wolin Island to the west, and in Kołobrzeg to the east [7].

Mutinus caninus (Huds.: Pers.) Fr. – P

1. Uznam and Wolin, Ba-23, Wolin National Park, Kawcza Góra east of Międzyzdroje; on the soil and on a stump, *Melico-Fagetum* beech grove; 10 fruitbodies; 25.10.2008.
2. Równina Goleniowska Plain, Ba-53, Goleniów Forest, east of Widzieńsko, Stepnica District; on the soil, *Luzulo pilosae-Fagetum* beech grove; 5 fruitbodies; 25.07.2007.
3. Wzniesienia Szczecińskie Hills, Ba-73, Szczecin, Kasprowicz park; on the soil, under *Fagus sylvatica* and *Larix decidua*; 21 fruitbodies; 11.07.2007.
4. Równina Pyrzycka Plain, Ca-16, Przelewiec, Dendrological Garden (section XIX); on the soil, under *Fagus sylvatica*; 4 fruitbodies; 20.09.2008.

In Poland, *Mutinus caninus* has been recorded at over 30 locations scattered throughout the country, also in Pomerania [7].

Discussion

The locations of the threatened and protected species of *Gasteromycetes* in northwestern Poland described here supplement knowledge on their distribution in Poland and in Europe [2, 7]. *Geastrum floriforme*, *Lycoperdon ericaeum*, and *Phallus duplicatus* previously had only two locations each. Apart from *Phallus duplicatus*, they did not occur in Pomerania. *Geastrum coronatum*, *G. quadrifidum*, *G. striatum*, *G. triplex*, and *Mycenastrum corium* were not previously recorded in northwestern Poland. These species had more than 10 locations in the remaining part of Poland. It is also noteworthy that *Mycenastrum corium*, a typically nitrophilic species that was not previ-

ously recorded in Pomerania, was observed over a few seasons at as many as six anthropogenic locations in Szczecin. *Lycoperdon marginatum*, a species associated with natural xerothermic communities, is also interesting. Three of its seven known locations were reported only in the 19th century [27, 28].

Species such as *Geastrum fimbriatum*, *G. rufescens*, *Trichaster melanocephalus*, *Lycoperdon echinatum*, *Nidularia deformis*, *Pisolithus arhizos*, *Phallus hadriani*, and *Mutinus caninus* were known from northwestern Poland, including Cedynia Landscape Park and the Puszcza Wkrzańska old-growth forest. *Langermannia gigantea*, a nitrophilic species, is the most common protected gasteromycete in Poland and in Pomerania. It occurs on fertile soil at anthropogenic and natural locations. *L. gigantea* is known from a high number of locations as it has a large, conspicuous fruitbody and its taxonomic identification is easy.

The analysis of the distribution of the gasteromycete species examined here shows that their locations are scattered throughout Poland and their density differs. Intensified mycological investigations in anthropogenic sites will help recognize the distribution of many gasteromycete species more fully.

Abbreviations

E	– endangered
V	– vulnerable
R	– rare
P	– protected
leg.	– collected by
det.	– determined by

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