



Taxonomy & Inventories

The diversity of macromycetes in peatlands: nine years of plot-based monitoring and barcoding in the raised bog "Mukhrino", West Siberia

Nina Filippova[‡], Elena Zvyagina^{‡,§}, Elena Rudykina[‡], Alevtina Dobrynina[‡], Sergey Bolshakov^l

[‡] Yugra State University, Khanty-Mansiysk, Russia

[§] Lomonosov Moscow State University, Moscow, Russia

^l Komarov Botanical Institute of the Russian Academy of Sciences, Saint Petersburg, Russia

Corresponding author: Nina Filippova (filippova.courlee.nina@gmail.com)

Academic editor: Olivier Raspé

Received: 17 Apr 2023 | Accepted: 02 Oct 2023 | Published: 20 Oct 2023

Citation: Filippova N, Zvyagina E, Rudykina E, Dobrynina A, Bolshakov S (2023) The diversity of macromycetes in peatlands: nine years of plot-based monitoring and barcoding in the raised bog "Mukhrino", West Siberia.

Biodiversity Data Journal 11: e105111. <https://doi.org/10.3897/BDJ.11.e105111>

Abstract

Background

Peatland ecosystems are defined by soils with sufficient under-decomposed organic layer, called peat, formed under anoxic conditions. Peatlands are widespread around the world, with several highly paludified regions, one of which is the Western Siberian Plain. Peatlands store large amounts of carbon and are important in their intact state to counteract climate change, as well as for a variety of other ecosystem functions. From the practical aspect, these ecosystems are used as a source of peat for fuel, peat-based fertilisers and growing media, berries and *Sphagnum* plantations. Fungi are the key part of the decomposer community of peatlands, playing a critical role in the aerobic decomposition in the upper peat layer. The community of peatland fungi is adapted to decomposition of peat and dead parts of *Sphagnum* in wet acidic conditions; they form specific mycorrhizal associations with a variety of plants. Thus, the research of fungal diversity of peatlands is important for several reasons: 1) adding knowledge of peatland fungal diversity to local or global biodiversity databases; 2) studying carbon cycling in

peatlands; 3) using peat and peatlands for different applications, such as cultivation of *Sphagnum* with regards to some parasitic species of fungi and 4) peatland restoration and conservation, to mention a few.

New information

The community of macromycetes of the raised bog “Mukhrino” in Western Siberia was studied using plot-based monitoring throughout a 9-year observation period. The revealed species diversity is represented by approximately 500 specimens in the [Fungarium of Yugra State University collection](#). Selected specimens were used for barcoding of the ITS region to reveal a total of 95 species from 33 genera and three classes. The barcoding effort confirmed morphological identifications for most specimens and identified a number of cryptic species and several potentially new taxa. Based on regular all-season observations, we describe the phenology of the community sporophore production. The quantitative community structure, based on sporophores, revealed a difference in abundance between species by four orders of magnitude, with rare species representing nearly half of the species list. The inter-annual fruiting abundance varied several times by the total number of sporophores per year. To make the comparisons with global studies, we created an open access database of literature-based observations of fungi in peatlands, based on about 120 published papers (comprising about 1300 species) and compared our species list with this database.

As a result, the study created an accurate representation of taxonomic and quantitative structure of the community of macromycetes in raised bogs in the region. The raw data of plot-based counts was published as a sampling-event dataset and the sequenced specimens with the sequence information as an DNA-derived extension dataset in [GBIF](#).

Keywords

sphagnum, macromycetes, peat, biodiversity, decomposers, fungal conservation

Introduction

The study of fungal diversity of peatlands started over a century ago with a microbiological approach (for a detailed history of research of fungi in peatlands, see Thormann 2006, Rydin et al. 2006 and Artz 2013). Microfungal communities of peat layer were first studied using *in vitro* culture techniques: fungi were discovered at all depths, but in the lower peat layers, they were considered dormant. The composition and structure of microfungal communities depend on micro-element composition, decomposition state and aerobic conditions of the peat horizons (Thormann 2006, Chernov 2018). The microbiological approach, however, is biased towards species of microfungi easily cultivated *in vitro*. With an integral approach, peatlands became a subject of interest to mycologists working by direct observation of fruit-bodies of macromycetes. Studies of different types of peatlands

were carried out in a variety of paludified regions globally; the following works are noteworthy: Favre (1948) Jura mountain range, France; Einhellinger (1976), Einhellinger (1977) Upper Bavaria, Germany; Lange and Lange (1982) Maglemose, northern Denmark; Stasinska (2011) Pomeranian peatlands, Poland; Ohenoja (1974) and Salonen and Saari (1990) Finland; Kalamees (1982), Kalamees and Raitviir (1982) Estonia; Kotlaba (1953), Kotlabam and Kubicka (1960), Vašutová et al. (2021), Vašutová et al. (2023) in Czechia; Chastukhin (1965) north-western Russia. With the recent development of environmental DNA methods of sampling, all methods complement each other, helping to reveal the diversity and ecological role of fungi in peatlands. A number of published works employed the environmental DNA approach in peatlands: Jackson et al. 2008, Elliott et al. 2015, Garcés-Pastor et al. 2019, Kim et al. 2021, Vašutová et al. 2021; however, the results were rarely verified by cultures or direct observation of fruit-bodies.

In this study, we aimed to describe the diversity, community structure and dynamics of macromycetes of peatlands in West Siberia by direct observation and complement it by a molecular approach (barcoding of accumulated collections). In contrast to the existing research, we used permanent plots with regular visits throughout the growing (snow-free) season from May till October and have been monitoring the plots for nine years, which is, to our knowledge, the longest observation series on the community of macromycetes in peatlands. Long-term plot-based monitoring is necessary to reveal the fullest possible diversity of macromycetes, as shown by many authors (O'Dell et al. 2004). There had been no published in-depth studies in regard to macromycetes of peatlands before the beginning of this project in Western Siberia; the study complements several research initiatives on peatland fungal diversity conducted country-wide in Russia. The plot-based description of the community by the direct observation method will be validated or used for validation for future metabarcoding analyses in the same location.

This publication aims:

- to summarise the results of nine years of plot-based monitoring of the community fruiting dynamics;
- to describe the quantitative structure of the community, to reveal dominant and rare species and gain insight into its potential protection status;
- to revise the species diversity of macromycetes by barcoding the voucher collection.

Materials and methods

Study site

The study site – the [Mukhrino field station](#) and the Mukhrino Bog – is located in the middle taiga zone of Western Siberia, near the regional capital city of Khanty-Mansiysk (60.89N, 68.68E) (Fig. 1). The Mukhrino Bog is an ombrotrophic landscape entity covering an area of about 10 by 15 km, located along the northern edge of a larger paludified area, the Konda Lowlands (Russian *Кондинская низменность*), on the left terrace of the Irtysh

River close to its confluence with the Ob'. The vegetation of the raised bog is represented by the typical ombrotrophic or oligo-mesotrophic communities from the geobotanical classes *Scheuchzerio-Caricetea nigrae*, *Oxycocco-Sphagnetes* and *Vaccinio-Piceetea*. Two major vegetation types dominate: treed Scots pine – dwarf shrubs – *Sphagnum* bogs dominated by *Pinus sylvestris*, *Chamaedaphne calyculata*, *Rhododendron groenlandicum*, *Rubus chamaemorus* and *Sphagnum fuscum*) and open graminoid-*Sphagnum* lawns (dominated by *Scheuchzeria palustris*, *Carex limosa*, *Eriophorum russeolum*, *Vaccinium oxycoccos* and *Sphagnum balticum*).

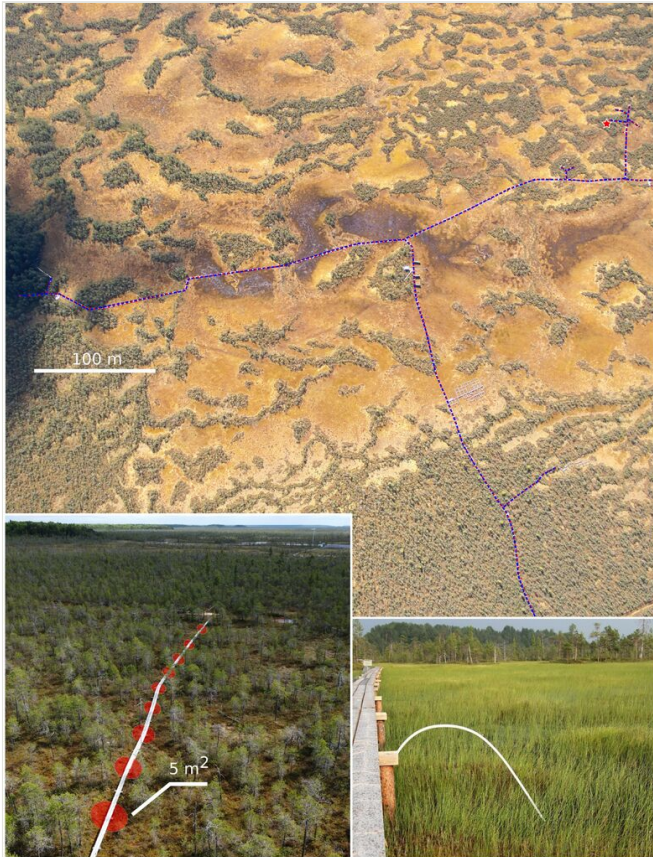


Figure 1. [doi](#)

Layout of the Mukhrino field station infrastructure and position of plots (red dots) alongside the walking board (blue dashed line), the star marking the position of an automated meteorological complex; in lower right insert: layout of half-circles on each side of the boardwalk in the treed bog; in lower left insert – counting event in the graminoid-*Sphagnum* bog, using an arch.

Collection of voucher specimens

About 500 specimens were collected during plot-based observations from 2014 through 2022. The specimens are accessible through the Fungarium YSU collection database at

the biological portal of the Yugra State University (<http://bioportal.ugrasu.ru/>; <https://fungariumysu.org>) or through the [collection's dataset in GBIF](#) (Filippova 2023). The collections were processed as described by Lodge and Ammirati (2004). Fresh fruit-bodies were wrapped in aluminium foil and transported to the laboratory to be processed on the day of collection. The processing of specimens included photography in situ and ex situ, description of vital characters, preliminary microscopy and identification, entering new data into the database, labelling and drying at 40°C for packaging and storage in the YSU Fungarium.

For the purpose of barcoding, the collection was revised and specimens of good quality with good photographs and descriptions were selected. Each morphologically-defined taxon was represented by 2-3 specimens on average, with up to 10 specimens for some cryptic taxa.

Morphological identification

Common and easily recognisable species were identified in the field. Thorough identification of collections impossible to identify with certainty in the field was done in the laboratory. Samples from dry specimens were rehydrated in tap water or potassium hydroxide (KOH) (10%), dyes and other chemicals (Congo Red, Melzer's Reagent, ammonia) were applied when necessary. A Zeiss Axiostar microscope with Achromat 5/0.12, 10/0.25, 40/0.65 (dry) and 100/1.25 (oil immersion) objectives were used for microscopical examination. Most of the specimens were identified using Funga Nordica keys (Knudsen and Vesterholt 2018); a number of monographs on particular taxa were used when necessary.

Molecular methods

We relied primarily on the ITS region using the ITS1-F and ITS4 primers (Gardes and Bruns 1993); for 10 specimens, TEF1 region using the primers EF1-983F and EF1-1567R (Rehner and Buckley 2005) and for three specimens, LSU using the primers LR0R, LR5 (Vilgalys and Hester 1990) were amplified. DNA extraction was done from dry exsiccata or freshly-collected material using Diatom DNA Prep 200 or TransDirect® Plant Tissue PCR Kit following the standard protocols of these kits. The PCR was made using ready mix for PCR 5X ScreenMix (Evrogen). PCR and sequence reaction products were purified using Cleanup Standard (Evrogen), CleanMag DNA (Evrogen) and Dynabeads™ Sequencing Clean-Up kits. Sequencing was performed with BrilliantDye™ Terminator (v.3.1) Cycle Sequencing Kit (NimaGen) using Applied Biosystems® Sanger Sequencing 3500 Series Genetic Analyzer. Sequences were processed with Sequencing Analyst 7 and MEGA 11 software. The resulting sequences were uploaded to GenBank, PlutoF and BOLD (Filippova et al. 2023c) and as a DNA-derived extension dataset to GBIF (Filippova et al. 2023b). The closest or matching taxa were chosen by BLAST at NCBI (<https://blast.ncbi.nlm.nih.gov/Blast.cgi>) and massBLASter SH matching (BLAST+ 2.13.0) at PlutoF (<https://plutof.ut.ee/en>).

The following approach was used to search for the correct taxon name using sequence alignment. The NCBI BLAST search was performed to find the nearest sequences from a type specimen or an authentic specimen with a percentage identity conventionally accepted (for example, 99% for *Cortinarius*, Liimatainen et al. (2020)). In case no type or authentic specimen exists in NCBI, any other reliable sequence was chosen. The sequences of each group were aligned with the nearest sequence of a type (or an authentic specimen) from this group, trimmed for maximum overlap and the ITS1 and ITS2 regions with the number of nucleotides conventional for this group (including 5.8S) were left. The chosen taxon name with final species assignment, percentage identity and nearest sequences in GenBank are presented in Suppl. material 1. Most of the sequences (107) had 100% similarity and an additional 33 sequences had 99% percentage similarity. However, 15 sequences had much lower threshold (98% and less) and identifications were left at genus level. These specimens should be studied in detail by taxon-specific phylogenetic analyses.

Statistical analyses

The dataset was analysed and visualised using a collection of packages (Wickham et al. 2019) for R ver. 4.1.2 (RCoreTeam 2021) in RStudio ver. 2021.09.1+372. The «metacoder» package was used to visualise the taxonomic coverage (Foster et al. 2017). The packages «tsibble», «tidyverse», «feasts» and «ggplot2» were used for data analysis and visualisation (Hyndman and Athanasopoulos 2021). The estimation of species diversity was carried out using the «iNEXT.3D» and «iNEXT.4steps» packages (Chao et al. 2020, Chao et al. 2021). The ordination of fungal communities was made using t-SNE ordination (Laurens and Geoffrey 2008).

Data management and storage

[The plot-counts dataset](#) includes two related tables of sampling event format: the basic Event table and the related Occurrence table. The Event table includes 18 fields and about 25 thousand records (263 plots and 96 visits): habitat, geography, date and plot size fields. The Occurrence table includes seven fields and 8284 records of observations with fruit-body counts within each plot on a particular day. The absence of occurrence records corresponding to the record in the Event table denotes an absence of fungi within a plot on a particular day (an approach recommended in [GBIF IPT user manual](#)). The database is attached as Suppl. material 2 and can [be accessed through GBIF](#) dataset (Filippova et al. 2023a).

Since different number of surveys were carried out in different years, we used a standardisation procedure before any comparative analyses could be performed. We transformed the actual data to a matrix of 9 years per 13 decade counts, where each year had an equal number of counts from the end of May to the end of September. Empty decades (without a single count) were interpolated by calculating the mean value between adjacent counts.

Since many morphological species were re-identified into several taxa, based on molecular analysis, we used composite names for these species (e.g. *Cortinarius armeniacus/kauffmanianus* or adding *s.l.* in some cases).

[The sequenced specimens dataset](#) includes two connected tables: the occurrence table and the DNA-derived data extension table (https://rs.gbif.org/extension/gbif/1.0/dna_derived_data_2021-07-05.xml#DNA_sequence). The Occurrence table contains the descriptions (in 22 fields) of 149 sequenced specimens, including images of fresh fruit-bodies. The related DNA-derived data extension table provides 155 sequences with descriptions of their parameters in eight fields. The dataset can be [accessed through GBIF](#) (Filippova et al. 2023b).

[The literature-based dataset](#) contains roughly 5000 citations of data on peatland fungi globally. Additional information includes bibliographic citation, date, country where the species was studied, habitat and substrate. The database can [be accessed through GBIF](#) (Filippova and Rudykina 2023). To avoid a mix-up of taxonomical concepts in literature datasets, names were synonymised using the GBIF species matching tool following the GBIF Backbone taxonomy.

The checklist of macrofungi collected during the monitoring in raised bogs with associated sequences

Amanita porphyria Alb. & Schwein.

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892632; decimalLongitude: 68.677156; eventDate: 2013-09-07; habitat: Dwarfshrubs - sphagnum ombrotrophic bog; catalogNumber: YSU-F-04416; recordedBy: Filippova, Nina; associatedSequences: [OP866197](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: A7AEF718-99A1-509F-9458-802CCF98FFF5

Arrhenia bigelowii Voitk, Lickey & I.Saar, 2022

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-07-11; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12021; recordedBy: Filippova, Nina; associatedSequences: [OP866238](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28;

- identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 6B8C0121-5C1A-509E-81F1-BA80CE006001
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-04; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12125; recordedBy: Filippova, Nina|Rudykina, Elena; associatedSequences: [OP866246](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 5DBDC9C1-A067-5903-85A9-A3F37609D77D
- c. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2018-08-04; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-08245; recordedBy: Filippova, Nina; associatedSequences: [OP866223](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 8D1F2D46-306E-59DF-B0CB-60EFC3D68D45

***Arrhenia gerardiana* (Peck) Elborne**

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Tomskaya Oblast'; county: Tomskiy Rayon; locality: Orlovka village vicinity, Chernoye lake; decimalLatitude: 56.878320; decimalLongitude: 84.665770; eventDate: 2018-08-22; habitat: Raised Pine-dwarfshrubs-*Sphagnum* bog; catalogNumber: YSU-F-08514; recordedBy: Filippova, Nina; associatedSequences: [OP866228](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 1C2FC960-006E-51BE-94C0-01B17E37D787
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Chistoe bog, 20 km E from Khanty-Mansiysk; decimalLatitude: 61.046340; decimalLongitude: 69.440660; eventDate: 2019-07-06; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-08855; recordedBy: Filippova, Nina; associatedSequences: [OP866230](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 0DACEE8B-D278-5278-BF5D-505F90290B39

***Arrhenia philonotis* (Lasch) Redhead, Lutzoni, Moncalvo & Vilgalys**

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Sovetskiy Rayon; locality: Potanay oilfield area; decimalLatitude: 61.188503; decimalLongitude: 65.456627; eventDate: 2018-07-29; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-08140; recordedBy: Filippova, Nina; associatedSequences: [OP866221](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: DC4AF85A-9FF4-58AB-BF01-39563377BDF3

Arrhenia* sp.*Material**

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Sovetskiy Rayon; locality: Potanay oilfield area; decimalLatitude: 61.188503; decimalLongitude: 65.456627; eventDate: 2018-07-29; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-08148; recordedBy: Filippova, Nina; associatedSequences: [QQ396707](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 033E8211-350D-5E1E-A764-83B8BD5FAB27

Ascocoryne turficola* (Boud.) Korf*Materials**

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Surgutskiy Rayon; locality: Yuganskiy State Nature Reserve; decimalLatitude: 60.021295; decimalLongitude: 74.462242; eventDate: 2016-06-29; habitat: The community of dwarf shrubs and sphagnum, with micro complexity of hummocks and hollows; catalogNumber: YSU-F-06580; recordedBy: Zvyagina, Elena|Zvyagina, Elena; associatedSequences: [OP866214](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: FFE85935-0D44-5D1D-BC12-8F99EFDE0EBD
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino FS boardwalks, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; catalogNumber: YSU-F-12193; recordedBy: Filippova, Nina|Rudykina, Elena; occurrenceID: 1BDD84B8-7D0F-52CB-9BAA-74F47E4323E4

Auriscalpium vulgare* Gray*Material**

- a. country: Russian Federation; countryCode: RU; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-19; habitat: Raised *Sphagnum* bog; recordedBy: Filippova, Nina; identifiedBy: Filippova, Nina; identificationRemarks: Identification based on observation, no collections were made; occurrenceID: DE2249A1-483A-5CF5-9C3C-2F1AE15F0B67

Cantharellula umbonata* (J.F.Gmel.) Singer*Material**

- a. country: Russian Federation; countryCode: RU; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.89; decimalLongitude: 68.67; eventDate: 2014-08-09; habitat: Pine - dwarfshrubs - sphagnum ombrotrophic bog; catalogNumber: YSU-F-04503; recordedBy: Filippova,

Nina; identifiedBy: Filippova, Nina; dateIdentified: 2014-08-09; identificationRemarks: Identification based on morphological characters only; occurrenceID: 388596C9-3E8A-5BFA-A3A0-8591D4CCE254

***Clavaria sphagnicola* Boud.**

Material

- a. country: Russian Federation; countryCode: RU; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2014-08-08; habitat: Pine - dwarfshrubs - *S. fuscum* ombrotrophic bog; catalogNumber: YSU-F-05830; recordedBy: Filippova, Nina; identifiedBy: Filippova, Nina; dateIdentified: 2014-08-08; identificationRemarks: Identification based on morphological characters only; occurrenceID: DD58AF74-84E8-54B3-A582-87DB1A99DB61

***Collybia cirrhata* (Schumach.) Quél.**

Material

- a. country: Russian Federation; countryCode: RU; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892632; decimalLongitude: 68.677156; eventDate: 2013-09-05; habitat: Dwarfshrubs - sphagnum ombrotrophic bog; catalogNumber: YSU-F-04415; recordedBy: Filippova, Nina; identifiedBy: Filippova, Nina; dateIdentified: 2013-09-05; identificationRemarks: Identification based on morphological characters only; occurrenceID: 31D64D45-463D-5490-B638-220C25356110

***Cortinarius armeniacus* (Schaeff.) Fr.**

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892010; decimalLongitude: 68.682420; eventDate: 2015-08-24; habitat: Pine - dwarfshrubs - *S. fuscum* ombrotrophic bog; catalogNumber: YSU-F-06277; recordedBy: Filippova, Nina; associatedSequences: [OQ366589](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 09FD8B86-1C37-505D-A9DA-4192E5AB613F
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892010; decimalLongitude: 68.682420; eventDate: 2015-08-24; habitat: Pine - dwarfshrubs - *S. fuscum* ombrotrophic bog; catalogNumber: YSU-F-06278; recordedBy: Filippova, Nina; associatedSequences: [OP866211](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: A1F0E284-E221-5DFA-9D74-A0BD66CAD870
- c. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of

- YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.889934; decimalLongitude: 68.700686; eventDate: 2012-09-02; habitat: Pine - dwarfshrubs - sphagnum bog (close to forest); catalogNumber: YSU-F-03969; recordedBy: Filippova, Nina; associatedSequences: [OP866185](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 52F90AE8-9C78-510A-834C-3E56257A9D81
- d. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2016-09-13; habitat: Pine-dwarfshrubs-*S.fussum* ombrotrophic bog; catalogNumber: YSU-F-07410; recordedBy: Filippova, Nina; associatedSequences: [OP866219](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: CB61994E-1632-5D1B-9D3D-8C31D0DA5365
- e. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Khanty-Mansiysk town vicinity; decimalLatitude: 60.891900; decimalLongitude: 68.682260; eventDate: 2020-09-08; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-10526; recordedBy: Filippova, Nina; associatedSequences: [OP866233](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 59C9DCC7-CB1A-5BFE-8B1E-4B90ACA95F08

***Cortinarius aurantiobasis* Ammirati & A.H.Sm.**

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2015-08-08; habitat: Pine - dwarfshrubs - *S. fussum* ombrotrophic bog; catalogNumber: YSU-F-05842; recordedBy: Filippova, Nina; associatedSequences: [OP866208](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 7FC77C06-4EA5-5B32-84A6-7B50F58B0ED8

***Cortinarius bataillei* (J.Favre ex M.M.Moser) Høil.**

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892022; decimalLongitude: 68.691502; eventDate: 2012-09-09; habitat: Pine - dwarfshrubs - sphagnum ombrotrophic bog; catalogNumber: YSU-F-04090; recordedBy: Filippova, Nina; associatedSequences: [OP866190](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 7266D007-4149-53E0-86D6-C0FA1F1B9918
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of

YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-19; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12164; recordedBy: Rudykina, Elena|Dobrynina, Alevtina; associatedSequences: [OP866252](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: E57AD120-5B3C-5B46-A616-A42A2E700608

***Cortinarius brunneotinctus* Niskanen, Liimat., Ammirati, André Paul & Lebeuf**

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2016-08-13; habitat: Pine-dwarfshrubs-*S.fuscum* ombrotrophic bog; catalogNumber: YSU-F-07111; recordedBy: Filippova, Nina; associatedSequences: [QQ366575](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 98747B4E-3D95-52E6-85A1-053C60C0D754

***Thaxterogaster causticus* Fr.**

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892632; decimalLongitude: 68.677156; eventDate: 2013-09-02; habitat: Dwarfshrubs - sphagnum ombrotrophic bog; catalogNumber: YSU-F-04409; recordedBy: Filippova, Nina; associatedSequences: [OP866196](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: C373D94A-B2E6-5829-A84C-92CC3054CE3F
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.889934; decimalLongitude: 68.700686; eventDate: 2012-09-01; habitat: Pine - dwarfshrubs - sphagnum bog (close to forest); catalogNumber: YSU-F-03944; recordedBy: Filippova, Nina; associatedSequences: [QQ366579](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: ADE1FB6C-6C0D-5C4E-ABB5-8591037917AD

***Cortinarius cinnamomeus* (L.) Gray**

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude:

68.684251; eventDate: 2022-08-19; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12166; recordedBy: Rudykina, Elena|Dobrynina, Alevtina; associatedSequences: [OP866254](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 76D43F18-8811-571D-A13C-39BD1AF5DAB1

***Cortinarius coleoptera* H.Lindstr. & Soop**

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2018-08-28; habitat: Treed Pine-dwarfshrubs-*Sphagnum* bog; catalogNumber: YSU-F-08357; recordedBy: Filippova, Nina; associatedSequences: [OP866224](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: F94994DD-6483-5139-8620-7C4165C7D5AE
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-19; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12168; recordedBy: Rudykina, Elena|Dobrynina, Alevtina; associatedSequences: [OP866256](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: E8F425CA-0F70-52E2-AD68-C404F9B55F8A

***Cortinarius collinitus* (Sowerby) Gray**

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892010; decimalLongitude: 68.682420; eventDate: 2015-08-15; habitat: Pine - dwarfshrubs - *S. fuscum* ombrotrophic bog; catalogNumber: YSU-F-05994; recordedBy: Filippova, Nina; associatedSequences: [QQ366566](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: B29EC05D-D24E-5CBF-BAD8-3D8143DEFD1C
- b. country: Russian Federation; countryCode: RU; stateProvince: Tomskaya Oblast'; county: Tomskiy Rayon; locality: Orlovka village vicinity, Chernoye lake; decimalLatitude: 56.878320; decimalLongitude: 84.665770; eventDate: 2018-08-22; habitat: Raised Pine-dwarfshrubs-*Sphagnum* bog; catalogNumber: YSU-F-08467; recordedBy: Filippova, Nina; associatedSequences: [QQ366567](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 3A02782C-5D1E-511C-9B52-CCE23AD7C5C1
- c. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-19; habitat: Raised *Sphagnum* bog; catalogNumber:

YSU-F-12173; recordedBy: Rudykina, Elena|Dobrynina, Alevtina; associatedSequences: [OP866260](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 9688D5DC-7495-52EF-8997-815388848D18

***Thaxterogaster comarostaphylidis* Ammirati, Halling & Garnica**

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892632; decimalLongitude: 68.677156; eventDate: 2013-08-23; habitat: Dwarfshrubs - sphagnum ombrotrophic bog; catalogNumber: YSU-F-04388; recordedBy: Filippova, Nina; associatedSequences: [OQ366583](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: DE9BF282-30AE-5EC1-B782-40EC5A9C7CC6
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.889934; decimalLongitude: 68.700686; eventDate: 2012-09-01; habitat: Pine - dwarfshrubs - sphagnum bog (close to forest); catalogNumber: YSU-F-03949; recordedBy: Filippova, Nina; associatedSequences: [OQ366584](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: E908B388-6CDD-5497-8BD9-A8282E3990EC

***Cortinarius cruentiphyllus* Niskanen, Liimat., Kytöv., Ammirati, Dima, L. Albert & K.W.**

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Shapsha village vicinity, 20 km E from Khanty-Mansiysk; decimalLatitude: 61.066410; decimalLongitude: 69.468030; eventDate: 2022-08-07; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12099; recordedBy: Filippova, Nina; associatedSequences: [OP866240](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 623630B6-75D5-5D75-A3A8-AC4E54BCFEB1

***Cortinarius davemallochii* Ammirati, Niskanen & Liimat.**

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Khanty-Mansiysk town vicinity; decimalLatitude: 60.891890; decimalLongitude: 68.682040; eventDate: 2020-07-28; habitat: Treed Pine-dwarfshrubs-*Sphagnum* bog; catalogNumber: YSU-F-10097; recordedBy: Filippova, Nina; associatedSequences: [OP866232](#); identifiedBy:

Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: CCEDB011-FEBC-5BB6-BB69-00CD6CCAD244

- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-04; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12122; recordedBy: Filippova, Nina|Rudykina, Elena; associatedSequences: [OQ366568](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: C2175434-49F0-5440-BF39-CCABA3B92DB7
- c. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-19; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12165; recordedBy: Rudykina, Elena|Dobrynina, Alevtina; associatedSequences: [OP866253](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 3A50BEAC-C5F5-5084-837F-271F37B43B76

***Cortinarius glandicolor* (Fr.) Fr.**

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892010; decimalLongitude: 68.682420; eventDate: 2015-08-15; habitat: Pine - dwarfshrubs - *S. fuscum* ombrotrophic bog; catalogNumber: YSU-F-05991; recordedBy: Filippova, Nina; associatedSequences: [OP866209](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 868F99D4-38E6-55A7-A3AA-FBD113CCDF9C

***Cortinarius kauffmanianus* A.H.Sm.**

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892010; decimalLongitude: 68.682420; eventDate: 2015-08-24; habitat: Pine - dwarfshrubs - *S. fuscum* ombrotrophic bog; catalogNumber: YSU-F-06276; recordedBy: Filippova, Nina; associatedSequences: [OQ366586](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 18858B58-E0C4-5D1A-BE1C-38D87475D1D8
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2016-09-05; habitat: Pine-dwarfshrubs-*S.fuscum* ombrotrophic bog; catalogNumber: YSU-F-07313; recordedBy: Filippova, Nina; associatedSequences:

- [OP866216](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 78A4F1C9-21C4-556C-A603-1536CA231141
- c. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2016-09-05; habitat: Pine-dwarfshrubs-*S.fussum* ombrotrophic bog; catalogNumber: YSU-F-07314; recordedBy: Filippova, Nina; associatedSequences: [QQ366587](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: FD1B18D1-0615-5DB0-B753-225C39AAD587
- d. country: Russian Federation; countryCode: RU; stateProvince: Tomskaya Oblast'; county: Tomskiy Rayon; locality: Orlovka village vicinity, Chernoye lake; decimalLatitude: 56.878320; decimalLongitude: 84.665770; eventDate: 2018-08-22; habitat: Raised Pine-dwarfshrubs-*Sphagnum* bog; catalogNumber: YSU-F-12725; recordedBy: Filippova, Nina; associatedSequences: [QQ366585](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 633B97EA-9FE9-58C5-A6BE-93C1CB2C6BBC
- e. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2018-09-04; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-08628; recordedBy: Filippova, Nina; associatedSequences: [OP866229](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: E374A934-EA57-5C90-904B-F227281A589C
- f. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2018-08-28; habitat: Treed Pine-dwarfshrubs-*Sphagnum* bog; catalogNumber: YSU-F-08358; recordedBy: Filippova, Nina; associatedSequences: [OP866225](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: DBE77E8E-0A93-5611-A340-4D69AEB0C82A
- g. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-19; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12170; recordedBy: Rudykina, Elena|Dobrynina, Alevtina; associatedSequences: [OP866258](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 23739D82-E509-5BD7-9FF8-72C85C8779B9
- h. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; decimalLatitude: 60.891780; decimalLongitude: 68.684250; eventDate: 2022-08-31; habitat: Raised *Sphagnum* bog; recordedBy: Filippova, Nina; associatedSequences: [QQ396710](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: FBF4CF3B-1622-59EB-8837-264005AA60EA

- i. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-04; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12131; recordedBy: Filippova, Nina|Rudykina, Elena; associatedSequences: [OP866250](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 54BCFD0E-650F-5845-AFB3-9839F0AE3BFE

***Cortinarius lindstroemii* Niskanen, Kytov. & Liimat.**

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-19; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12167; recordedBy: Rudykina, Elena|Dobrynina, Alevtina; associatedSequences: [OP866255](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 481657C2-5379-5456-9FC4-FCA3F346F010

***Cortinarius malachius* (Fr.) Fr.**

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892010; decimalLongitude: 68.682420; eventDate: 2015-08-24; habitat: Pine - dwarfshrubs - *S. fuscum* ombrotrophic bog; catalogNumber: YSU-F-06275; recordedBy: Filippova, Nina; associatedSequences: [OQ366597](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 068F9024-F3ED-54EA-B940-0C1A66C35911
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.889934; decimalLongitude: 68.700686; eventDate: 2012-09-01; habitat: Pine - dwarfshrubs - sphagnum bog (close to forest); catalogNumber: YSU-F-03938; recordedBy: Filippova, Nina; associatedSequences: [OQ366598](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 00633617-C1F9-523D-BBA1-380B51D1337D

***Thaxterogaster pinophilus* Soop**

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude:

68.684251; eventDate: 2016-09-05; habitat: Pine-dwarfshrubs-*S.fuscum* ombrotrophic bog; catalogNumber: YSU-F-07312; recordedBy: Filippova, Nina; associatedSequences: [OQ366578](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 62B63D0B-CB2E-57E4-82B9-D6F2B0666695

***Cortinarius quarciticus* H.Lindstr.**

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Tomskaya Oblast'; county: Tomskiy Rayon; locality: Orlovka village vicinity, Chernoye lake; decimalLatitude: 56.878320; decimalLongitude: 84.665770; eventDate: 2018-08-22; habitat: Raised Pine-dwarfshrubs-*Sphagnum* bog; catalogNumber: YSU-F-08477; recordedBy: Filippova, Nina; associatedSequences: [OQ366595](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: A8CDBF38-1D00-5DF2-9490-10C77491FABD
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Khanty-Mansiysk town vicinity; decimalLatitude: 60.891900; decimalLongitude: 68.682260; eventDate: 2020-09-08; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-10532; recordedBy: Filippova, Nina; associatedSequences: [OQ366594](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: B4D043FF-69D2-5DEA-9996-5BFDE77ED749
- c. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2018-08-28; habitat: Treed Pine-dwarfshrubs-*Sphagnum* bog; catalogNumber: YSU-F-08353; recordedBy: Filippova, Nina; associatedSequences: [OQ366593](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 88D328D5-44D5-554A-9EDC-EB24C19FFA0C

***Cortinarius rubellus* Cooke**

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2015-08-08; habitat: Pine - dwarfshrubs - *S. fuscum* ombrotrophic bog; catalogNumber: YSU-F-05844; recordedBy: Filippova, Nina; associatedSequences: [OQ366581](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: C9DC8601-0FD9-5EAF-A7EA-D829434C43AE
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2017-08-07; habitat: Pine-dwarfshrubs-*S.fuscum* ombrotrophic

bog; catalogNumber: YSU-F-07913; recordedBy: Filippova, Nina; associatedSequences: [QQ366582](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: FD9EA0EF-A07C-5CCA-B1C4-166EF12501C7

Cortinarius scaurus (Fr.) Fr.

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Chistoe bog, 20 km E from Khanty-Mansiysk; decimalLatitude: 61.046340; decimalLongitude: 69.440660; eventDate: 2012-08-22; habitat: Pine - dwarfshrubs - sphagnum ombrotrophic bog; catalogNumber: YSU-F-03821; recordedBy: Filippova, Nina; associatedSequences: [QQ366576](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 4BE00B63-C6E2-5298-A268-E6F4C13F53BA
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2018-08-28; habitat: Treed Pine-dwarfshrubs-*Sphagnum* bog; catalogNumber: YSU-F-08356; recordedBy: Filippova, Nina; associatedSequences: [QQ366577](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 8E225DAD-017D-512B-8374-393C461DD2A9

Cortinarius semisanguineus (Fr.) Gillet

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892022; decimalLongitude: 68.691502; eventDate: 2012-09-09; habitat: Pine - dwarfshrubs - sphagnum ombrotrophic bog; catalogNumber: YSU-F-04089; recordedBy: Filippova, Nina; associatedSequences: [QQ366571](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 4868C501-8E37-50A8-AB59-3009F2BCEB38
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Khanty-Mansiysk town vicinity; decimalLatitude: 60.891900; decimalLongitude: 68.682260; eventDate: 2020-09-08; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-10539; recordedBy: Filippova, Nina; associatedSequences: [QQ366570](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: B4C5062C-75F0-55A4-8523-05487A24BE4B

Cortinarius sphagnoravus Liimat., Kytöv., Niskanen & Ammirati

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892632; decimalLongitude: 68.677156; eventDate: 2013-08-22; habitat: Dwarfshrubs - sphagnum ombrotrophic bog; catalogNumber: YSU-F-04378; recordedBy: Filippova, Nina; associatedSequences: [OQ366590](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 2DB3B76D-2330-5650-A98C-DDA155DC2B89
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892010; decimalLongitude: 68.682420; eventDate: 2015-08-24; habitat: Pine - dwarfshrubs - *S. fuscum* ombrotrophic bog; catalogNumber: YSU-F-06282; recordedBy: Filippova, Nina; associatedSequences: [OP866213](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 414EC551-167F-5168-B7EA-163F5D8C5008
- c. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2015-08-08; habitat: Pine - dwarfshrubs - *S. fuscum* ombrotrophic bog; catalogNumber: YSU-F-05840; recordedBy: Filippova, Nina; associatedSequences: [OP866207](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 58F6D14A-A81A-5CF8-9B5C-C1DCB6764A6C
- d. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.889934; decimalLongitude: 68.700686; eventDate: 2012-09-02; habitat: Pine - dwarfshrubs - sphagnum bog (close to forest); catalogNumber: YSU-F-03985; recordedBy: Filippova, Nina; associatedSequences: [OP866187](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 7CDCB481-E72D-5FE3-BEEA-73565EA1E411
- e. country: Russian Federation; countryCode: RU; stateProvince: Tomskaya Oblast'; county: Tomskiy Rayon; locality: Orlovka village vicinity, Chernoye lake; decimalLatitude: 56.878320; decimalLongitude: 84.665770; eventDate: 2018-08-22; habitat: Raised Pine-dwarfshrubs-*Sphagnum* bog; catalogNumber: YSU-F-08472; recordedBy: Filippova, Nina; associatedSequences: [OP866227](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 65166951-E7A2-54AD-8B09-FAC2A611395D
- f. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Khanty-Mansiysk town vicinity; decimalLatitude: 60.891900; decimalLongitude: 68.682260; eventDate: 2020-09-08; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-10537; recordedBy: Filippova, Nina; associatedSequences: [OP866237](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: F6354D21-8173-55F6-ACF9-EAC329B62E80

- g. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-19; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12169; recordedBy: Rudykina, Elena|Dobrynina, Alevtina; associatedSequences: [OP866257](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: CA7BCABB-D804-560B-8497-039C82AAF095
- h. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-19; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12172; recordedBy: Rudykina, Elena|Dobrynina, Alevtina; associatedSequences: [OP866259](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: B921CABE-5EA1-55BA-B990-415FAA7D0735

Cortinarius suberi Soop

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892632; decimalLongitude: 68.677156; eventDate: 2013-09-02; habitat: Dwarfshrubs - sphagnum ombrotrophic bog; catalogNumber: YSU-F-04407; recordedBy: Filippova, Nina; associatedSequences: [QQ366592](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 08CBBB5A-B56D-531F-9DC2-0945F9DB5E80

Cortinarius tenuifulvescens Kytöv., Niskanen & Liimat.

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892010; decimalLongitude: 68.682420; eventDate: 2015-08-24; habitat: Pine - dwarfshrubs - *S. fuscum* ombrotrophic bog; catalogNumber: YSU-F-06281; recordedBy: Filippova, Nina; associatedSequences: [OP866212](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: BF9D0746-D25C-5276-9DEA-D38E6D1977E6
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892022; decimalLongitude: 68.691502; eventDate: 2012-09-09; habitat: Pine - dwarfshrubs - sphagnum ombrotrophic bog; catalogNumber: YSU-F-04092; recordedBy: Filippova, Nina; associatedSequences: [QQ366569](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 4DACD1A3-5B5A-5A71-AEE0-4394F10348D2

Cortinarius biformis* Fr.*Material**

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2016-09-20; habitat: Pine-dwarfshrubs-*S.fuscum* ombrotrophic bog; catalogNumber: YSU-F-07592; recordedBy: Filippova, Nina; associatedSequences: [OQ366596](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 1430F8F0-3D01-56E3-A3B7-7FD82C873ED8

Cortinarius venustus* P.Karst.*Material**

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2016-09-20; habitat: Pine-dwarfshrubs-*S.fuscum* ombrotrophic bog; catalogNumber: YSU-F-07591; recordedBy: Filippova, Nina; associatedSequences: [OQ366588](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 9EE21C14-1725-5D3A-9250-F82642DCB58A

Cortinarius* sp.*Material**

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892632; decimalLongitude: 68.677156; eventDate: 2013-08-22; habitat: Dwarfshrubs - sphagnum ombrotrophic bog; catalogNumber: YSU-F-04376; recordedBy: Filippova, Nina; associatedSequences: [OQ406266](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 7C47453D-9D2D-5575-83BE-137598B1BF9D

Cortinarius* sp. 1*Materials**

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2016-08-13; habitat: Pine-dwarfshrubs-*S.fuscum* ombrotrophic bog; catalogNumber: YSU-F-07112; recordedBy: Filippova, Nina; associatedSequences: [OQ366573](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28;

identificationRemarks: Identification based on morphological and molecular characters;
occurrenceID: 68878D77-BC55-5D57-A666-354EBD4A5928

- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-19; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12171; recordedBy: Rudykina, Elena|Dobrynina, Alevtina; associatedSequences: [QQ366572](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: B56EB31D-5D54-572D-A47B-2D55DAF9C20F

Cortinarius sp. 2

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892010; decimalLongitude: 68.682420; eventDate: 2015-09-05; habitat: Pine - dwarfshrubs - *S. fuscum* ombrotrophic bog; catalogNumber: YSU-F-06488; recordedBy: Filippova, Nina; associatedSequences: [QQ366574](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 2078BD8B-0F28-5DDC-B4CC-B121888CFBAF

Cortinarius sp. 3

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2015-08-08; habitat: Pine - dwarfshrubs - *S. fuscum* ombrotrophic bog; catalogNumber: YSU-F-05845; recordedBy: Filippova, Nina; associatedSequences: [QQ366580](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: EEA2E476-4939-5F99-B356-0A1CC75B8147

Cortinarius sp. 4

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892632; decimalLongitude: 68.677156; eventDate: 2013-09-11; habitat: Dwarfshrubs - sphagnum ombrotrophic bog; catalogNumber: YSU-F-04424; recordedBy: Filippova, Nina; associatedSequences: [QQ366591](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 7E0DBF71-3B71-5CCE-893E-06B51D590449

Cuphophyllus cinerellus (Kühner) Bon

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891777; decimalLongitude: 68.683476; eventDate: 2014-07-16; habitat: Andromeda-graminoid-S.papillosum lawn; catalogNumber: YSU-F-04491; recordedBy: Filippova, Nina; associatedSequences: [OP866201](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 3F31C9B7-2A00-5889-967F-76ED1B1AFA7F

Entoloma sp.

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Shapsha village vicinity, 20 km E from Khanty-Mansiysk; decimalLatitude: 61.066410; decimalLongitude: 69.468030; eventDate: 2022-07-30; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12105; recordedBy: Filippova, Nina|Rudykina, Elena; associatedSequences: [OQ396709](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 3CC67DC4-A033-5B55-98D1-5036492E873E

Entoloma fuscomarginatum P.D.Orton

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Khanty-Mansiysk town vicinity; decimalLatitude: 60.891900; decimalLongitude: 68.682260; eventDate: 2020-09-08; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-10530; recordedBy: Filippova, Nina; associatedSequences: [OP866236](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 6F67D9ED-1D19-5381-B253-FF0358B9D8CE

Galerina allospora A.H.Sm. & Singer

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892632; decimalLongitude: 68.677156; eventDate: 2013-08-23; habitat: Dwarfshrubs - sphagnum ombrotrophic bog; catalogNumber: YSU-F-04385; recordedBy: Filippova, Nina; associatedSequences: [OP866193](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28;

- identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 9F4E433F-0ACD-5C15-878A-03A54AC7AC4C
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892010; decimalLongitude: 68.682420; eventDate: 2015-08-15; habitat: Pine - dwarfshrubs - *S. fuscum* ombrotrophic bog; catalogNumber: YSU-F-05998; recordedBy: Filippova, Nina; associatedSequences: [OP866210](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: A9EB6A92-F709-590C-A139-B1995F9821B8
- c. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892010; decimalLongitude: 68.682420; eventDate: 2015-09-05; habitat: Pine - dwarfshrubs - *S. fuscum* ombrotrophic bog; catalogNumber: YSU-F-06496; recordedBy: Filippova, Nina; associatedSequences: [OQ380701](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: D7CB0165-75E9-5CD8-BA5D-9D873324055C
- d. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-19; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12176; recordedBy: Rudykina, Elena|Dobrynina, Alevtina; associatedSequences: [OP866262](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 356B7B3C-6237-59B2-8197-4B69AAF9455E

Galerina calypttrata P.D.Orton

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892632; decimalLongitude: 68.677156; eventDate: 2013-08-22; habitat: Dwarfshrubs - sphagnum ombrotrophic bog; catalogNumber: YSU-F-04379; recordedBy: Filippova, Nina; associatedSequences: [OQ380704](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: D9071435-5E7C-5AC3-B060-7A5FF065DBF2
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.889934; decimalLongitude: 68.700686; eventDate: 2012-09-02; habitat: Pine - dwarfshrubs - sphagnum bog (close to forest); catalogNumber: YSU-F-03955; recordedBy: Filippova, Nina; associatedSequences: [OQ380698](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 61C442AF-220C-5823-B953-6D23A88CAF0F

Galerina paludosa (Fr.) Kühner

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Shapsha village vicinity, 20 km E from Khanty-Mansiysk; decimalLatitude: 61.066410; decimalLongitude: 69.468030; eventDate: 2022-07-30; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12103; recordedBy: Filippova, Nina|Rudykina, Elena; associatedSequences: [OP866242](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 76F13EF6-5A13-5249-914F-DF3161A2D8DC

Galerina pumila (Pers.) Singer

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2015-08-08; habitat: Pine - dwarfshrubs - *S. fuscum* ombrotrophic bog; catalogNumber: YSU-F-05827; recordedBy: Filippova, Nina; associatedSequences: [OP866205](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: C88B0D7E-A8C2-5598-B027-068560B9F88E

Galerina sphagnicola (G.F.Atk.) A.H.Sm. & Singer

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.893086; decimalLongitude: 68.677082; eventDate: 2012-09-09; habitat: Graminoid - sphagnum hollow (patterned ridge - hollow bog); catalogNumber: YSU-F-04084; recordedBy: Filippova, Nina; associatedSequences: [OQ380703](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: F4ADF2F4-A771-5298-9845-C767393CE0F8
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892632; decimalLongitude: 68.677156; eventDate: 2013-08-26; habitat: Graminoid - sphagnum hollow (patterned ridge - hollow bog); catalogNumber: YSU-F-04399; recordedBy: Filippova, Nina; associatedSequences: [OP866195](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 37ED525F-E7D0-5C77-83DB-9A176996BD73
- c. country: Russian Federation; countryCode: RU; stateProvince: Tomskaya Oblast'; county: Tomskiy Rayon; locality: Orlovka village vicinity, Chernoye lake; decimalLatitude: 56.878320; decimalLongitude: 84.665770; eventDate: 2018-08-22; habitat: Raised Pine-dwarfshrubs-*Sphagnum* bog; catalogNumber: YSU-F-08473; recordedBy: Filippova, Nina;

- associatedSequences: [OQ380702](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 08304FFF-8395-541F-97F6-9890B2C49A71
- d. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-19; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12177; recordedBy: Rudykina, Elena|Dobrynina, Alevtina; associatedSequences: [OP866263](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 981E7D40-5103-5120-BF9B-B205F715C140

Galerina tibiicystis (G.F.Atk.) Kühner

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-04; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12123; recordedBy: Filippova, Nina|Rudykina, Elena; associatedSequences: [OP866244](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 35ADD260-F108-547B-93A5-FD30D3737D5F
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Shapsha village vicinity, 20 km E from Khanty-Mansiysk; decimalLatitude: 61.066410; decimalLongitude: 69.468030; eventDate: 2022-07-30; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12104; recordedBy: Filippova, Nina|Rudykina, Elena; associatedSequences: [OP866243](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 32F94061-10FC-5A75-BC59-531FDBE1264E

Galerina sp.

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Khanty-Mansiysk town vicinity; decimalLatitude: 60.891900; decimalLongitude: 68.682260; eventDate: 2020-09-08; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-10529; recordedBy: Filippova, Nina; associatedSequences: [OQ380700](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 951E5EAE-2A54-5883-B6B4-E90E4C7B0DD8
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2018-09-04; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-08625; recordedBy: Filippova, Nina; associatedSequences: [OQ380699](#);

identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28;
 identificationRemarks: Identification based on morphological and molecular characters;
 occurrenceID: E3DBA78B-FDAB-595B-BDF4-F95469711EFB

***Galerina* sp. 1**

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2017-07-08; habitat: Pine-dwarfshrubs-*S.fuscum* ombrotrophic bog; catalogNumber: YSU-F-07835; recordedBy: Filippova, Nina; associatedSequences: [QQ380706](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: CA77951C-ECB8-5423-8A81-76E9A809FED4
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-04; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12130; recordedBy: Filippova, Nina|Rudykina, Elena; associatedSequences: [QQ380707](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 3C821BD6-E7CD-55A2-9F7C-ECE6FCBCA496
- c. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-19; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12175; recordedBy: Rudykina, Elena|Dobrynina, Alevtina; associatedSequences: [QQ380708](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 12D9BFB3-F636-55CD-8B75-5E847BB70E10
- d. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2015-08-08; habitat: Pine - dwarfshrubs - *S. fuscum* ombrotrophic bog; catalogNumber: YSU-F-05828; recordedBy: Filippova, Nina; associatedSequences: [QQ380705](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 2B917C8B-A819-5FE6-886B-81C1E6BF2BFF

***Galerina* sp. 2**

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2018-09-04; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-08626; recordedBy: Filippova, Nina; associatedSequences: [QQ380709](#);

identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28;
 identificationRemarks: Identification based on morphological and molecular characters;
 occurrenceID: 53F60077-A223-5EDD-907F-027ECE8F82CA

Gymnopilus decipiens (Sacc.) P.D.Orton

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Khanty-Mansiysk town vicinity; decimalLatitude: 60.891900; decimalLongitude: 68.682260; eventDate: 2020-09-08; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-10528; recordedBy: Filippova, Nina; associatedSequences: [OP866235](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: C1484C7B-48C6-52A3-B90F-4EA4F07B1B13
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2016-07-02; habitat: Treed pine-dwarfshrubs-S. *fuscum* ombrotrophic bog; catalogNumber: YSU-F-06667; recordedBy: Filippova, Nina; associatedSequences: [OP866215](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: F20A3E45-F70F-5E8C-B9EA-E3784475243C
- c. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-04; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12129; recordedBy: Filippova, Nina|Rudykina, Elena; associatedSequences: [OP866249](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 040F08EB-00DE-5047-99B3-84EB81A2D5C4

Gymnopilus sp.

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.888786; decimalLongitude: 68.686395; eventDate: 2012-09-08; habitat: Graminoid - sphagnum hollow (patterned ridge - hollow bog); catalogNumber: YSU-F-04064; recordedBy: Filippova, Nina; associatedSequences: [OQ380715](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 0617518F-761D-559E-840F-B7C675AE8556
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2018-09-04; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-08623; recordedBy: Filippova, Nina; associatedSequences: [OQ406271](#);

identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28;
 identificationRemarks: Identification based on morphological and molecular characters;
 occurrenceID: 2687BE71-3B7A-5A5D-A458-AF2A3B328677

***Gymnopus androsaceus* (L.) Della Magg. & Trassin.**

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891980; decimalLongitude: 68.682430; eventDate: 2015-06-06; habitat: Pine - dwarfshrubs - *S. fuscum* ombrotrophic bog; catalogNumber: YSU-F-04985; recordedBy: Filippova, Nina; associatedSequences: [OP866203](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 54B1176F-120F-528A-B1B1-F64B28894464

***Gymnopus dryophilus* (Bull.) Murrill**

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Khanty-Mansiysk town vicinity; decimalLatitude: 60.89171; decimalLongitude: 68.68451; eventDate: 2020-06-28; habitat: Raised bog with *Pinus sylvestris*; catalogNumber: YSU-F-09780; recordedBy: Filippova, Nina; associatedSequences: [OQ366384](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: D4246552-F6B7-5E71-BEC1-3FD211BAC035

***Gymnopus junquilleus* R.H.Petersen & J.L.Mata**

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891980; decimalLongitude: 68.682430; eventDate: 2015-05-31; habitat: Pine - dwarfshrubs - *S. fuscum* ombrotrophic bog; catalogNumber: YSU-F-04971; recordedBy: Filippova, Nina; associatedSequences: [OP866202](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 0C7C3986-A599-52D6-8600-0939AB20202E
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2017-08-07; habitat: Pine-dwarfshrubs-*S.fuscum* ombrotrophic bog; catalogNumber: YSU-F-07912; recordedBy: Filippova, Nina; associatedSequences: [OQ366385](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 456E3810-0F1B-584A-B4CE-247A84745570

- c. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891954; decimalLongitude: 68.687647; eventDate: 2018-06-24; habitat: Raised bog, among *S. fuscum*; catalogNumber: YSU-F-08014; recordedBy: Filippova, Nina; associatedSequences: [OP866220](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 98E9EC09-FFB1-5D33-A2C0-1967413DFF9A

***Gymnopus* sp.**

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892010; decimalLongitude: 68.682420; eventDate: 2015-08-24; habitat: Pine - dwarfshrubs - *S. fuscum* ombrotrophic bog; catalogNumber: YSU-F-06283; recordedBy: Filippova, Nina; associatedSequences: [OQ366383](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 29EBDEB9-670A-5D90-BAD5-F374FA3C9141
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2015-08-08; habitat: Pine - dwarfshrubs - *S. fuscum* ombrotrophic bog; catalogNumber: YSU-F-05835; recordedBy: Filippova, Nina; associatedSequences: [OQ366382](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 61A8E942-28C0-5A9A-824D-91291C25A7C0
- c. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.889934; decimalLongitude: 68.700686; eventDate: 2012-09-02; habitat: Pine - dwarfshrubs - sphagnum bog (close to forest); catalogNumber: YSU-F-03953; recordedBy: Filippova, Nina; associatedSequences: [OQ406264](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 27064764-4968-5BFA-ADFA-E7F927D79440

***Gyroflexus brevibasidiatus* (Singer) Redhead, Moncalvo, Vilgalys & Lutzoni**

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2015-08-08; habitat: Pine - dwarfshrubs - *S. fuscum* ombrotrophic bog; catalogNumber: YSU-F-05832; recordedBy: Filippova, Nina; associatedSequences: [OP866206](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28;

identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 239FF4B4-CF6B-5A88-AB33-6D96E083D365

- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-04; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12127; recordedBy: Filippova, Nina|Rudykina, Elena; associatedSequences: [OP866248](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: BBC81A3F-DD66-5775-A3E2-9519F52F52DA

***Hebeloma incarnatum* A.H.Sm.**

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892632; decimalLongitude: 68.677156; eventDate: 2013-08-24; habitat: Dwarfshrubs - sphagnum ombrotrophic bog; catalogNumber: YSU-F-04390; recordedBy: Filippova, Nina; associatedSequences: [OP866194](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 10DE3EFF-6D58-56BA-9515-1DFDBA7413AF
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.889934; decimalLongitude: 68.700686; eventDate: 2012-09-01; habitat: Pine - dwarfshrubs - sphagnum bog (close to forest); catalogNumber: YSU-F-03939; recordedBy: Filippova, Nina; associatedSequences: [OP866184](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: B7D02454-1B7E-5C61-9769-1501A485CEFA

***Hypholoma capnoides* (Fr.) P.Kumm.**

Material

- a. country: Russian Federation; countryCode: RU; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-19; habitat: Raised *Sphagnum* bog; recordedBy: Filippova, Nina; identifiedBy: Filippova, Nina; identificationRemarks: Identification based on observation, no collections were made; occurrenceID: C1D32E79-F1F2-51A2-9573-E7B6B0D4405D

***Hypholoma elongatum* (Pers.) Ricken**

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude:

68.684251; eventDate: 2016-09-05; habitat: Graminoid-*Sphagnum* ombrotrophic hollow; catalogNumber: YSU-F-07318; recordedBy: Filippova, Nina; associatedSequences: [OP866218](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: C9408C4B-5F38-5851-861E-113D1435D4E8

- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.900413; decimalLongitude: 68.691845; eventDate: 2012-09-11; habitat: Pine - dwarfshrubs - sphagnum bog (close to forest); catalogNumber: YSU-F-04112; recordedBy: Filippova, Nina; associatedSequences: [OP866192](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: CCAF12D1-ADEC-5BBF-87D5-48E3D3BC3AD4

Laccaria proxima (Boud.) Pat.

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892632; decimalLongitude: 68.677156; eventDate: 2013-09-15; habitat: Dwarfshrubs - sphagnum ombrotrophic bog; catalogNumber: YSU-F-04431; recordedBy: Filippova, Nina; associatedSequences: [OP866199](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: C0716471-51D7-56AF-9105-62D8314553D6

Lactarius helvus (Fr.) Fr.

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892632; decimalLongitude: 68.677156; eventDate: 2013-09-14; habitat: Dwarfshrubs - sphagnum ombrotrophic bog; catalogNumber: YSU-F-04428; recordedBy: Filippova, Nina; associatedSequences: [OP866198](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 63925012-C9DD-5F8E-9885-409B28E21462

Lactarius musteus Fr.

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Shapsha village vicinity, 20 km E from Khanty-Mansiysk; decimalLatitude: 61.062728; decimalLongitude: 69.478030; eventDate: 2018-08-05; habitat: Treed bog, "tall ryam"; catalogNumber: YSU-F-08240; recordedBy: Filippova, Nina|Tomkovich, Konstantin; associatedSequences: [OP8](#)

- [66222](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 9C437F0F-6A05-59B1-9FBC-7CC78BF9DD07
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-04; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12126; recordedBy: Filippova, Nina|Rudykina, Elena; associatedSequences: [OP8 66247](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: A6F1DF16-F341-51CA-B346-BEF5B9E05631

***Lactarius rufus* (Scop.) Fr.**

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Khanty-Mansiysk town vicinity; decimalLatitude: 60.891710; decimalLongitude: 68.684510; eventDate: 2020-06-28; habitat: Raised bog with *Pinus sylvestris*; catalogNumber: YSU-F-09780; recordedBy: Filippova, Nina; associatedSequences: [OQ366384](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: AFAAC398-7421-5C6F-9508-FC4102D17FED
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-04; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12133; recordedBy: Filippova, Nina|Rudykina, Elena; associatedSequences: [OP8 66251](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: E7B52401-F6D5-5FD2-9198-1DE6144A80D9

***Lactarius uvidus* (Fr.) Fr.**

Material

- a. country: Russian Federation; countryCode: RU; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-19; habitat: Raised *Sphagnum* bog; recordedBy: Filippova, Nina; identifiedBy: Filippova, Nina; identificationRemarks: Identification based on observation, no collections were made; occurrenceID: 90161AAA-08CF-5D8F-A5D2-555B537BFEB0

***Lactarius vietus* (Fr.) Fr.**

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of

YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-19; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12178; recordedBy: Rudykina, Elena|Dobrynina, Alevtina; associatedSequences: [OP866264](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 26CE9CCD-09B5-57F1-83BA-5B76491EBE6E

***Leccinum holopus* (Rostk.) Watling**

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-19; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12179; recordedBy: Rudykina, Elena|Dobrynina, Alevtina; associatedSequences: [OQ406273](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 349038D6-D530-545A-B837-9529CAFA898D

***Leccinum schistophilum* Bon**

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Shapsha village vicinity, 20 km E from Khanty-Mansiysk; decimalLatitude: 61.066410; decimalLongitude: 69.468030; eventDate: 2022-07-30; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12102; recordedBy: Filippova, Nina; associatedSequences: [OP866241](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: CDAACA96-1B15-528D-8CF1-570D46A65DD5

***Lichenomphalia umbellifera* (L.) Redhead, Lutzoni, Moncalvo & Vilgalys**

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.888930; decimalLongitude: 68.702550; eventDate: 2015-06-20; habitat: Pine - dwarfshrubs - *S. fuscum* ombrotrophic bog; catalogNumber: YSU-F-05069; recordedBy: Filippova, Nina; associatedSequences: [OP866204](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 1CE95FFA-FC4C-5032-BC7C-2D21972CA400

Mycena* sp.*Material**

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892773; decimalLongitude: 68.674893; eventDate: 2012-09-02; habitat: Pine - dwarfshrubs - sphagnum bog (close to forest); catalogNumber: YSU-F-03932; recordedBy: Filippova, Nina; associatedSequences: [OQ407681](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 25EBDDF2-099A-5EC8-9CE3-9B943C809129

Mycena galopus* (Pers.) P.Kumm.*Material**

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Chistoe bog, 20 km E from Khanty-Mansiysk; decimalLatitude: 61.064432; decimalLongitude: 69.460545; eventDate: 2012-08-18; habitat: Dwarfshrubs - sphagnum ombrotrophic bog; catalogNumber: YSU-F-03777; recordedBy: Filippova, Nina; associatedSequences: [OQ407680](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 793379D3-298C-533F-8196-2DADA32369D5

Mycena megaspora* Kauffman*Material**

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-19; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12174; recordedBy: Rudykina, Elena|Dobrynina, Alevtina; associatedSequences: [OP866261](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: EF9A6873-1F22-5E17-B911-08E8F10CF253

Mycena pura* (Pers.) P.Kumm.*Material**

- a. country: Russian Federation; countryCode: RU; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-19; habitat: Raised *Sphagnum* bog; recordedBy: Filippova, Nina; identifiedBy: Filippova, Nina; identificationRemarks: Identification based on observation, no collections were made; occurrenceID: 467E3637-37BD-5AD7-9F50-BBAC1AFA34AC

Mycena cf. aff. megaspora* (Pers.) P.Kumm.*Material**

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892022; decimalLongitude: 68.691502; eventDate: 2012-09-09; habitat: Pine - dwarfshrubs - sphagnum ombrotrophic bog; catalogNumber: YSU-F-04086; recordedBy: Filippova, Nina; associatedSequences: [OP866189](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 2B03CF15-9F68-525C-A756-F6F3B824A5AC

Bogbodia uda* (Pers.) Redhead*Materials**

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2016-09-05; habitat: Graminoid-*Sphagnum* ombrotrophic hollow; catalogNumber: YSU-F-07317; recordedBy: Filippova, Nina; associatedSequences: [OP866217](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: AD803EAD-70DF-50C1-833B-E42C42A58543
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Khanty-Mansiysk town vicinity; decimalLatitude: 60.891900; decimalLongitude: 68.682260; eventDate: 2020-09-08; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-10527; recordedBy: Filippova, Nina; associatedSequences: [OP866234](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 313A3813-D2EE-5FC5-9C65-4031F1AEBCBA

Omphaliaster* sp.*Material**

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Chistoe bog, 20 km E from Khanty-Mansiysk; decimalLatitude: 61.054422; decimalLongitude: 69.456725; eventDate: 2012-09-17; habitat: Pine - dwarfshrubs - sphagnum hummock (patterned ombrotrophic bog); catalogNumber: YSU-F-04122; recordedBy: Filippova, Nina; associatedSequences: [OQ396705](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 5B297732-D6ED-5F14-95F8-868070ACA234

Psathyrella sphagnicola* (Maire) J.Favre*Material**

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892632; decimalLongitude: 68.677156; eventDate: 2013-09-18; habitat: Graminoid - sphagnum hollow (patterned ridge - hollow bog); catalogNumber: YSU-F-04433; recordedBy: Filippova, Nina; associatedSequences: [OP866200](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 5747BC2B-27EB-5C96-89AE-2F9EF1046008

Pseudoplectania episphagnum* (J. Favre) M. Carbone, Agnello & P. Alvarado*Material**

- a. country: Russian Federation; countryCode: RU; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2017-06-03; habitat: Pine-dwarfshrubs-*S.fuscum* ombrotrophic bog; catalogNumber: YSU-F-07716; recordedBy: Filippova, Nina; occurrenceID: C99AD73C-E065-5506-BD4D-BD2552D8761F

Pseudoplectania lignicola* Glejdura, V.Kučera, Lizoň & Kunca*Material**

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2017-06-03; habitat: Pine-dwarfshrubs-*S.fuscum* ombrotrophic bog; catalogNumber: YSU-F-07713; recordedBy: Filippova, Nina; associatedSequences: [QQ396706](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: C0E1A760-ED3B-5FF9-AC8C-9DE4B33EA46B

Psilocybe turficola* J.Favre*Material**

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Chistoe bog, 20 km E from Khanty-Mansiysk; decimalLatitude: 61.053093; decimalLongitude: 69.448142; eventDate: 2012-08-29; habitat: Sedge - sphagnum oligo-mesotrophic hollow; catalogNumber: YSU-F-03896; recordedBy: Filippova, Nina; associatedSequences: [OP866183](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 93046516-E43A-55A9-9175-CE7CAE76AB19

Russula decolorans* (Fr.) Fr.*Material**

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2018-08-28; habitat: Treed Pine-dwarfshrubs-*Sphagnum* bog; catalogNumber: YSU-F-08371; recordedBy: Filippova, Nina; associatedSequences: [OP866226](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 7F70CD2E-ECAE-579F-84AA-E44AB4B4999C

Russula emetica* (Schaeff.) Pers.*Material**

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.900413; decimalLongitude: 68.691845; eventDate: 2012-09-11; habitat: Pine - dwarfshrubs - sphagnum bog (close to forest); catalogNumber: YSU-F-04107; recordedBy: Filippova, Nina; associatedSequences: [OQ396704](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: DD8F7BC5-49F2-5EA4-B7B9-7A3797F6BAF2

Russula paludosa* Britzelm.*Materials**

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Chistoe bog, 20 km E from Khanty-Mansiysk; decimalLatitude: 61.060051; decimalLongitude: 69.459472; eventDate: 2012-08-28; habitat: Pine - dwarfshrubs - sphagnum ombrotrophic bog; catalogNumber: YSU-F-03868; recordedBy: Filippova, Nina; associatedSequences: [OP866182](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: E821F179-5D5E-57B9-BD01-7030F656645C
- b. country: Russian Federation; countryCode: RU; stateProvince: Tomskaya Oblast'; county: Tomskiy Rayon; locality: Orlovka village vicinity, Chernoye lake; decimalLatitude: 56.878320; decimalLongitude: 84.665770; eventDate: 2018-08-22; habitat: Raised Pine-dwarfshrubs-*Sphagnum* bog; catalogNumber: YSU-F-08507; recordedBy: Filippova, Nina; associatedSequences: [OQ396708](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: EB58A1EE-0620-5DE6-81B6-F5743EFCE27B

***Sagaranella tylicolor* (Fr.) V.Hofst., Cléménçon, Moncalvo & Redhead**

Material

- a. country: Russian Federation; countryCode: RU; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2017-07-08; habitat: Pine-dwarfshrubs-*S.fuscum* ombrotrophic bog; catalogNumber: YSU-F-07834; recordedBy: Filippova, Nina; identifiedBy: Filippova, Nina; dateIdentified: 2017-07-08; identificationRemarks: Identification based on morphological characters only; occurrenceID: 234CA784-46BC-5E4E-AEDE-0145B9ECB620

***Sphagnurus paluster* (Peck) Redhead & V.Hofst.**

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-07-11; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12022; recordedBy: Filippova, Nina; associatedSequences: [OP866239](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 551A6A83-DF4B-5F51-954A-0FD172C603DA
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-04; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-12124; recordedBy: Filippova, Nina|Rudykina, Elena; associatedSequences: [OP866245](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: D366F273-316C-59DB-9959-5E36046E21EF

***Strobilurus stephanocystis* (Kühner & Romagn. ex Hora) Singer**

Material

- a. country: Russian Federation; countryCode: RU; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-19; habitat: Raised *Sphagnum* bog; recordedBy: Filippova, Nina; identifiedBy: Filippova, Nina; identificationRemarks: Identification based on observation, no collections were made; occurrenceID: 066287C6-F9A5-5A25-8729-C37D0889823A

***Suillus praetermissus* Zvyagina & Svetash.**

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of

YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892632; decimalLongitude: 68.677156; eventDate: 2013-08-22; habitat: Dwarfshrubs - sphagnum ombrotrophic bog; catalogNumber: YSU-F-04382; recordedBy: Filippova, Nina; associatedSequences: [OQ407682](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 0026892C-5BB6-5C3E-AC79-EEB4AF1744B2

Suillus flavidus (Fr.) J.Presl

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892773; decimalLongitude: 68.674893; eventDate: 2012-09-02; habitat: Pine - dwarfshrubs - sphagnum hummock (patterned ombrotrophic bog); catalogNumber: YSU-F-03981; recordedBy: Filippova, Nina; associatedSequences: [OP866186](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: BA89F6AB-FE9B-5F39-A14D-A9B1E5C7D40A

Suillus punctipes (Peck) Singer

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Khanty-Mansiysk town vicinity; decimalLatitude: 60.891900; decimalLongitude: 68.682260; eventDate: 2020-09-08; habitat: Raised *Sphagnum* bog; catalogNumber: YSU-F-10533; recordedBy: Filippova, Nina; associatedSequences: [OQ406272](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 7E714B52-5FD6-5274-A3C8-ED3D67CFC54D

Thelephora terrestris Ehrh.

Material

- a. country: Russian Federation; countryCode: RU; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.892022; decimalLongitude: 68.691502; eventDate: 2012-09-09; habitat: Pine - dwarfshrubs - sphagnum ombrotrophic bog; catalogNumber: YSU-F-04098; recordedBy: Filippova, Nina; identifiedBy: Filippova, Nina; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological characters only; occurrenceID: FFD804E6-BEAD-5355-8F8F-6AF842475E33

Tubaria furfuracea (Pers.) Gillet

Material

- a. country: Russian Federation; countryCode: RU; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2022-08-19; habitat: Raised *Sphagnum* bog; recordedBy: Filippova, Nina; identifiedBy: Filippova, Nina; identificationRemarks: Identification based on observation, no collections were made; occurrenceID: 3DE6220F-DC39-53B2-B388-2C07D071F9E4

Xeromphalina sp.

Materials

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Chistoe bog, 20 km E from Khanty-Mansiysk; decimalLatitude: 61.057330; decimalLongitude: 69.462476; eventDate: 2012-08-21; habitat: Dwarfshrubs - sphagnum ombrotrophic bog; catalogNumber: YSU-F-03795; recordedBy: Filippova, Nina; associatedSequences: [OQ407679](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 45720CA3-6B5C-5344-A3FC-49487DA9D41F
- b. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891980; decimalLongitude: 68.682430; eventDate: 2015-06-13; habitat: Pine - dwarfshrubs - *S. fuscum* ombrotrophic bog; catalogNumber: YSU-F-05025; recordedBy: Filippova, Nina; associatedSequences: [OQ407678](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: 701F4CCB-8605-5FF3-89EE-6C93526795E5

Xeromphalina campanelloides Redhead

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Chistoe bog, 20 km E from Khanty-Mansiysk; decimalLatitude: 61.066591; decimalLongitude: 69.457326; eventDate: 2012-09-07; habitat: Pine - dwarfshrubs - sphagnum bog (close to forest); catalogNumber: YSU-F-04042; recordedBy: Filippova, Nina; associatedSequences: [OP866188](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: E204C94B-7D1F-56E1-ADDA-6815E28B3768

Xeromphalina setulipes Esteve-Rav. & G.Moreno

Material

- a. country: Russian Federation; countryCode: RU; stateProvince: Khanty-Mansiyskiy Avtonomnyy Okrug; county: Khanty-Mansiyskiy Rayon; locality: Mukhrino field station of YSU, 20 km SW from Khanty-Mansiysk; decimalLatitude: 60.891781; decimalLongitude: 68.684251; eventDate: 2015-08-08; habitat: Graminoid-*Sphagnum* hollow in ombrotrophic bog; catalogNumber: YSU-F-05833; recordedBy: Filippova, Nina; associatedSequences: [OQ406267](#); identifiedBy: Filippova, Nina|Zvyagina, Elena; dateIdentified: 2023-02-28; identificationRemarks: Identification based on morphological and molecular characters; occurrenceID: DC11A58C-AADC-5BE7-B7D9-9981178C6F85

Analysis

Taxonomic diversity

Morphological identification, based on macro- and micro-morphological characters, revealed 79 species. Barcoding of a selected reference collection resulted in 95 species. Sixty-nine species were assigned by BLAST search reliably to taxonomically valid species, 14 taxa remain unassigned ('molecular species') and possibly represent under-described taxa, while 12 taxa remain unsequenced. Molecular identification added several cryptic species to the genera *Cortinarius*, *Galerina*, *Gymnopus* and *Russula*. Several sequences revealed potentially new species (*Arrhenia* sp., *Cortinarius* spp. (5), *Entoloma* sp., *Galerina* spp. (3), *Gymnopus* sp., *Gymnopilus* sp., *Mycena* sp., *Omphaliaster* sp. and *Xeromphalina* sp.), which were not assigned to any existing sequences using BLAST and require further study. Finally, the taxonomic diversity of macromycetes of the raised bog "Mukhrino" revealed by a complex approach is represented by 95 species from 33 genera, 23 families, seven orders, three classes and two phyla (Fig. 2, Suppl. material 1).

Eleven species are reported for the first time in Russia, based on a recently-published country-scale checklist of agaricoid and boletoid fungi (Bolshakov et al. 2021): *Cortinarius aurantiobasis*, *C. brunneotinctus*, *C. cruentiphylus*, *C. davemallochii*, *C. kauffmanianus*, *C. lindstroemii*, *C. sphagnoravus*, *C. tenuifulvescens*, *Gymnopus junquilleus*, *Xeromphalina campanelloides* and *X. setulipes*.

Estimates of species diversity

The results of the estimated sample completeness are shown in Fig. 3. Sample completeness was maximal for Simpson diversity ($q = 2$) and minimal for Shannon diversity ($q = 1$) (Fig. 3A). Sample-size-based rarefaction and extrapolation curves reached asymptote for the Simpson and Shannon diversity ($q = 1, 2$), demonstrating a slight growth in species richness ($q = 0$) (Fig. 3B). The asymptotic diversity estimations for the whole community and divided by two habitats is shown in Table 1. Under-estimated species diversity is at least 10.6 species for the raised bog community in total, 12.5 species for treed bogs and 5.1 species for open bog habitats. Comparison of the rarefaction and

extrapolation sample-coverage curves confirms that the diversity of treed bogs is significantly higher than that of open bogs; this is true when comparing samples by all diversity orders ($q = 0, 1$ and 2) (Fig. 3C and D).

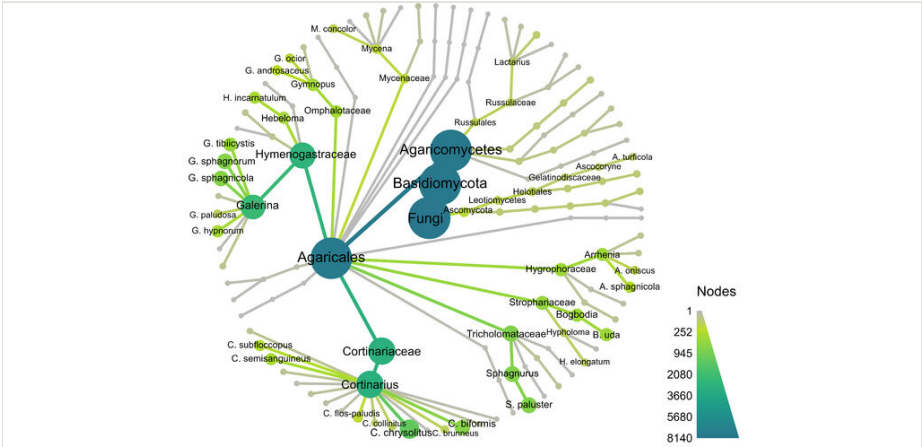


Figure 2. [doi](#)
The taxonomical structure of the macromycetes community studied in the raised bog “Mukhrino” revealed by a complex approach. Node size and colour mark the number of occurrences.

Table 1.
Asymptotic diversity estimation for species richness ($q = 0$), Shannon diversity ($q = 1$) and Simpson diversity ($q = 3$) for the community of macromycetes in peatlands in total (all data) and divided by two habitats (treed bogs, open bogs).

Assemblage	Type	q = 0	q = 1	q = 2
All data	Empirical	76.0	34.8	25.8
All data	Asymptotic	86.6	35.5	26.1
All data	Undetected	10.6	0.7	0.3
Treed bogs	Empirical	74.0	36.1	27.5
Treed bogs	Asymptotic	86.5	37.1	28.0
Treed bogs	Undetected	12.5	1.0	0.5
Open bogs	Empirical	32.0	12.7	9.2
Open bogs	Asymptotic	37.1	13.2	9.3
Open bogs	Undetected	5.1	0.5	0.1

Quantitative community structure

The total fruiting abundance, defined as the number of fruit-bodies of a particular species accumulated in the course of a year, varies by three orders of magnitude (from 1 to

thousands of fruitbodies per hectare). Following the logarithmic abundance scale (Table 2), only six species are abundant, while 28 species are rare; others can be considered common and regular. The species abundance rank varies insignificantly between years, with the most abundant species always occupying the top positions amongst other species.

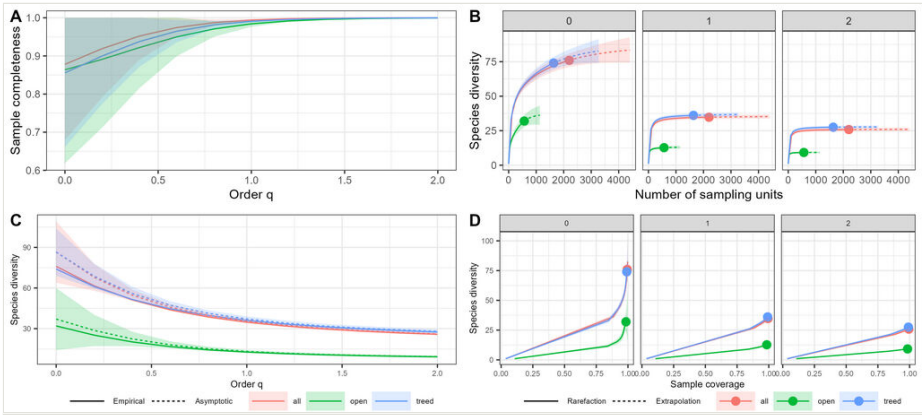


Figure 3. doi

Species diversity estimates. **A** Estimated sample completeness curves as a function of order q between 0 and 2. **B** Sample-size-based rarefaction (solid lines) and extrapolation curves (dashed lines) up to double-sized samples. **C** Empirical diversity profiles (solid lines) and asymptotic estimates of diversity profiles (dotted lines). **D** Coverage-based rarefaction (solid lines) and extrapolation (dashed lines) curves up to the corresponding coverage value for double-sized samples ($C_{\max} = 99.7\%$).

Table 2.

Fruiting abundance classes, using logarithmic abundance scale, total number of fruit-bodies per 1 ha over a year (mean number between all years).

Abundance scale	Number of species	Species list
Abundant (> 1000 frb/ha)	6	<i>Galerina sphagnicola</i> , <i>Cortinarius aurantiobasis+cinnamomeus+davemallochii</i> , <i>Sphagnurus paluster</i> , <i>Galerina allospora+sp+sp2</i> , <i>Bogbodia uda</i> , <i>Cortinarius armeniacus+kauffmanianus</i>
Common (100 - 1000 frb/ha)	18	<i>Galerina tiblicystis</i> , <i>Galerina calyptata</i> s.l., <i>Gymnopus androsaceus</i> , <i>Hebeloma incarnatum</i> , <i>Cortinarius semisanguineus+cruentiphyllus</i> , <i>Cortinarius tenuifulvescens</i> , <i>Arrhenia gerardiana</i> , <i>Cortinarius sphagnoravus</i> , <i>Monilinia oxycocci</i> , <i>Hypholoma elongatum</i> , <i>Mycena concolor</i> , <i>Arrhenia bigelowii</i> , <i>Pseudoplectania episphagnum</i> , <i>Lactarius rufus</i> , <i>Galerina paludosa</i> , <i>Cortinarius glandicolor</i> /Coleoptera, <i>Gymnopus junquilleus</i> , <i>Ascocoryne turficola</i>
Regular (10-100 frb/ha)	21	<i>Cortinarius lindstroemii</i> , <i>Cortinarius collinitus</i> , <i>Collybia cirrhata</i> , <i>Sphagnomphalia brevibasidiata</i> , <i>Lichenomphalia umbellifera</i> , <i>Galerina allospora</i> , <i>Gymnopilus decipiens</i> , <i>Cortinarius causticus</i> , <i>Galerina pumila</i> , <i>Mycena galopus</i> , <i>Cortinarius quarcticus</i> s.l., <i>Cortinarius scaurus</i> , <i>Suillus punctipes</i> , <i>Suillus praetermissus+flavidus</i> , <i>Xeromphalina campanelloides+setulipes+sp.</i> , <i>Cortinarius sp1+sp3</i> , <i>Cortinarius bataillei</i> , <i>Gymnopus</i> sp., <i>Mycena megaspora</i> , <i>Cuphophyllus cinerellus</i> , <i>Lactarius helvus</i>

Abundance scale	Number of species	Species list
Rare (< 10 frb/ha)	28	<i>Cortinarius pinophilus</i> + <i>comarostaphylii</i> , <i>Lactarius musteus</i> , <i>Russula emetica</i> , <i>Lactarius uvidus</i> , <i>Hygrocybe cinerella</i> , <i>Hypholoma capnoides</i> , <i>Leccinum holopus</i> + <i>schistophilum</i> , <i>Russula paludosa</i> + <i>decolorans</i> , <i>Cortinarius rubellus</i> , <i>Psilocybe turficola</i> , <i>Clavaria sphagnicola</i> , <i>Thelephora terrestris</i> , <i>Cortinarius caperatus</i> , <i>Entoloma fuscomarginatum</i> , <i>Galerina atkinsoniana</i> , <i>Mycena epipterygia</i> , <i>Amanita porphyria</i> , <i>Cantharellula umbonata</i> , <i>Entoloma fernandae</i> , <i>Gynnopilus</i> sp., <i>Laccaria proxima</i> , <i>Lyophyllum tylicolor</i> , <i>Omphaliaster</i> sp., <i>Tubaria furfuracea</i> , <i>Auriscalpium vulgare</i> , <i>Mycena pura</i> , <i>Pseudoplectania lignicola</i> , <i>Strobilurus stephanocystis</i>

Fruiting phenology

The fruiting of different species varies during the vegetation season. There are a few species fruiting in yearly summer (May-June), some species fruit in mid-summer (June – August); however, most species appear at the end of the season (August-September) (Fig. 4). The number of species per month varies from six in May to about 60 in September (Table 3). Fruiting abundance increases seasonally from spring to autumn by an order of magnitude, reaching its maximum in September (Fig. 5).

Table 3. Total number and the list of species registered by month, for all years of observations.		
Month	Number of species	Species list
May	6	<i>Monilinia oxycocci</i> , <i>Pseudoplectania episphagnum</i> , <i>Gymnopus ocior</i> , <i>Arrhenia sphagnicola</i> , <i>Lichenomphalia umbellifera</i>
June	17	<i>Sphagnurus paluster</i> , <i>Arrhenia sphagnicola</i> , <i>Gymnopus junquilleus</i> , <i>Pseudoplectania episphagnum</i> , <i>Arrhenia bigelowii</i> , <i>Gymnopus androsaceus</i> , <i>Monilinia oxycocci</i> , <i>Galerina paludosa</i> , <i>Galerina tibiicystis</i> , <i>Lichenomphalia umbellifera</i> , <i>Xeromphalina campanelloides</i> + <i>setulipes</i> +sp., <i>Galerina calyptrata</i> s.l., <i>Galerina allospora</i> +sp+sp2, <i>Mycena galopus</i> , <i>Cuphophyllum cinerellus</i> , <i>Pseudoplectania lignicola</i> , <i>Strobilurus stephanocystis</i>
July	31	<i>Sphagnurus paluster</i> , <i>Galerina tibiicystis</i> , <i>Arrhenia gerardiana</i> , <i>Gymnopus androsaceus</i> , <i>Cortinarius aurantiobasis</i> + <i>cinnamomeus</i> + <i>davemallochii</i> , <i>Arrhenia bigelowii</i> , <i>Galerina paludosa</i> , <i>Galerina calyptrata</i> s.l., <i>Gymnopus junquilleus</i> , <i>Galerina allospora</i> +sp.+sp., <i>Cortinarius semisanguineus</i> + <i>cruentiphylus</i> , <i>Gymnopilus decipiens</i> , <i>Xeromphalina campanelloides</i> + <i>setulipes</i> +sp., <i>Sphagnomphalia brevibasidiata</i> , <i>Cortinarius lindstroemii</i> , <i>Mycena galopus</i> , <i>Cuphophyllum cinerellus</i> , <i>Pseudoplectania episphagnum</i> , <i>Lichenomphalia umbellifera</i> , <i>Suillus praetermissus</i> + <i>flavidus</i> , <i>Collybia cirrhata</i> , <i>Galerina sphagnicola</i> , <i>Cortinarius armeniacus</i> + <i>kauffmanianus</i> , <i>Bogbodia uda</i> , <i>Hebeloma incarnatum</i> , <i>Cortinarius sphagnoravus</i> , <i>Lactarius rufus</i> , <i>Cortinarius scaurus</i> , <i>Gymnopus</i> sp., <i>Entoloma fernandae</i> , <i>Lyophyllum tylicolor</i>

Month	Number of species	Species list
August	56	<i>Cortinarius aurantiobasis</i> + <i>cinnamomeus</i> + <i>davemallochii</i> , <i>Galerina allospora</i> +sp+sp2, <i>Cortinarius armeniacus</i> + <i>kauffmanianus</i> , <i>Galerina tibiicystis</i> , <i>Galerina calyptrata</i> s.l., <i>Sphagnurus paluster</i> , <i>Galerina sphagnicola</i> , <i>Hebeloma incarnatum</i> , <i>Cortinarius semisanguineus</i> + <i>cruentiphyllus</i> , <i>Bogbodia uda</i> , <i>Cortinarius sphagnoravus</i> , <i>Cortinarius tenuifulvescens</i> , <i>Gymnopus androsaceus</i> , <i>Arrhenia gerardiana</i> , <i>Gymnopus junquilleus</i> , <i>Cortinarius glandicolor</i> + <i>coleoptera</i> , <i>Sphagnomphalia brevibasidiata</i> , <i>Cortinarius lindstroemii</i> , <i>Cortinarius collinitus</i> , <i>Arrhenia bigelowii</i> , <i>Lactarius rufus</i> , <i>Mycena concolor</i> , <i>Suillus praetermissus</i> + <i>flavidus</i> , <i>Ascocoryne turficola</i> , <i>Cortinarius bataillei</i> , <i>Gymnopilus decipiens</i> , <i>Galerina allospora</i> , <i>Collybia cirrhata</i> , <i>Suillus punctipes</i> , <i>Cortinarius causticus</i> , <i>Cortinarius</i> sp1+sp3, <i>Galerina paludosa</i> , <i>Gymnopus</i> sp., <i>Mycena galopus</i> , <i>Cortinarius scaurus</i> , <i>Lichenomphalia umbellifera</i> , <i>Hypholoma elongatum</i> , <i>Lactarius musteus</i> , <i>Cortinarius quarcticus</i> s.l., <i>Cortinarius rubellus</i> , <i>Xeromphalina campanelloides</i> + <i>setulipes</i> +sp., <i>Galerina pumila</i> , <i>Russula paludosa</i> , <i>Clavaria sphagnicola</i> , <i>Lactarius uvidus</i> , <i>Pseudoplectania episphagnum</i> , <i>Cortinarius pinophilus</i> + <i>comarostaphylii</i> , <i>Lactarius helvus</i> , <i>Leccinum holopus</i> + <i>schistophilum</i> , <i>Cantharellula umbonata</i> , <i>Galerina atkinsoniana</i> , <i>Psilocybe turficola</i> , <i>Thelephora terrestris</i> , <i>Amanita porphyria</i> , <i>Mycena epipterygia</i> , <i>Mycena pura</i>
September	57	<i>Cortinarius aurantiobasis</i> + <i>cinnamomeus</i> + <i>davemallochii</i> , <i>Galerina sphagnicola</i> , <i>Cortinarius armeniacus</i> + <i>kauffmanianus</i> , <i>Galerina allospora</i> +sp+sp2, <i>Bogbodia uda</i> , <i>Cortinarius tenuifulvescens</i> , <i>Hebeloma incarnatum</i> , <i>Cortinarius semisanguineus</i> + <i>cruentiphyllus</i> , <i>Galerina calyptrata</i> s.l., <i>Galerina tibiicystis</i> , <i>Cortinarius sphagnoravus</i> , <i>Mycena concolor</i> , <i>Hypholoma elongatum</i> , <i>Gymnopus androsaceus</i> , <i>Sphagnurus paluster</i> , <i>Cortinarius glandicolor</i> + <i>coleoptera</i> , <i>Ascocoryne turficola</i> , <i>Cortinarius collinitus</i> , <i>Gymnopus junquilleus</i> , <i>Lactarius rufus</i> , <i>Galerina allospora</i> , <i>Cortinarius causticus</i> , <i>Sphagnomphalia brevibasidiata</i> , <i>Cortinarius lindstroemii</i> , <i>Galerina pumila</i> , <i>Cortinarius scaurus</i> , <i>Suillus punctipes</i> , <i>Cortinarius pinophilus</i> + <i>comarostaphylii</i> , <i>Arrhenia bigelowii</i> , <i>Gymnopus</i> sp., <i>Mycena galopus</i> , <i>Russula emetica</i> , <i>Collybia cirrhata</i> , <i>Galerina paludosa</i> , <i>Lactarius musteus</i> , <i>Russula paludosa</i> + <i>decolorans</i> , <i>Lactarius helvus</i> , <i>Leccinum holopus</i> + <i>schistophilum</i> , <i>Hypholoma capnoides</i> , <i>Mycena megaspora</i> , <i>Entoloma fuscumarginatum</i> , <i>Omphaliaster</i> sp., <i>Suillus praetermissus</i> + <i>flavidus</i> , <i>Cortinarius bataillei</i> , <i>Gymnopilus decipiens</i> , <i>Lichenomphalia umbellifera</i> , <i>Clavaria sphagnicola</i> , <i>Lactarius uvidus</i> , <i>Cantharellula umbonata</i> , <i>Galerina atkinsoniana</i> , <i>Psilocybe turficola</i> , <i>Thelephora terrestris</i> , <i>Cuphophyllus cinerellus</i> , <i>Cortinarius caperatus</i> , <i>Gymnopilus</i> sp., <i>Laccaria proxima</i> , <i>Tubaria furfuracea</i>

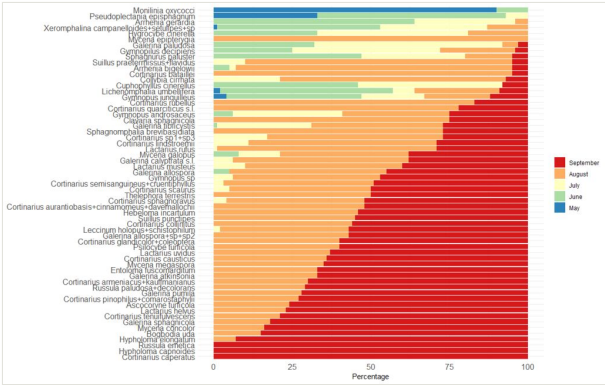


Figure 4. [doi](#)
The relative number of fruit-bodies per species per month, mean for all years of observations (only species with over two observations are shown).

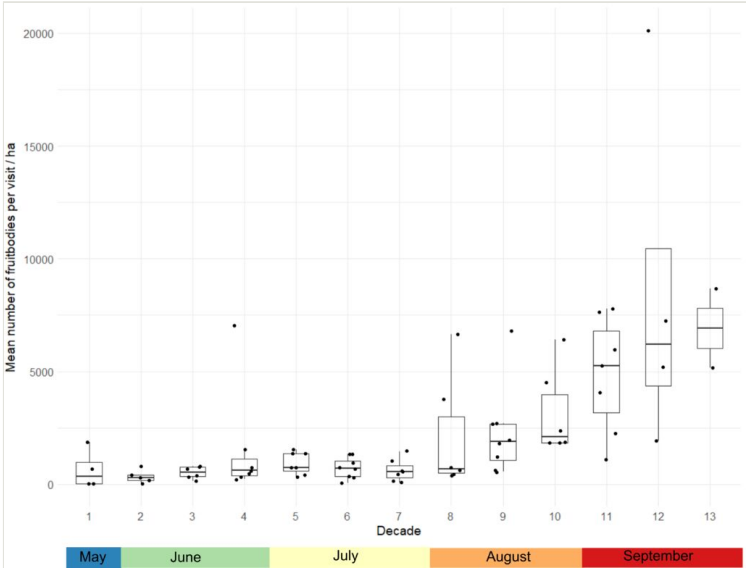


Figure 5. [doi](#)
Seasonal dynamics of fruiting abundance, mean number of fruit-bodies per visit per hectare.

Interannual dynamics

The total abundance, or accumulated number of counted fruit-bodies, varies strongly between years: it reached the maximum of about 5000 frb/year/ha in 2016 and was the lowest in 2021 at 844 frb/year/ha (Fig. 6).

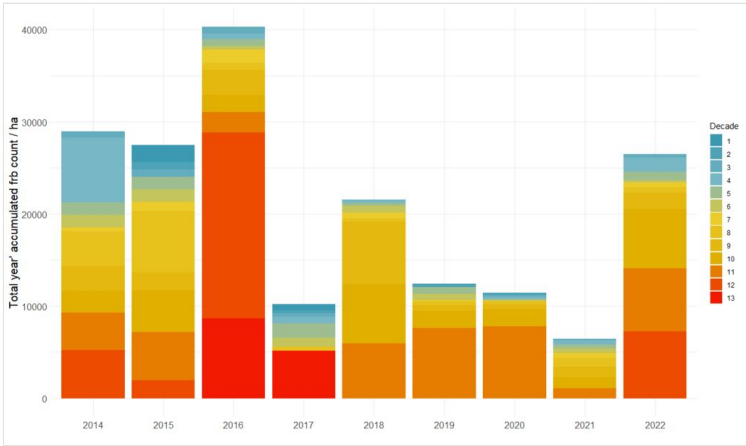


Figure 6. [doi](#)
Fruiting dynamics between years, shown by the total number of accumulated fruit-bodies per year (colour showing decades).

Fungal community in relation to vegetation types

In order to study the influence of habitat on community composition of macromycetes, we created total species lists for each plot and arranged them according to habitat types and vegetation composition. Fig. 7 shows a sufficient distinction between the fungal composition of two habitats (treed bogs and open *Sphagnum* lawns).

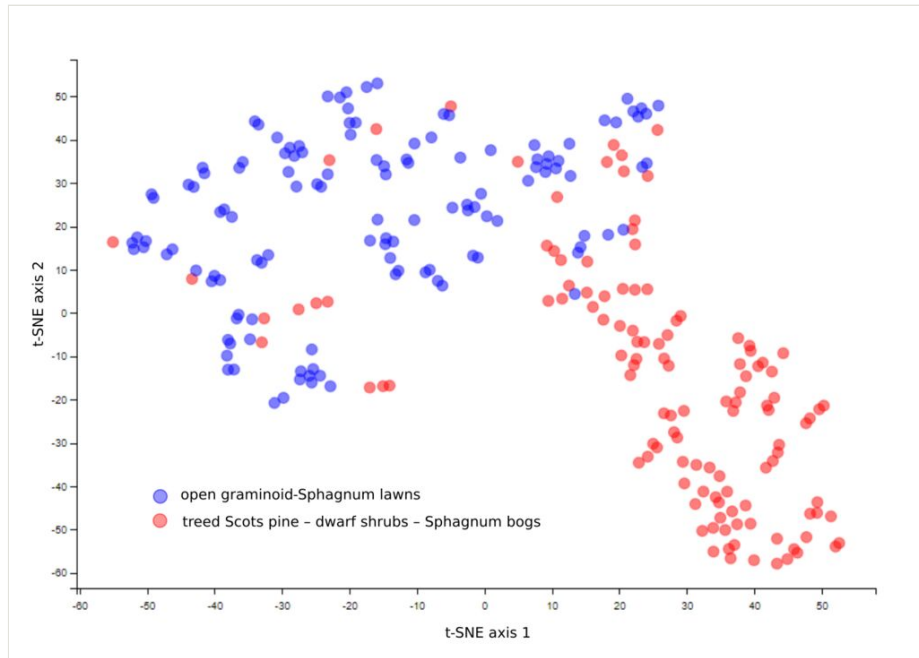


Figure 7. [doi](#)

Arrangement of fungal community by two types of habitats (treed bogs and open *Sphagnum* lawns) using t-SNE ordination.

Discussion

Taxonomic diversity

The previously-reported species diversity of fungi of peatlands globally (based on literature records) is estimated at about 600 species (Thormann and Rice 2007), including both micro- and macrofungi. This diversity is represented nearly equally by ascomycetes and basidiomycetes, with chytridiomycetes and zygomycetes being far less abundant. Based on the compilation created by Thormann and Rice (2007), we created an open-access literature-based global dataset of fungal records from peatlands (Filippova and Rudykina 2023). At the time of publication, the dataset included about 120 published works and about 5000 records of 1300 species of fungi from 15 countries. About a half of the published works used cultivation techniques (with a total of about 1000 records in the

dataset), another half was derived from direct observation of fruiting structures of macromycetes (a total of about 4000 records in the dataset). The taxonomic structure of fungal diversity (after synonymisation using the GBIF species matching tool) includes three kingdoms (Fungi, Chromista, Protozoa), seven phyla, 26 classes, 80 orders, 212 families and about 1300 species. *Macromycetes* are represented by about 960 species, with only about 350 species of microfungi.

We used this dataset to compare our species list with the existing research of macromycetes in oligotrophic peatlands. Table 4 shows the summary of results by different authors (only the most complete studies conducted specifically in oligo- or mesotrophic raised bogs) by the total number of species revealed (about 20-70 species per study) and the proportion of shared species (up to 20%). The high number of unique species in each study may be explained by differences in the studied habitats or the broad scope of the habitats examined in each study (only a few works used the standardised plots located in explicitly-assigned vegetation types). The total number of species from all studies of macromycetes in oligotrophic peatlands is five times larger than our species list and the proportion of shared species is only 40% (28 species) from our species list. The unique species in our study are either species mostly restricted to our region overlooked by other researchers or potentially new taxa.

Table 4. Comparison of species lists from the studies of macromycetes in raised bogs globally: the lower part shows the absolute numbers of shared species; the upper part (<i>italic bold</i>) shows the percentage of shared species; the intersection provides the total number of species in each publication.																
	1. PS	2. Fl87	3. Fr97	4. Hol97	5. Km 82	6. KmR 82	7. Lan48	8. Ł07	9. Oh74	10. Rob04	11. Sal79	12. Sl04	13. St11	14. Tan00	15. Ch65	Totally
1. Present study	95	11	7	9	10	6	11	9	10	5	13	11	16	1	6	7
2. Flesinska 1987	12	46	17	6	12	15	15	14	11	3	14	14	18	5	5	8
3. Friedrich 1997	6	11	20	10	7	15	14	13	21	3	12	12	18	1	8	4
4. Holec 1997	9	5	5	32	11	22	11	9	14	3	11	13	16	2	8	1
5. Kalamees 1982	12	12	5	9	53	17	11	11	11	4	14	9	15	0	1	9
6. Kalamees and Raitviir 1982	6	7	3	7	14	31	8	7	12	3	8	7	11	1	4	4
7. Lange 1948	13	15	10	9	12	7	53	13	14	8	16	18	18	4	9	10

	1. PS	2. Fl87	3. Fr97	4. Hol97	5. Km 82	6. KmR 82	7. Lan48	8. Ł07	9. Oh74	10. Rob04	11. Sal79	12. Sl04	13. St11	14. Tan00	15. Ch65	Totally
8. Łuszczynski 2007	11	14	10	8	12	6	14	55	11	5	14	17	20	7	8	10
9. Ohenoja 1974	9	7	8	7	8	6	10	8	19	5	17	11	14	3	6	5
10. Roberts et al. 2004	7	3	3	3	5	3	10	6	4	66	6	6	5	3	0	6
11. Salo 1979	19	17	11	12	18	8	20	18	16	9	74	17	20	6	6	15
12. Ślusarczyk 2004	15	15	10	12	11	7	21	20	9	8	23	64	23	3	10	3
13. Stasinska 2011	20	19	14	14	16	10	20	22	11	6	26	28	57	4	11	12
14. Tanase 2000	1	5	1	2	0	1	4	8	2	4	8	4	4	57	0	4
15. Chastukhin 1965	5	3	3	4	1	2	6	6	2	0	5	8	8	0	17	3
Total species list	28	31	17	4	35	17	38	37	18	25	57	11	48	15	11	388

Phenology

The phenology of fruiting of macromycetes in raised bog communities was studied by different authors (Lange 1948, Kotlaba 1953, Salo 1979, Saari and Salonen 1983). All authors agree about the seasonal development of fruiting, with the maximum fruiting abundance and number of species developing from August to October. We assumed a lack of data on long-term fruiting dynamics in peatlands in literature before this study. Several papers show a positive effect of peatland drainage on fruiting abundance (Chastukhin 1965, Veijalainen 1974, Kalamees 1982). Previous authors have shown the influence of a combination of factors (precipitation, soil or air humidity, soil temperature, soil heat flux and others) on fungal fruiting in general (Arnolds 1981, Kotilová-Kubičková et al. 1990, Straatsma et al. 2001, Pinna et al. 2010) and also registered global changes of fungal fruiting with climate change (Gange et al. 2007, Kauserud et al. 2008, Buntgen et al. 2013).

Conservation initiatives

Macromycetes adapted to peatland ecosystems deserve special attention in conservation initiatives due to the ongoing degradation of these habitats on the global scale (Arnolds 2007). Species with low abundance, as well as species restricted to raised bog habitats,

should be considered as targets in conservation programmes. We evaluated the list of species restricted to raised bog habitats according to their conservation status in Europe and found that many species were already included in conservation lists of many countries (Table 5). Understanding the ecology and population dynamics of these species is especially important in the light of their conservation.

Table 5.

Conservation status of species specialised to raised bog habitats, in Red Data books of several European countries (<http://www.eccf.eu/activities-en.ehtml>)

N	Species	Protection status in different countries
1	<i>Arrhenia gerardiana</i>	Austria (2), Czech Republic (EN), France (4), Germany (endangered), Latvia (LC), Netherlands (EN), Norway (LC), Poland (V), Serbia (DD), Switzerland (EN)
2	<i>Ascocoryne turficola</i>	Norway (DD), Sweden (NT)
3	<i>Clavaria sphagnicola</i>	France (1), Germany (critically endangered)
4	<i>Cortinarius huronensis</i>	Czech Republic (DD), Italy (X), Latvia (LC), Netherlands (SU)
5	<i>Entoloma fuscomarginatum</i>	Denmark (EN), Netherlands (SU), Norway (NE)
6	<i>Galerina sphagnicola</i>	Austria (2)
7	<i>Gymnopilus fulgens</i>	Austria (2), Czech Republic (RE), Denmark (E 1997), Finland (DD), France (5), Germany (very rare/potentially endangered), Latvia (DD), Netherlands (VU), Norway (NE), Russia (3)
8	<i>Lactarius musteus</i>	Austria (2), Czech Republic (EN), Denmark (VU), Germany (endangered), Great Britain (NT), Latvia (VU), Norway (LC), Sweden (NT), Switzerland (EN)
9	<i>Lichenomphalia umbellifera</i>	France (5)
10	<i>Omphaliaster borealis</i>	Germany (critically endangered), Norway (LC)
11	<i>Psathyrella sphagnicola</i>	Czech Republic (CR), Denmark (RE 1997), France (2), Germany (endangered), Latvia (DD), Norway (NE), Switzerland (ED)
12	<i>Pseudoplectania episphagnum</i>	Czech Republic (RE), Germany (critically endangered), Norway (NT)
13	<i>Psilocybe turficola</i>	Denmark (EN), France (2), Netherlands (SU), Poland (E)
14	<i>Sphagnomphalia brevibasidiata</i>	France (1), Norway (NE), Switzerland (CR)
15	<i>Suillus sibiricus</i>	Austria (3), Bulgaria (V), Czech Republic (CR), Estonia (CR), Germany (endangered), Poland (E), Slovakia (VU), Switzerland (VU)

Acknowledgements

The work was funded by a grant for the organisation of a new laboratory for young researchers at the Yugra State University as part of the implementation of the National Project "Science and Universities".

References

- Arnolds E (1981) Ecology and coenology of macrofungi in grasslands and moist heathlands in Drenthe, the Netherlands. J. Cramer in der A.R. Grantner Verlag Kommanditgesellschaft, Vaduz, 411 pp.
- Arnolds E (2007) Biogeography and conservation. In: Druzhinina S, Kubicek C (Eds) Environmental and microbial relationships: The mycota. IV. Springer Berlin Heidelberg, 105-124 pp.
- Artz R (2013) Microbial community structure and carbon substrate use in northern peatlands. Carbon Cycling in Northern Peatlands 111-129. <https://doi.org/10.1029/2008gm000806>
- Bolshakov S, Kalinina L, Palomozhnykh E, Potapov K, Ageev D, Arslanov S, Filippova N, Palamarchuk M, Tomchin D, Voronina E (2021) Agaricoid and boletoid fungi of Russia: the modern country-scale checklist of scientific names based on literature data. Biological communications 66 (4): 316-325. <https://doi.org/10.21638/spbu03.2021.404>
- Büntgen U, Peter M, Kauserud H, Egli S (2013) Unraveling environmental drivers of a recent increase in Swiss fungi fruiting. Global Change Biology 19 (9): 2785-2794. <https://doi.org/10.1111/gcb.12263>
- Chao A, Kubota Y, Zelený D, Chiu C, Li C, Kusumoto B, Yasuhara M, Thorn S, Wei C, Costello M, Colwell R (2020) Quantifying sample completeness and comparing diversities among assemblages. Ecological Research 35 (2): 292-314. <https://doi.org/10.1111/1440-1703.12102>
- Chao A, Henderson P, Chiu C, Moyes F, Hu K, Dornelas M, Magurran A (2021) Measuring temporal change in alpha diversity: A framework integrating taxonomic, phylogenetic and functional diversity and the iNEXT.3D standardization. Methods in Ecology and Evolution 12 (10): 1926-1940. <https://doi.org/10.1111/2041-210x.13682>
- Chastukhin VY (1965) Makromitsety i ikh rol' v dinamike rastitel'nosti pri osushenii [The mycoflora of oligotrophic bogs and paludified forests and its role in the the dynamics of plant associations in the course of drainage. I. Macromytetes]. Botanicheskiy Zhurnal 51: 161-175.
- Chernov IY (Ed.) (2018) Funktsionirovaniye mikrobnykh kompleksov v verkhovykh torfyanikakh - analiz prichin medlennoy destruktсии torfa. [Functioning of microbial complexes in raised peatlands - analysis of the reasons for the slow destruction of peat]. Tovarishchestvo nauchnykh izdaniy KMK, Moscow, 128 pp.
- Einhellinger A (1976) Die Pilze in primären und sekundären Pflanzengesellschaften oberbayerischer Moore Teil 1. Berichte der Bayerischen Botanischen Gesellschaft zur Erforschung der heimischen Flora (47)75-149.
- Einhellinger A (1977) Die Pilze in primären und sekundären Pflanzengesellschaften oberbayerischer Moore Teil 2. Berichte der Bayerischen Botanischen Gesellschaft zur Erforschung der heimischen Flora 48: 61-146.
- Elliott D, Caporn SM, Nwaishi F, Nilsson RH, Sen R (2015) Bacterial and Fungal Communities in a Degraded Ombrotrophic Peatland Undergoing Natural and Managed Re-Vegetation. PLOS One 10 (5). <https://doi.org/10.1371/journal.pone.0124726>
- Favre J (1948) Les associations fongiques des hauts-marais jurassiens et de quelques regions voisines. [Fungal associations in the Jura high marshes and some neighboring regions]. Kommissionsverlag Buchdruckerei Buchler & Co., Bern, 228 pp.

- Filippova N (2023) The Fungarium of Yugra State University. Version 1.114. Yugra State University Biological Collection (YSU BC). Occurrence dataset. Release date: 2023-3-07. URL: <https://doi.org/10.15468/g4bk6h>
- Filippova N, Rudykina E (2023) Literature occurrence database of global fungal diversity in peatlands. Version 1.7. Yugra State University Biological Collection (YSU BC). Occurrence dataset. Release date: 2023-3-07. URL: <https://doi.org/10.15468/p8q8q4>
- Filippova N, Rudykina E, Dobrynina A (2023a) Plot-based observations of macrofungi in raised bogs in Western Siberia (2014-2022). Version 1.37. Yugra State University Biological Collection (YSU BC). Sampling event dataset. Release date: 2023-3-07. URL: <https://doi.org/10.15468/e9g5ri>
- Filippova N, Rudykina E, Zvyagina E (2023b) The checklist of macrofungi of raised bogs: barcoding of accumulated collection following the 9-year plot-based monitoring in Northwestern Siberia. Occurrence dataset. Version 1.3. Yugra State University Biological Collection (YSU BC). Release date: 2023-7-24. URL: <https://doi.org/10.15468/dl.gebk9c>
- Filippova N, Zvyagina E, Rudykina E (2023c) BOLD dataset: Barcoding of Macromycetes from Raised bogs in Northwestern Siberia. URL: [dx.doi.org/10.5883/DS-BFSEG](https://doi.org/10.5883/DS-BFSEG)
- Flesinska Z (1987) Macromycetes zbiorowisk leśnych i torfowiskowych Pojezierza Łęczyńsko-Włodawskiego [The macromycetes of forests and peatbog communities of the Łęczyńska-Włodawa Lake District]. *Acta Mycologica* 23 (1): 19-92. <https://doi.org/10.5586/am.1987.002>
- Foster ZL, Sharpton T, Grünwald N (2017) Metacoder: An R package for visualization and manipulation of community taxonomic diversity data. *PLOS Computational Biology* 13 (2). <https://doi.org/10.1371/journal.pcbi.1005404>
- Friedrich S (1997) Macromycetes of the proposed nature reserve Wilcze Uroczysko-Olszanka in the Odra estuary. *Acta Mycologica* 32 (2): 239-255. <https://doi.org/10.5586/am.1997.020>
- Gange AC, Gange EG, Sparks TH, Boddy L (2007) Rapid and Recent Changes in Fungal Fruiting Patterns. *Science* 316 (5821): 71-71. <https://doi.org/10.1126/science.1137489>
- Garcés-Pastor S, Wangenstein O, Pérez-Haase A, Pèlachs A, Pérez-Obiol R, Cañellas-Boltà N, Mariani S, Vegas-Vilarrúbia T (2019) DNA metabarcoding reveals modern and past eukaryotic communities in a high-mountain peat bog system. *Journal of Paleolimnology* 62 (4): 425-441. <https://doi.org/10.1007/s10933-019-00097-x>
- Gardes M, Bruns TD (1993) ITS primers with enhanced specificity for basidiomycetes - application to the identification of mycorrhizae and rusts. *Molecular Ecology* 2 (2): 113-118. <https://doi.org/10.1111/j.1365-294x.1993.tb00005.x>
- Holec J (1997) Studium makromycetů na trvalých plochách v hlavních klimaxových společenstvech Šumavy [Monitoring of macromycetes in the main climax communities of the Šumava Mts.]. *Příroda* 10: 15-48.
- Hyndman RJ, Athanasopoulos G (2021) *Forecasting: Principles and Practice*. OTexts, Melbourne, 442 pp.
- Jackson C, Liew KC, Yule C (2008) Structural and functional changes with depth in microbial communities in a tropical Malaysian Peat Swamp Forest. *Microbial Ecology* 57 (3): 402-412. <https://doi.org/10.1007/s00248-008-9409-4>

- Kalamees K (1982) The composition and seasonal dynamics of fungal cover on peat soils. In: Mazing VV (Ed.) Peatland ecosystems. Researchers into the plant cover of Estonian bogs and their productivity. Valgus, Tallin, 12-29 pp.
- Kalamees K, Raitviir A (1982) A list of higher fungi of Estonian peatlands. In: Mazing VV (Ed.) Peatland ecosystems. Researchers into the plant cover of Estonian bogs and their productivity. Valgus, Tallin, 30-33 pp.
- Kausrud H, Stige LC, Vik JO, Økland R, Høiland K, Stenseth N (2008) Mushroom fruiting and climate change. Proceedings of the National Academy of Sciences 105 (10): 3811-3814. <https://doi.org/10.1073/pnas.0709037105>
- Kim J, Rochefort L, Hogue-Hugron S, Alqulaiti Z, Dunn C, Pouliot R, Jones T, Freeman C, Kang H (2021) Water table fluctuation in peatlands facilitates fungal proliferation, impedes *Sphagnum* growth and accelerates decomposition. Frontiers in Earth Science 8 <https://doi.org/10.3389/feart.2020.579329>
- Knudsen H, Vesterholt J (2018) Funga Nordica: Agaricoid, boletoid, cyphelloid and gastrpoid. Nordsvamp, Denmark, 1083 pp.
- Kotilová-Kubičková L, Ondok JP, Přibáň K (1990) Phenology and growth of *Dermocybe uliginosa* in a willow carr. I. Phenology of fruiting. Mycological Research 94 (6): 762-768. [https://doi.org/10.1016/s0953-7562\(09\)81375-0](https://doi.org/10.1016/s0953-7562(09)81375-0)
- Kotlaba F (1953) Vzácne nebo nové druhy mykoflory Soběslavských blat [Rare or new species mycoflora Soběslav marshland]. Ceska Mykologie 7 (4): 191-192.
- Kotlabam F, Kubicka J (1960) Die Mykoflora des Moores "Rotes Moos" bei Schalmanowitz in ihrer Beziehung zur Mykoflora der sudbomischen Torfgebiete [The mycoflora of "Cervene blato", the peat bog near Salomanovice, with observations on the Southern Bohemian peat bogs]. Ceska Mykologie 1 4: 90-100.
- Lange M (1948) The agarics of Maglemose: a study in the ecology of the agarics. Munksgaard, Copenhagen, 141 pp.
- Lange M, Lange B (1982) Agarics growing in *Sphagnum*: specialization and distribution in arctic and alpine zones. In: Laursen GA, Ammirati JF (Eds) Arctic and Alpine Mycology. University of Washington Press, Seattle, WA, U.S.A.
- Laurens vdM, Geoffrey H (2008) Visualizing Data using t-SNE. Journal of Machine Learning Research 9: 2579-2605.
- Liimatainen K, Niskanen T, Dima B, Ammirati J, Kirk P, Kytövuori I (2020) Mission impossible completed: unlocking the nomenclature of the largest and most complicated subgenus of *Cortinarius*, *Telamonia*. Fungal Diversity 104 (1): 291-331. <https://doi.org/10.1007/s13225-020-00459-1>
- Lodge DJ, Ammirati JF (2004) Terrestrial and lignicolous macrofungi. In: Mueller G (Ed.) Biodiversity of Fungi. Elsevier Academic Press, San Diego, 127-173 pp. <https://doi.org/10.1016/B978-012509551-8/50011-8>
- Łuszczynski J (2007) Diversity of Basidiomycetes in various ecosystems of the Góry Świętokrzyskie Mts. Monographiae Botanicae 97: 1-200. <https://doi.org/10.5586/mb.2007.001>
- O'Dell TE, Lodge JD, Mueller GM (2004) Approaches to sampling macrofungi. In: Mueller GM (Ed.) Biodiversity of fungi. Inventory and monitoring methods. Elsevier Academic Press, Amsterdam, Boston, 163-168 pp.
- Ohenoja E (1974) Metsäsienien määrän mittaamisesta [On the quantitative study of fungi in forest and bogs]. Karstenia 14: 46-53. <https://doi.org/10.29203/ka.1974.89>

- Pinna S, Gévry M-, Côté M, Sirois L (2010) Factors influencing fructification phenology of edible mushrooms in a boreal mixed forest of Eastern Canada. *Forest Ecology and Management* 260 (3): 294-301. <https://doi.org/10.1016/j.foreco.2010.04.024>
- RCoreTeam (2021) R: A language and environment for statistical computing. Vienna: R Foundation for Statistical Computing. URL: [https:// www.R-project.org/](https://www.R-project.org/)
- Rehner SA, Buckley E (2005) A *Beauveria* phylogeny inferred from nuclear ITS and EF1- α sequences: evidence for cryptic diversification and links to *Cordyceps* teleomorphs. *Mycologia* 95 (1): 84-98. <https://doi.org/10.1080/15572536.2006.11832842>
- Roberts C, Ceska O, Kroeger P, Kendrick B (2004) Macrofungi from six habitats over five years in Clayoquot Sound, Vancouver Island. *Canadian Journal of Botany* 82 (10): 1518-1538. <https://doi.org/10.1139/b04-114>
- Rydin H, Jeglum J, Hooijer A (2006) Diversity of life in peatlands: fungi and microorganisms. In: Rydin H (Ed.) *The biology of peatlands*. Oxford University Press, Oxford, 20-24 pp. <https://doi.org/10.1093/acprof:oso/9780198528722.003.0002>
- Saari V, Salonen V (1983) Luonnontilaisten suotyyppien sienisadoista Korpilahden Ristisuolla vuosina 1981 ja 1982 [Mire types of natural mushroom harvest Korpilahden Cross Swamp in 1981 and 1982]. *Metsäntutkimuslaitoksen Tiedonantoja* 91: 11-20.
- Salo K (1979) Mushrooms and mushroom yield on transitional peatlands in Central Finland. *Ann. Bot. Fenn.* 16: 181-192.
- Salonen V, Saari V (1990) Generic composition of macrofungus communities on virgin mire site types in Central Finland. *Annales Botanici Fennici* 27: 33-38.
- Slusarczyk T (2004) Grzyby wielkoowocnikowe rezerwatu torfowiskowego Pniowski Lug. *Przegląd Przyrodniczy* 15 (1-2): 19-27.
- Stasinska M (2011) Macrofungi of raised and transitional bogs of Pomerania. *Monographiae Botanicae* 101: 1-142. <https://doi.org/10.5586/mb.2011.001>
- Straatsma G, Ayer F, Egli S (2001) Species richness, abundance, and phenology of fungal fruit bodies over 21 years in a Swiss forest plot. *Mycological Research* 105 (5): 515-523. <https://doi.org/10.1017/s0953756201004154>
- Tanase C (2000) Macromycetes found in oligotrophe swamps located in the Dornel depression (Eastern Carpathians). *Studii si Cercetari* 17-22.
- Thormann M (2006) Diversity and function of fungi in peatlands: A carbon cycling perspective. *Canadian Journal of Soil Science* 86: 281-293. <https://doi.org/10.4141/s05-082>
- Thormann MN, Rice AV (2007) Fungi from peatlands. *Fungal Diversity* 24: 241-299.
- Vašutová M, Jiroušek M, Hájek M (2021) High fungal substrate specificity limits the utility of environmental DNA to detect fungal diversity in bogs. *Ecological Indicators* 121 <https://doi.org/10.1016/j.ecolind.2020.107009>
- Vašutová M, Vítovcová K, Manukjanová A, Prach K (2023) Fungal troublemakers – using indicator species with ephemeral fruitbodies to evaluate recovery of formerly extracted raised bogs. *Ecological Indicators* 154 <https://doi.org/10.1016/j.ecolind.2023.110574>
- Veijalainen H (1974) Metsäojitusalueiden sienisadosta / Mushroom production on drained peatlands. *Suo* 26: 31-33.
- Vilgalys R, Hester M (1990) Rapid genetic identification and mapping of enzymatically amplified ribosomal DNA from several *Cryptococcus* species. *Journal of Bacteriology* 172 (8). <https://doi.org/10.1128/jb.172.8.4238-4246.1990>

- Wickham H, Averick M, Bryan J, Chang W, McGowan L, François R, Golemund G, Hayes A, Henry L, Hester J, Kuhn M, Pedersen T, Miller E, Bache S, Müller K, Ooms J, Robinson D, Seidel D, Spinu V, Takahashi K, Vaughan D, Wilke C, Woo K, Yutani H (2019) Welcome to the Tidyverse. *Journal of Open Source Software* 4 (43). <https://doi.org/10.21105/joss.01686>

Supplementary materials

Suppl. material 1: Sequenced specimens of macromycetes accumulated during the monitoring period with corresponding morphology- and molecular-based identifications [doi](#)

Authors: Filippova N.V., Zvyagina E.A.

Data type: sequences

Brief description: The table contains information about sequenced specimens with corresponding fields: Catalogue Number, GenBank number, Region, BOLD ID, Morphologically-defined species, DNA-defined species, UNITE SH, Closest sequence in GenBank, Closest Type specimen in GenBank, Percentage identity to the closest sequence in GenBank, Closest GenBank sequence citation.

[Download file](#) (60.91 kb)

Suppl. material 2: Plot-based counts of macrofungi in the raised bog "Mukhrino"

[doi](#)

Authors: Filppova N.V., Zvyagina E.A., Rudykina E.A., Dobrynina A.S.

Data type: occurrences

Brief description: The table contains the results of plot-based counts for 9 years on permanent plots located in the raised bog "Mukhrino", with corresponding fields: eventID (count event ID), parentEventID (plot ID), habitat (vegetation), decimalLatitude, decimalLongitude, minimumElevationInMeters, samplingProtocol, sampleSizeValue, sampleSizeUnit, eventDate, year, eventDate, country, countryCode, stateProvince, municipality, locality, geodeticDatum, coordinateUncertaintyInMeters, basisOfRecord, occurrenceID, scientificName, genus, organismQuantity, organismQuantityType, kingdom.

This table is published as a GBIF Sampling Event dataset and will be updated there (<https://www.gbif.org/dataset/acd76923-54da-4799-b4b0-cfe585c2c0b8>).

[Download file](#) (10.67 MB)