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# Hypogeous fungi of Lithuania: a preliminary checklist

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The paper reports on hypogeous fungi known from Lithuania, and data on their habitats, phenology, and distribution. References on the collections kept in the herbaria are also pointed out. The information is based on literature data and re-examination of all available voucher specimens. 22 species (12 genera, 3 phyla) recorded from 124 localities are presented in a preliminary checklist.

**Key words:** hypogeous fungi, diversity, distribution, Lithuania

## INTRODUCTION

Hypogeous fungi of Lithuania are poorly known as only few mycologists have investigated them. The first relevant data on six species of hypogeous fungi were published by Bucholtz (1904, 1907), one of the pioneers in the study of sequestrate fungi (Castellano et al. 2004). F. Bucholtz's examined specimens collected by M. Domaradsky from Kaunas surroundings in 1904. Unfortunately, all Lithuanian collections seen by F. Bucholtz were lost during First World War. Some records of hypogeous species were published by Trzebiński (1934), Mazelaitis and Minkevičius (1957), Mazelaitis (1961, 1966). These species belonging to *Leucogaster* R. Hesse, *Melanogaster* Corda and *Rhizopogon* Fr. & Nordholm were included by Mazelaitis (1982) in his monograph on Lithuanian gasteromycetes. The data on ascomycete species of *Choiromyces* Vittad., *Geopora* Harkn., *Hydnotrya* Berk. & Broome and *Tuber* F. H. Wigg. have been published in a monographic work on the *Pezizales* of Lithuania (Kutorga 2000). Recently undertaken special sampling by raking the soil has extended the known range of several species, and added three species to the Lithuanian mycobiota (Kataržytė, Kutorga 2005).

The aim of the present study is to re-examine all available material on hypogeous fungi known in Lithuania, to re-evaluate taxonomic arrangement and nomenclature for all taxa treated, and finally to present an annotated checklist of these fungi.

## MATERIALS AND METHODS

All relevant specimens in fungal reference collections of the Institute of Botany, Vilnius (BILAS) and Vilnius University (WI) have been located and re-examined. The checklist includes also all the published records of species from Lithuania. The concept of hypogeous fungi follows Castellano et al. (2004). Other sequestrate fungi that produce sporocarps above soil surface in Lithuania, i.e. from the genera *Scleroderma* Pers. and *Endoptychum* Czern., are not included in this checklist.

For each fungus the information is given in the following order: scientific name, it's synonym (when used in Lithuanian literature), data on habitat and phenology: months in which fungus has been observed/collected), distribution (Distr: number of known localities and administrative districts/cities); preserved and examined fungal exsiccata (Exs.; an acronym of herbarium in which specimens are deposited, and herbarium access number, fungal name on the label, if current identification is different), literature (Lit.), and notes (when necessary). Taxa of *Glomeromycota*, *Ascomycota*, and *Basidiomycota* are treated separately in alphabetical order. The taxonomical arrangement of taxa follows Kirk et al. (2008), and an author citation was used according the Authors of Fungal Names (2 ed., http://www.indexfungorum.org/ AuthorsOfFungalNames.htm).

## LIST OF TAXA

### GLOMEROMYCOTA

***Endogone lactiflua*** Berk. & Broome

Under *Picea abies*, in ca. 90 years old Norway spruce wood, October. Distr.: 1 locality, Plungė district. Exs.: WI (5476). Lit.: Kataržytė and Kutorga (2005).

### ASCOMYCOTA

***Choiromyces meandriformis*** Vittad. (=*Choiromyces venosus* (Fr.) Th. Fr.)

In the vicinity of deciduous trees *(Quercus robur, Betula* sp., *Alnus* sp., *Salix* sp.), in deciduous, mixed and coniferous woods, August–October. Distr.: 4 localities (documented by specimens), Ignalina, Marijampolė, Molėtai and Raseiniai districts; additional 4 localities (not documented), Kėdainiai, Klaipėda, Molėtai and Panevėžys districts. Exs.: BILAS (4898, 9643, 18624), WI (3350). Lit.: Mazelaitis and Minkevičius (1957), Mazelaitis (1966), Ławrynowicz (1990), Kutorga (2000).

***Elaphomyces asperulus*** Vittad.

Under *Pinus sylvestris* and *Picea abies*, in coniferous woods, occasionally in mixed woods with *Betula*, April–June, August–October. Distr.: 28 localities, Anykščiai, Elektrėnai, Kupiškis, Panevėžys, Plungė, Šalčininkai, Šilutė, Tauragė, Varėna, Vilnius and Zarasai districts, and Neringa. Exs.: BILAS (3517 as *Elaphomyces cervinus*, 7582 as *E. muricatus*, 14066 as *E granulatus*, 14416 as *E. cervinus*, 18633, 18635, 19440, 21247 all latter four as *E. granulatus*, 24544, 24747, 28928), WI (5453, 5454, 5465–5472, 5551); in collections of *Cordyceps ophioglossoides* – BILAS (2918, 2981, 2988, 3295, 3931), WI (3005). Lit.: Kataržytė and Kutorga (2005).

NOTES. *E. asperulus* is distinguished from *E. granulatus* mainly on the basis of spore ornamentation and colour of peridium (Ławrynowicz 1988). *E. asperulus* has spore spines up to 2 $\mu$m long and whitish to greyish pink peridium. *E. granulatus* is characterised by spines longer than 2 $\mu$m and whitish to yellowish peridium.

***Elaphomyces granulatus*** Fr. (=*Elaphomyces cervinus* (Pers.) Schltdl.)

Mostly under *Pinus sylvestris* and *Picea abies*, rarely associated with *Quercus robur*, in coniferous and mixed woods, May–October. Distr.: 14 localities, Plungė, Šakiai, Tauragė, Varėna and Vilnius districts. Exs.: BILAS (4875 as *Elaphomyces variegatus*, 18632, 24545), WI (5452, 5455, 5458–5464, 5474, 5552). Lit.: Mazelaitis (1966), Kataržytė and Kutorga (2005).

***Elaphomyces muricatus*** Fr. (=*Elaphomyces variegatus* Vittad.)

Under *Picea abies* and *Pinus sylvestris*, in coniferous woods, occasionally in mixed woods with *Betula* and *Populus tremula*, April, July–September. Distr.: 11 localities, Alytus, Anykščiai, Jurbarkas, Kretinga, Plungė, Širvintos and Tauragė districts. Exs.: BILAS (18634, 18781, 19411 all as *E. granulatus*), WI (5475); in collections of *Cordyceps ophioglossoides* – BILAS (2899, 2909, 3196, 3931, 5631, 11570, 24732). Lit.: Bucholtz (1904), Mazelaitis (1966), Kataržytė and Kutorga (2005).

NOTES. The fruit-bodies of *Elaphomyces* species were commonly observed in the places disturbed by feeding wild animals or in association of mycoparasitic species of the genus *Cordyceps* (Fr.) Link.

***Geopora arenicola*** (Lév.) Kers

On soil, in coniferous and deciduous woods, usually on forest paths and in other naturally or artificially disturbed sites, occasionally in fire places, June–October. Distr.: 16 localities, Jonava, Jurbarkas, Pakruojis, Plungė, Šakiai, Šilutė, Ukmergė, Varėna and Vilnius districts, and Neringa. Exs.: BILAS (21294, 34521–34528), WI (4810, 5456, 5523–5526). Lit.: Kutorga (1994, 2000).

***Hydnotrya tulasnei*** Berk. & Broome

In *Picea abies* wood, July. Distr.: 1 locality, Šilutė district. Exs.: BILAS (18627). Lit.: Kutorga (2000).

***Peziza ammophila*** Durieu & Mont.

In the vicinity of grasses (*Ammophila arenaria*, *Festuca arenaria*, *Leymus arenarius*), in littoral sand dunes, September–October. Distr.: 4 localities, Neringa. Exs.: BILAS (18566, 18593, 21780), WI (5527, 5528). Lit.: Kutorga (2000, 2004).

***Tuber exiguum*** R. Hesse

In mixed wood, August. Distr.: 1 locality, Kaunas surroundings. Exs.: None. Lit.: Bucholtz (1904), Kutorga (2000).

***Tuber puberulum*** Berk. & Broome

Under *Pinus sylvestris*, in a *ca*. 30 years old *Pinus sylvestris* plantation with intermixed younger *Picea abies* trees, September–October. Distr.: 1 locality, Plungė district. Exs.: WI (5475). Lit.: Kataržytė and Kutorga (2005).

***Tuber rufum*** Pico : Fr. f. ***nitidum*** (Vittad.) Montecchi & Lazzari (=*Tuber nitidum* Vittad.)

In mixed wood on slope along Nemunas river, August. Distr.: 1 locality, Kaunas surroundings. Exs.: None. Lit.: Bucholtz (1904), Kutorga (2000).

## BASIDIOMYCOTA

***Hymenogaster arenarius*** Tul. & C. Tul.

In mixed woods, August–September. Distr.: 2 localities, Kaunas surroundings. Exs.: None. Lit.: Bucholtz (1907).

NOTES. The specimen, reported as *Hymenogaster rehsteineri* Bucholtz (Bucholtz 1904), was later reconsidered as *H. arenarius* by Bucholtz (1907).

***Hymenogaster citrinus*** Vittad.

In wood, August. Distr.: 1 locality, Kaunas surroundings. Exs.: None. Lit.: Bucholtz (1904, 1907).

***Hymenogaster olivaceus*** Vittad.

In a ca. 40 years old *Pinus sylvestris* plantation with intermixed *Picea abies* trees, August. Distr.: 1 locality, Plungė district. Exs.: WI (5477). Lit.: Kataržytė and Kutorga (2005).

***Leucogaster nudus*** (Hazsl.) Hollós (=*Leucogaster floccosus* R. Hesse)

Not reported. Distr.: 1 locality, Vilnius surroundings. Exs.: None. Lit.: Mazelaitis (1982).

NOTES. Mazelaitis (1982) noted that the species usually grows in deciduous and coniferous forests, especially in *Quercus* stands, however, an exact data on ecology of Lithuanian record was not provided.

***Melanogaster ambiguus*** (Vittad.) Tul. & C. Tul.

In *Quercus robur* wood, September. Distr.: 2 localities, Plungė (documented by specimen) and Varėna districts (not documented). Exs.: BILAS (18989). Lit.: Mazelaitis (1982).

***Melanogaster variegatus*** (Vittad.) Tul. & C. Tul.

In deciduous woods, the months of observations were not reported. Distr.: 2 localities, Vilnius surroundings. Exs.: None. Lit.: Trzebiński (1934), Mowszowicz (1957), Mazelaitis (1982).

NOTES. Reports on *M. variegatus* were based on collections made in 1928 and 1952. However, there are no specimens available under this name in WI and BILAS. According to the description provided by Mazelaitis (1982) the basidiospores were ellipsoid, 6–9 × 3–4 $\mu$m. Mentioned spore size fits better the concept of *M. broomeianus* Berk. Extremely closely related *M. variegatus* s. str., a species of southern and central Europe, differs mainly in broader basidiospores, 7.5–10 × 5.5–8 $\mu$m (Lange 1956; Pegler et al. 1993).

***Pompholyx sapida*** Corda

Under *Tilia* sp., in park, August. Distr.: 1 locality, Kaunas surroundings. Exs.: None. Lit.: Bucholtz (1904).

***Rhizopogon angustisepta*** Zeller & C. W. Dodge

Not reported. Distr.: Not reported. Exs.: None. Lit.: Mazelaitis (1982).

NOTES. In the treatment of gasteromycetes from the former Soviet Union (Sosin 1973) the species was reported as known from Lithuania. However, the attempt to reveal more data concerning this report has failed (Mazelaitis 1982).

***Rhizopogon luteolus*** Fr. & Nordholm

In *Pinus sylvestris* woods, July–October. Distr.: 16 localities, Kretinga, Prienai, Šalčininkai, Švenčionys, Tauragė and Varėna districts, Druskininkai and Neringa. Exs.: BILAS (3361, 4869, 5175, 6525, 7832, 8097, 9994, 11271, 12674 as *Rhizopogon virens*, 12709 as *R. vulgaris*, 12719, 12759, 13435, 20507 as *R. obtextus*), WI (5478). Lit.: Mazelaitis (1961, 1982).

***Rhizopogon roseolus*** (Corda) Th. M. Fr.

In *Pinus sylvestris* woods, July, September–October. Distr.: 6 localities, Ignalina, Švenčionys, Varėna, Vilnius (documented by specimens) and Molėtai (not documented) districts. Exs.: BILAS (13149 as *Rhizopogon virens*, 13482, 13488, 14652), M (1809 as *R. virens*). Lit.: Mazelaitis (1961, 1982), Martín (2001).

NOTES. Both *R. roseolus* and *R. vulgaris* are characterized by peridium discoloring red to purplish red on bruising, however, these taxa can be distinguished by spore size. Following the concepts of taxa by Pegler et al. (1993) we assigned the specimens with larger spores (7–10 ×3–3.5 $\mu$m) to *R. roseolus*, and those with smaller spores (5,5–7 × 2–3 μm) – to *R. vulgaris*.

The specimen, which has been collected by G. Bresadola in 1921 from Varėna district and currently preserved at M, was re-examined by Martín (2001).

***Rhizopogon vulgaris*** (Vittad.) M. Lange

In *Pinus sylvestris* woods, August–October. Distr.: 5 localities, Varėna districts, Druskininkai and Neringa (documented by specimens) and Molėtai (not documented) district. Exs.: BILAS (13087, 15357 as *Rhizopogon roseolus*, 15238 as *R. roseolus*; 21218 as *R. roseolus*). Lit.: Mazelaitis (1982).

## DISCUSSION

22 species (12 genera, 3 phyla) recorded from 124 localities are presented in the list of hypogeous fungi from Lithuania. *Elaphomyces asperulus*, *E. granulatus*, *E. muricatus*, *Geopora arenicola* and *Rhizopogon luteolus* are the most commonly observed and collected species. 82 out of total 105 preserved specimens of hypogeous fungi belong to the five latter species. 13 species are known in Lithuania from one or two localities only. Voucher specimens of 8 species are no longer extant, and these taxa are currently known only from the literature.

Many more hypogeous fungi remain to be discovered in Lithuania, and the knowledge of already known and yet not recorded species ecology and distribution needs to be investigated in greater depth.

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