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THE DIVERSITY OF LARGER FUNGI IN THE VICINITIES OF KHANTY-MANSIYSK (MIDDLE TAIGA OF WEST SIBERIA)

Filippova N.V.[1)], ***Bulyonkova T.M.***[2)]

[1)] *Yugra State University, Khanty-Mansiysk*
[2)] *A.P. Ershov Institute of Informatics Systems Russian Academy of Sciences, Novosibirsk*

n_filippova@ugrasu.ru, ressaure@gmail.com

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This publication initiates an analysis of data obtained in mycocoenological survey in major forest types in the vicinities of Khanty-Mansiysk, Shapsha village (middle taiga zone of West Siberia). Ten permanent monitoring plots were set in the beginning of the summer of 2015 in different coniferous forest types and their after-cut deciduous derivatives. The total area of plot observation was 1000 m^2, supplemented by walking routes in adjacent areas to reveal additional rare species. Each plot and route was examined 6 times per season (May through September).

The analysis of the species composition of the studied area follows. We identified 460 species from 6 classes, 14 orders, 56 families and 130 genera. The species number of the locality in Shapsha was larger compared to published earlier in the vicinities of Khanty-Mansiysk (in Mukhrino) (460 vs. 324 species), these locations also substantially differed in their species composition (about 1/2 species of each list is unique). The survey yielded new finds to the compiled list of Khanty-Mansi autonomous okrug: 224 species from the list are reported for the first time for the area. Eight species from our list are in the Red List of KhMAO. These species are important for conservation programs and their recorded populations should be under special attention in future studies.

The taxonomic structure of the final list is summarized in the Table and the full database of the collection metadata is available as an electronic attachment.

INTRODUCTION

A series of permanent plots were established in the major forest types near Khanty-Mansiysk town to initiate long-term monitoring of communities of larger fungi (= macromycetes, macrofungi). The major goal was to study the structure of fungal communities in relation to forest types and their anthropogenic transformation in suburban areas. With logging being the main anthropogenic factor, the plots were associated with different stages of after-cut succession.

Plot-based studies of this type have a variety of applications. They provide a sufficiently detailed study of the fungal species composition. They can also aid the assessment of the industrial potential of commercially harvested species. The quantitative analysis of the community structure can reveal rare and vulnerable species and contribute to their conservation. Plot-based studies are particularly important in conservation areas to study native communities as well as in suburban areas where sustainable use of natural resources under high anthropogenic pressure is important. The territory of the study meets the last two characteristics being located nearby the capital of the district and at the same time protected by the Nature Park «Samarovskiy Chugas». The plots are located in the proximity of the Shapsha field station of the Yugra

State University (YSU) and thereby complement the complex studies of the local ecosystems performed by the field station.

No studies with similar goals and methods were performed in the vicinities of Khanty-Mansiysk before. We performed a similar plot-based survey at the Mukhrino field station of the YSU, where only fungal communities of ombrotrophic bogs were studied; the study revealed a relatively low diversity of about 60 species of macromycetes [Filippova, Thormann, 2014]. The first inventory of macrofungi in forests near Khanty-Mansiysk was carried out around the Mukhrino field station, resulting in a total 324 taxa [Filippova et al., 2015]. However, only random route method was used without quantitative analysis of the community structure. A series of studies of the communities of lignicolous macrofungi was done previously in the Nature Park «Samarovskiy Chugas» [Stavishenko, Zalesov, 2008; Stavishenko, 2008a; Stavishenko, 2008b]. These works focused primarily on Bracket and Crust fungi associated with the woody debris. Aside from vicinities of Khanty-Mansiysk itself, a few dozen studies dealing with the mycota of Khanty-Mansi autonomous okrug (middle and north taiga zones of West Siberia) were published in the last 30 years (the list of publications is provided in the electronic attachment). The total number of species compiled from these works reached approximately 1500 species (unpublished data).

The present publication begins the analysis of the data obtained during the plot-based survey in the vicinities of Khanty-Mansiysk in 2015. The quantitative analysis of the structure and other characteristics of the fungal communities will be done in a future publication. The ***goal of the present publications*** was to present the analysis of the species composition, including 1) taxonomical analysis of the list, 2) its comparison with earlier studies in the area.

METHODS

The study employed a plot monitoring method in combination with random routes in areas adjacent to the plots. Ten permanent monitoring plots were established in spring 2015 in the vicinities of the Khanty-Mansyisk town (around Shapsha village) distributed over an area of about 10 square kilometers (fig. 1). We used high-resolution satellite images for preliminary vegetation mapping of the area, followed by a walking survey. The locations were chosen to assess major homogenous contours of different forest types of the area. Two plots were established in each forest type when the contour was extensive and uniform (plots 1-6). For smaller and relatively mosaic vegetation contours a single plot for each type was only applicable (plots 7-10). The description of vegetation and geo-reference position of the plots summarized in Table 1 and in the electronic attachment. Each plot consisted of 20 circular 5 m^2 micro-plots 5 m apart aligned in a 200 m long line. The observation area of a plot thus equals 100 m^2 and the total area of plot-observation during the survey was 1000 m^2 (this represents roughly 0.002 % of the whole forested area shown in the upper insert in the Figure 1). Centers of each micro-plot were marked by plastic poles. A rope was used to draw the outlines of a plot during its examination. The advantages of use of circular dispersed micro-plots *vs*. rectangular of larger size were described by Lodge et al. [2004].

The plots were visited from the end of May (soon after snow melt) until the middle of September (when fungal fruiting was suppressed by the first frosts). The distribution of the number of collections by months is shown in Table 2. The time interval between subsequent visits of each plot ranged between 14-23 days, resulting in total of 6 visits per plot during the season. The total number of fruiting bodies of each species was counted on each micro-plot. Counted fruitbodies were removed in order to avoid repeated count in following visits. In cases where the species grew in high abundance or were densely clustered, part of the carpophores has been counted and extrapolation was made to estimate the approximate total number.

The microclimatic conditions of the plots were measured by temperature loggers and a rain-gauge. Thermochron (DS1921G-F5) loggers were mounted in handmade shelters and set in 5 plots of different vegetation types at 5 cm above soil level. A single automatic rain gauge (HOBO RG3-M) was installed in coniferous forest (Plot 4) to measure liquid precipitation.

In addition to plot observation, we used walking routes designed to find species not registered in plots (rare species or species with special requirements for environmental conditions). For this, we walked along a straight line (using GPS) and collected only new species (fig. 1). No quantitative count was done at this stage. The length of the routes ranged between 500 m to 2 km depending on the abundance of fruiting. Plot observations alternated with routes, thus 6 walking routes in each locality were done during the season.

The collection and processing of specimens was done as described in Lodge et al. [2004]. Fresh fruiting bodies were wrapped in aluminium foil and carried to the laboratory to be processed on the day of collection. The processing of specimens included: 1) photographing on a photo-studio table, 2) description of vital characters, 3) preliminary microscopy and determination, 4) filling the data in the database, 5) labeling, and 6) drying at 50°C to store in the Fungarium of Yugra State University. By the end of the study, the collection amounted to roughly 1500 dried specimens. The collection database was imported to Specify 6 (offline) and Specify 7 (available at http://bio.ugrasu.ru/) software.

Table 1. Characteristics of permanent plots in the vicinities of Khanty-Mansiysk (Shapsha village)

Plot #	**Coordinate**	**Vegetation type**	**Time after cut, years**	**Trees height and % cover**	**Plants* % cover**	**Mosses % cover**	**N species plants** and mosses**	**N of collection specimens**
1	61.08379°N 69.46695°E	Dark coniferous mixed forest	-	18-20 m; 80%	15	70	26	792
2	61.08553°N 69.47594°E	Dark coniferous mixed forest	-	20-22 m; 70%	25	70	22	
3	61.08259°N 69.45434°E	Dark coniferous-deciduous mixed forest	-	18-20 m; 80%	15	60	26	
4	61.07960°N 69.45287°E	Dark coniferous-deciduous mixed forest	-	18-20 m; 70%	15	75	24	
5	61.06641°N 69.46803°E	Aspen forest	25-30	14-16 m; 60%	15	3	30	264
6	61.06636°N 69.47094°E	Aspen forest	25-30	16-18 m; 70%	25	5	31	
7	61.05473°N 69.42897°E	Aspen forest	20-25	14-15 m; 70%	15	10	33	197
8	61.05523°N 69.41694°E	Fresh cutting site	5	1-3 m; 30%	40	5	37	124
9	61.05791°N 69.43936°E	Bogged birch forest with peat	-	3-4 m; 30%	40	90	22	30
10	61.05746°N 69.44044°E	Birch forest	10-15	8-10 m; 80%	8	80	27	76

	Dominant plants (only species with > 5 % of cover shown)
1	*Pinus sibirica, Abies sibirica, Betula pubescens, Picea obovata, Vaccinium myrtillus, Hylocomium splendens, Pleurozium schreberi, Polytrichum commune*
2	*Pinus sibirica, Abies sibirica, Pinus sylvestris, Picea obovata, Vaccinium myrtillus, Linnaea borealis, Hylocomium splendens, Pleurozium schreberi, Polytrichum commune*
3	*Pinus sibirica, Abies sibirica, Picea obovata, Populus tremula, Vaccinium myrtillus, Hylocomium splendens, Pleurozium schreberi*
4	*Pinus sibirica, Picea obovata, Abies sibirica, Populus tremula, Linnaea borealis, Hylocomium splendens, Pleurozium schreberi, Polytrichum commune*
5	*Pinus sibirica, Picea obovata, Abies sibirica, Populus tremula, Gymnocarpium dryopteris*
6	*Populus tremula, Betula pubescens, Pinus sibirica, Vaccinium vitis-idaea, Equisetum sylvaticum*
7	*Populus tremula, Betula pubescens, Polytrichum commune, Pleurozium schreberi*
8	*Populus tremula, Gymnocarpium dryopteris, Vaccinium vitis-idaea, Equisetum sylvaticum, Calamagrostis canescens*
9	*Betula pubescens, Carex globularis, Carex lasiocarpa, Calamagrostis purpurea, Sphagnum angustifolium, Polytrichum strictum*
10	*Betula pubescens, Vaccinium vitis-idaea, Polytrichum commune, Pleurozium schreberi, Polytrichum juniperinum*

* plants – assuming all other plants in the undergrowth except trees, which were showed in a separate column;
** plants here – all vascular plants, including trees and shrubs.

Table 2. Number of collections by months

May	June	July	August	September	Total number
25	166	503	634	163	1496

The detailed identification was done during the winter following the collection season. Dry specimens were rehydrated in tap water or KOH (10 %); dyes and other chemicals (Congo Red, Melzer 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 was used for microscopical examination. Micro-photographs were taken with an AxioCam ERc5s digital camera.

Most of the finds were identified using Funga Nordica keys [Knudsen, Vesterholt, 2008] and some additional monographs on particular taxa were used when necessary. One should make an assumption that the high diversity of the studied material invariably introduces a certain degree of error in identifications done by a single person. This certainly calls for further deeper revision of our material by taxonomists specializing in specific groups of macrofungi.

Fungal authorities are mentioned according to Index Fungorum (last access 15.05.2016) and Funga Nordica [Knudsen, Vesterholt, 2008], and the classification of the fungal taxa at various taxonomic ranks follows [Kirk et al., 2008].

The Larger fungi (=Macromycetes) defined as fungi with large spore-producing structures [Kirk et al., 2008, p. 396] and could be taken in different volume by different authors. Our study included following groups in the analysis: Discomycetes, Agaricoid, Boletoid, Aphyllophoroid fungi (we omitted brackets, ctusts and jellies but included clubs and coral fungi [Phillips, 2006]) and some other groups in minority. When comparing the final list with other studies only Agaricoid macromycetes were included in this analysis to make the comparison justified and bring all three lists to a uniform classification.

RESULTS AND DISCUSSION

The final list of larger fungi in the vicinities of Shapsha (Khanty-Mansiysk) has encompassed 460 species from 6 classes, 14 orders, 55 families and 130 genera. The Agaricales is the richest order comprising 75% of the total species number, followed by Russulales (10%), Boletales (3%), Pezizales (3%), Polyporales (2%) and others in minority. The six richest families which include about 50% of the species diversity are: Cortinariaceae (15% of total species number), Tricholomataceae (10%), Mycenaceae (10%), Strophariaceae (10%), Russulaceae (9%), Inocybaceae (5%). The richest genera are: *Cortinarius* (69 species), *Mycena* (34), *Russula* (24), *Lactarius* (19), *Inocybe* (16), *Clitocybe* (15), *Pluteus* (15), *Entoloma* (14), *Galerina* (12), *Pholiota* (8), *Gymnopus* (7), *Tricholoma* (7), *Amanita* (6), *Conocybe* (6), *Hebeloma* (6), *Hygrocybe* (6), *Psathyrella* (6). Other genera are represented by 5 and less species. The complete list of identified species diversity and taxonomic structure are shown in the Table 4 and available in the electronic attachment (.xls database).

The ratio of families in the final list corresponds to the general characteristics of the forest mycobiota of Agaricoid fungi in the Holarctic [Marina, 2006]: the dominant families are the Cortinariaceae, Russulaceae, Tricholomataceae, Mycenaceae and Strophariacea, taking into account the recent changes in the families' volume (the lists were analyzed according to present classification in Index Fungorum, accessed 22.11.2016).

Species diversity in Shapsha was compared with an earlier study of fleshy fungi nearby (about 30 km SW from our locality) [Filippova et al., 2015]. There, the authors found a total of 324 species during several brief forays mainly in mixed deciduous and coniferous forests in the vicinities of the Mukhrino field station. Vegetation types of both locations are quite similar. Although the Mukhrino list was compiled based on a number of short inventories spanning over several years, the ultimate species richness was found to be higher in Shapsha (324 *vs*. 460 species). Considering the similar habitat and duration (70 collection days in Mukhrino *vs*. 80 days in Shapsha), this may point to the advantage of the plot method over random forays in inventorying fungal diversity, however, with certain reservations in respect to identification precision using the former method, where specimens are collected regardless of their quality. Besides the total species number, the two sites differ substantially in fungal species composition: about a half (179 species) are shared while 147 species are unique for Mukhrino and 284 species are unique for Shapsha. We assume these differences are explained by the difference in collection method and insufficient degree of study, rather than objective differences in the mycota of both locations. However, the proximity of human settlement and the presence of fresh cutting sites could cause a rise in the number of early succession species. Thus, the mycobiota of macromycetes in the vicinities of Khanty-Mansiysk is still under study and additional species are continually registered in new studies. The full list of macromycetes of Khanty-Mansiysk area based on these two publications and a list of macrofungi of bogs [Filippova, Thormann, 2014] has amounted to 636 species.

The compiled list of macromycetes of Khanty-Mansiysk vicinities was compared with two major studies of local mycotas in nearby regions (only Agaricoid macromycetes were included in this analysis): the Yuganskiy and Visimskiy nature reserves (Table 3). We compiled the checklist for the Yuganskiy Nature Reserve from four papers published on the area [Zvyagina et al., 2007; Baykalova, Zvyagina, 2008; Zvyagina, 2012; Zvyagina, Baykalova, 2017], excluding works on Bracket and Crust fungi which were are not considered in present study. The reserve occupies over 600 thousand hectares of forests and wetland in the middle and south taiga zones of West Siberia and is overall similar to Khanty-Mansiysk (however, Scots Pine forests, which are a prominent feature of the Yuganskiy nature reserve, are absent around Khanty-Mansiysk). Visimskiy Nature Reserve is located on the West slope of the middle Ural mountains (at low altitudes) within the south taiga zone. Thus, the three locations are relatively similar in vegetation and climate characteristics and could have similar mycobiota. The number of species in the Visimskiy Nature Reserve and around Khanty-Mansiysk are more similar (542 *vs*. 636), while there are fewer recorded species in the Yuganskiy Nature Reserve (325).

The abundance of species in some leading genera is similar in the Visimskiy reserve and around Khanty-Mansiysk (*Cortinarius, Russula, Lactarius, Mycena, Clitocybe, Pholiota, Amanita, Galerina, Hypholoma, Hebeloma*), while other genera differ substantially in species abundance. In the Yuganskiy reserve, three genera are notably richer compared to other locations (*Suillus*, to a lesser degree *Leccinum and Hygrophorus*), which in the case with the former two genera is likely the result of ongoing special studies focused on the Boletaceae [Zvyagina et al., 2009]. The Jaccard similarity coefficient calculated between three mycobiota equals 0.24 (Khanty-Mansiysk/Yuganskiy), 0.2 (Yuganskiy/Visimskiy) and 0.23 (Khanty-Mansiysk/ Visimskiy).

The study revealed a substantial number of species new for the total checklist of fungi of the Khanty-Mansi autonomous okrug. The checklist was compiled based on 35 publications on fungal inventories in the region (including the majority of studies accomplished up to date). The full checklist includes as many as 1535 taxa of fungi (not only macromycetes). Shapsha checklist adds 224 species new for the region (highlighted in the electronic attachment), while the rest of the species have been reported in one or more earlier inventories. For example, *Hericium coralloides* has been registered in eleven different sites and thus its occurrence map is relatively well drawn within the region. However, 90% of species in the compiled list have only 1 to 3 records indicating the initial stage of studies of the mycobiota and the geography of larger fungi in the region.

Inventories of species diversity help to discover rare and protected species and to establish programs for their conservation. From the final list of macrofungi recorded by the study, eight species are in the Red List of Khanty-Mansi autonomous okrug [Vasin, Vasina, 2013] (making up 21 % of all redlisted species). These species include *Arrhenia discorosea* (the 3rd category of protection), *Baeospora myriadophylla* (4), *Clavariadelphus truncatus* (3), *Cortinarius violaceus* (3), *Gomphidius flavipes* (3), *Gomphus clavatus* (3), *Hericium cirrhatum* (3), *Hericium coralloides* (in Attachment to the Red List), and *Sarcosoma globosum* (3). These species are recommended for inclusion in conservation programs of the Nature Park «Samarovskiy Chugas» and their populations deserve special attention in future studies.

In summary, the first year of plot-based & routes study revealed significant species diversity with 224 species new for the region, and the total number of species in Shapsha was greater compared to an earlier study nearby (Mukhrino). The total species list of larger fungi in Khanty-Mansiysk vicinities therefore includes 636 species. This list differs considerably with the lists of similar territories which points probably to insufficient study degree in each case. The permanent plots research in Shapsha will be continued and additional years of data will undoubtedly add new species to the list, as well as solve taxonomical complexities of some doubtful species.

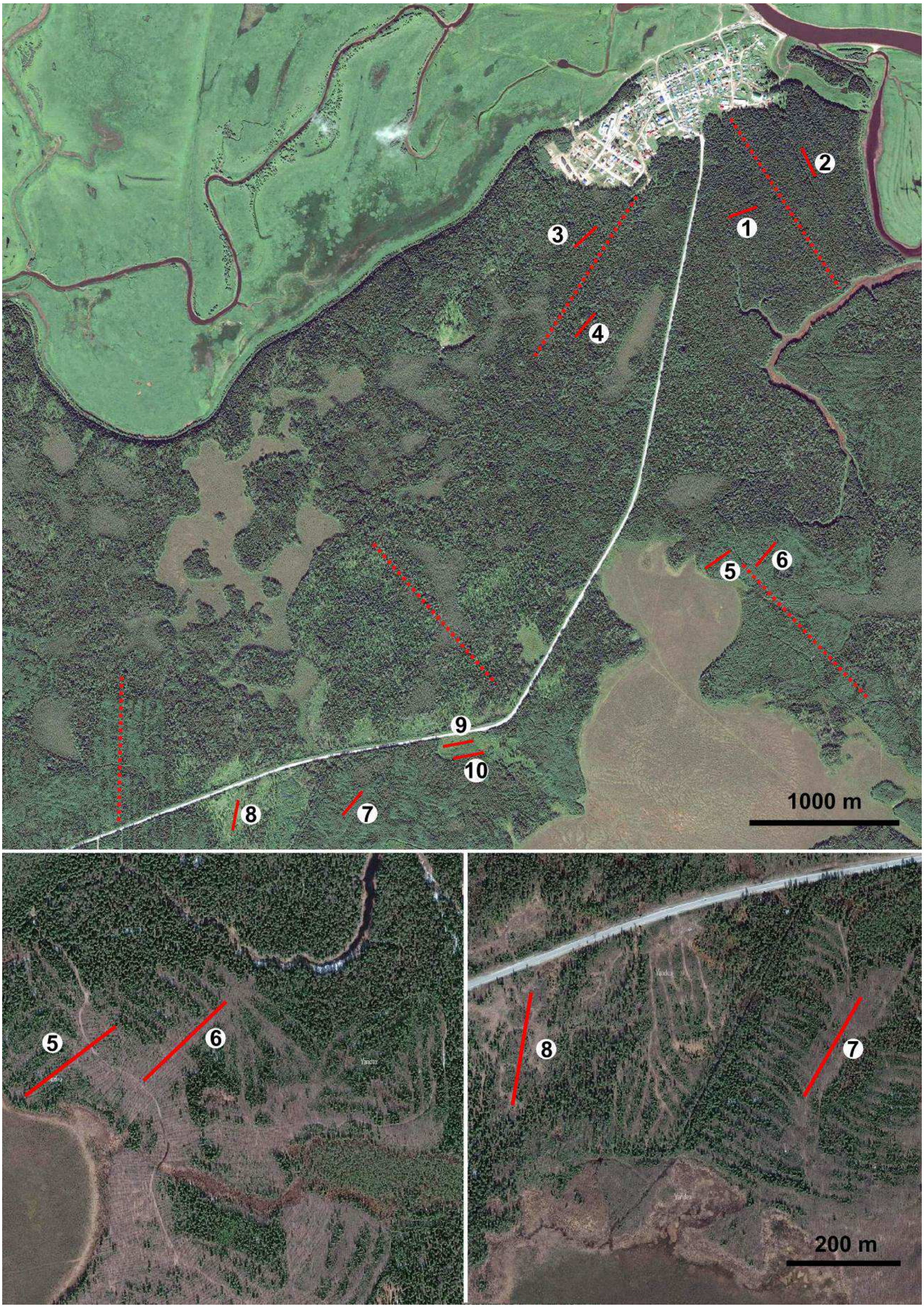

Fig. 1. Position of permanent plots for plot-based survey near Khanty-Mansiysk (Shapsha village); upper insert: position of 10 plots (red bars) and walking routes (dotted red lines) on a Landsat satellite image from July 2014; lower inserts: magnified views of two cutting areas showing shift from coniferous to deciduous forest on Landsat satellite image from May 2015 (season before leafing of deciduous trees)

Table 3. Species diversity and leading genera in compiled lists of macromycetes within south and middle taiga zones of West Siberia (+ West slope of Ural which circumscribes the WS from the East)

Genus	Khanty-Mansiysk*	Nature Reserve Yuganskiy	Nature Reserve Visimskiy
Total number of species / Number of Agaricoid macromycetes	**636/542**	**405/325**	**635**
Cortinarius	91	8	81
Russula	31	28	45
Lactarius	25	26	30
Mycena	40	8	44
Pluteus	18	16	10
Entoloma	17	9	26
Tricholoma	14	12	11
Suillus	6	19	9
Inocybe	16	7	28
Pholiota	13	10	12
Clitocybe	15	4	14
Amanita	11	7	13
Galerina	15	2	17
Hygrophorus	5	12	11
Leccinum	6	10	8
Psathyrella	12	2	19
Gymnopus	10	3	15
Hypholoma	9	4	9
Hygrocybe	8	3	6
Hebeloma	9	1	10

***** The list of Visimskiy Reserve includes only *Agaricoid* macromycetes, while the Macromycetes definition in our work includes about 50 species from *Clavarioid*, *Discomycetes*, *Gasteromycetes* and other groups. The volume of included groups in different publications of Yuganskiy Reserve varies.

Table 4. Species diversity and taxonomic structure of larger fungi revealed by the first year of plot-based & routs study in vicinities of Shapsha village, Khanty-Mansiysk

FAMILY (N of species)	GENUS (N of species)	SPECIES
Agaricomycetes (432):		
Agaricales (344):		
Agaricaceae (16)	*Agaricus* (1)	*semotus*
	Cystoderma (3)	*amianthinum, carcharias, jasonis*
	Cystodermella (3)	*adnatifolia, cinnabarina, granulosa*
	Cystolepiota (1)	*seminuda*
	Lepiota (3)	*clypeolaria, cristata, felina*
	Lycoperdon (5)	*molle, nigrescens, perlatum, pyriforme, umbrinum*
Amanitaceae (6)	*Amanita* (6)	*battarae, crocea, fulva, porphyria, regalis, vaginata*
Bolbitiaceae (7)	*Bolbitius* (1)	*titubans*
	Conocybe (6)	*apala, aurea, filipes, merdaria, mesospora, semiglobata*
Clavariaceae (4)	*Clavaria* (1)	*flavipes*
	Ramariopsis (3)	*asperulospora, crocea,* cf. *subtilis*
Cortinariaceae (69)	*Cortinarius* (69)	*acutus, agathosmus, alborufescens,*

		albovariegatus, *alboviolaceus*, *anomalus*, cf. *argutus*, *armeniacus*, *armillatus*, *aurantiomarginatus*, *balaustinus*, *bataillei*, *biformis*, *bivelus*, *bolaris*, *brunneus*, *camphoratus*, *carbunculus*, *casimiri*, cf. *cicindela*, *cinnamomeus*, *collinitus*, *comptulus*, *craticius*, *croceus*, *decipiens*, *delibutus*, *depressus*, *diasemospermus*, *disjungendus*, *dolabratus*, *duracinus*, *evernius*, *flexipes*, *fusisporus*, *gentilis*, *glandicolor*, *illuminus*, *laniger*, *lepidopus*, *lux-nymphae*, cf. *melleopallens*, *multiformis*, *obtusus*, cf. *ochrophyllus*, *paragaudis*, *parvannulatus*, *pholideus*, *phrygianus*, *pilatii*, *pluvius*, *porphyropus*, *praestigiosus*, *raphanoides*, *sanguineus*, cf. *saturninus*, *scaurus*, *semisanguineus*, *septentrionalis*, *spilomeus*, *subfloccopus*, cf. *suboenochelis*, *talus*, *tortuosus*, *traganus*, *trivialis*, *tubarius*, *umbrinolens*, *venustus*, *vernus*, *vibratilis*, *violaceus*
Entolomataceae (15)	*Clitopilus* (1)	*prunulus*
	Entoloma (14)	*allospermum*, *cetratum*, *conferendum*, *depluens*, *lampropus*, *lanuginosipes*, *myrmecophilum*, *nitens*, *rhodopolium*, *rusticoides*, *sericatum*, *sericellum*, *sericeum*, *solstitiale*
Hydnangiaceae (2)	*Laccaria* (2)	cf. *bicolor*, *proxima*
Hygrophoraceae (11)	*Cuphophyllus* (1)	*virgineus*
	Hygrocybe (6)	*cantharellus*, *conica*, *constrictospora*, cf. *glutinipes*, cf. *laeta*, *reidii*
	Hygrophorus (3)	*erubescens*, *olivaceoalbus*, *piceae*
	Lichenomphalia (1)	*umbellifera*
Inc. sed. (1)	*Alloclavaria* (1)	*purpurea*
Inocybaceae (22)	*Crepidotus* (3)	cf. *cesatii*, *epibryus*, *mollis*
	Flammulaster (2)	*rhombosporus*, *subincarnatus*
	Inocybe (16)	*albovelutipes*, *amethystina*, *cookei*, *geophylla*, *griseolilacina*, *jacobi*, *lacera*, *lanuginosa*, *maculata*, *mixtilis*, *perlata*, *phaeodisca*, *putilla*, *subcarpta*, *subnudipes*, *urceolicystis*
	Simocybe (1)	*sumptuosa*
Lyophyllaceae (5)	*Asterophora* (1)	*lycoperdoides*
	Calocybe (1)	*gambosa*
	Hypsizygus (1)	*ulmarius*
	Ossicaulis (1)	*lignatilis*
	Tephrocybe (1)	*rancida*
Marasmiaceae (4)	*Baeospora* (1)	*myriadophylla*
	Marasmius (2)	*epiphyllus*, *rotula*
	Megacollybia (1)	*platyphylla*
Mycenaceae (44)	*Hemimycena* (5)	*delectabilis*, *mairei*, *pseudocrispula*, *sordida*, *subtilis*

	Mycena (34)	*acicula, aciculata, adonis, algeriensis, amicta, capillaripes, citrinomarginata, clavicularis, concolor, epipterygia, erubescens, fragillima, galopus, haematopus, hiemalis, laevigata, leptocephala, metata, mirata, niveipes, olida, olivaceomarginata, pelianthina, pseudopicta, pura, silvae-nigrae, stipata, stylobates, subcana, tristis, viridimarginata, vitilis, vulgaris*
	Rickenella (2)	*fibula, swartzii*
	Roridomyces (1)	*roridus*
	Xeromphalina (2)	*campanella, fraxinophila*
Omphalotaceae (11)	*Gymnopus* (7)	*androsaceus, confluens, dryophilus, inodorus, ocior, peronatus, putillus*
	Mycetinis (1)	cf. *querceus*
	Rhodocollybia (3)	*butyracea, fodiens, maculata*
Physalacriaceae (4)	*Armillaria* (1)	*lutea*
	Flammulina (1)	*elastica*
	Strobilurus (2)	*stephanocystis, tenacellus*
Pleurotaceae (1)	*Pleurotus* (1)	*pulmonarius*
Pluteaceae (15)	*Pluteus* (17)	*chrysophaeus, cyanopus, exiguus, hibbettii, hongoi, leoninus, leucoborealis, nanus, petasatus, phlebophorus, plautus, podospileus, rangifer, romellii, salicinus, semibulbosus, umbrosus*
Psathyrellaceae (6)	*Psathyrella* (6)	cf. *caput-medusae*, cf. *fatua*, cf. *fusca*, cf. *larga*, *pygmaea*, cf. *squamosa*
Pterulaceae (1)	*Pterula* (1)	*multifida*
Schizophyllaceae (1)	*Schizophyllum* (1)	*amplum*
Strophariaceae (44)	*Agrocybe* (2)	*elatella, firma*
	Galerina (12)	*allospora, atkinsoniana, camerina, cephalotricha, cerina, hypnorum, marginata, mniophila, paludosa, pumila, salicicola, vittiformis*
	Gymnopilus (2)	*penetrans, sapineus*
	Hebeloma (6)	*fragilipes, hiemale, incarnatulum, radicosum, sordescens, velutipes*
	Hypholoma (5)	*capnoides, ericaeoides, fasciculare, marginatum, polytrichi*
	Kuehneromyces (2)	*lignicola, mutabilis*
	Pholiota (8)	*astragalina, flammans, lenta, limonella, lubrica, spumosa, squarrosa, subochracea*
	Psilocybe (4)	*inquilinus, montana, phyllogena, turficola*
	Stropharia (3)	*albonitens, hornemannii, pseudocyanea*
Tricholomataceae (48)	*Ampulloclitocybe* (1)	*clavipes*
	Arrhenia (4)	*acerosa, discorosea, epichysium, onisca*
	Clitocybe (15)	cf. *agrestis*, cf. *albofragrans*, cf. *amarescens*, *candicans*, cf. *diatreta*, cf. *diosma*, cf. *foetens*, cf. *globispora*, *metachroa, nebularis, odora, regularis, subspadicea, vermicularis, vibecina*

	Collybia (3)	*cirrhata, cookei, tuberosa*
	Dendrocollybia (1)	cf. *racemosa*
	Gamundia (2)	*hygrocyboides, striatula*
	Hohenbuehelia (2)	*nigra, petalodes*
	Infundibulicybe (2)	*gibba, squamulosa*
	Lepista (1)	*sordida*
	Melanoleuca (3)	*melaleuca, polioleuca, strictipes*
	Mycenella (1)	*lasiosperma*
	Myxomphalia (1)	*maura*
	Omphaliaster (1)	*asterosporus*
	Pseudoclitocybe (1)	*cyathiformis*
	Pseudoomphalina (1)	*pachyphylla*
	Tricholoma (7)	*fulvum, inamoenum,* cf. *rapipes, stiparophyllum, sudum, virgatum, viridilutescens*
	Tricholomopsis (2)	*decora, rutilans*
Tubariaceae (3)	*Tubaria* (3)	*confragosa, conspersa, furfuracea*
Typhulaceae (3)	*Macrotyphula* (2)	*fistulosa, juncea*
	Typhula (1)	*erythropus*
Boletales (16):		
Boletaceae (8)	*Boletus* (2)	*edulis, subtomentosus*
	Chalciporus (1)	*piperatus*
	Leccinum (4)	cf. *albostipitatum, aurantiacum, scabrum, versipelle*
	Tylopilus (1)	*felleus*
Gomphidiaceae (2)	*Chroogomphus* (1)	*rutilus*
	Gomphidius (1)	*flavipes*
Paxillaceae (1)	*Paxillus* (1)	*involutus* s.l.
Suillaceae (5)	*Suillus* (5)	*acidus, pictus, placidus, sibiricus, variegatus*
Cantharellales (7):		
Cantharellaceae (1)	*Cantharellus* (1)	*cibarius*
Clavulinaceae (4)	*Clavulina* (1)	*coralloides*
	Clavulinopsis (3)	*laeticolor, luteoalba,* cf. *umbrinella*
Hydnaceae (2)	*Hydnum* (2)	*repandum, rufescens*
Geastrales (1):		
Geastraceae (1)	*Sphaerobolus* (1)	*stellatus*
Gomphales (4):		
Clavariadelphaceae (1)	*Clavariadelphus* (1)	*truncatus*
Gomphaceae (3)	*Gomphus* (1)	*clavatus*
	Ramaria (2)	*pallida, tsugina*
Hymenochaetales (2):		
Hymenochaetaceae (2)	*Coltricia* (1)	*perennis*
	Hymenochaete (1)	*tabacina*
Polyporales (10):		
Fomitopsidaceae (1)	*Laetiporus* (1)	*sulphureus*
Meripilaceae (1)	*Grifola* (1)	*frondosa*
Polyporaceae (8)	*Lentinus* (1)	*vulpinus*
	Neolentinus (2)	*cyathiformis, lepideus*
	Panus (1)	*neostrigosus*
	Polyporus (4)	*ciliatus, melanopus, squamosus, varius*
Russulales (48):		
Auriscalpiaceae (3)	*Auriscalpium* (1)	*vulgare*
	Artomyces (1)	*pyxidatus*
	Lentinellus (1)	*micheneri*

Hericiaceae (2)	*Hericium* (2)	*cirrhatum, coralloides*
Russulaceae (43)	*Lactarius* (19)	*aurantiacus, auriolla*, cf. *hysginoides, deterrimus, flexuosus, glyciosmus, helvus, leonis, mammosus, musteus, plumbeus, pubescens, repraesentaneus, rufus, torminosus, trivialis, utilis, uvidus, vietus*
	Russula (24)	*acrifolia, aeruginea, aquosa*, cf. *amethystina*, cf. *atroglauca*, cf. *badia*, cf. *renidens*, cf. *rivulicola*, cf. *sapinea, claroflava, consobrina, decolorans, depallens, emetica, foetens, gracillima, grisescens, medullata, puellaris, rhodopus, sphagnophila, torulosa, versicolor, xerampelina*
Dacrymycetes (2):		
Dacrymycetales (2):		
Dacrymycetaceae (2)	*Calocera* (2)	*cornea, viscosa*
Eurotiomycetes (1):		
Eurotiales (1):		
Elaphomycetaceae (1)	*Elaphomyces* (1)	*asperulus*
Leotiomycetes (6):		
Helotiales (4):		
Geoglossaceae (1)	*Trichoglossum* (1)	*hirsutum*
Leotiaceae (1)	*Leotia* (1)	*lubrica*
Sclerotiniaceae (2)	*Ciboria* (2)	*betulicola, caucus*
Rhytismatales (2):		
Cudoniaceae (2)	*Cudonia* (1)	*circinans*
	Spathularia (1)	*rufa*
Pezizomycetes (15):		
Pezizales (15):		
Discinaceae (3)	*Gyromitra* (3)	*esculenta, gigas, infula*
Helvellaceae (3)	*Helvella* (3)	*cupuliformis, lacunosa, macropus*
Pezizaceae (2)	*Peziza* (2)	*arvernensis*, cf. *michelii*
Pyronemataceae (4)	*Humaria* (1)	*hemisphaerica*
	Otidea (2)	*leporina, platyspora*
	Trichophaeopsis (1)	*bicuspis*
Sarcosomataceae (3)	*Pseudoplectania* (2)	*melaena, nigrella*
	Sarcosoma (1)	*globosum*
Sordariomycetes (4):		
Hypocreales (4):		
Cordycipitaceae (1)	*Cordyceps* (1)	*militaris*
Hypocreaceae (2)	*Hypocrea* (1)	*gelatinosa*
	Hypomyces (1)	*luteovirens*
Ophiocordycipitaceae (1)	*Ophiocordyceps* (1)	*gracilis*

LITERATURE

Filippova N.V. 2010. Prior list of fungi of Khanty-Mansiysk region (prepared for XI workshop of the Macromycetes commission of the Mycological Section of Russian botanical society, 17-23 August, 2010). Khanty-Mansiysk: Yugra state university. Environmental dynamics and global climate change. 28 p. [in Russian]

Filippova N.V., Bulyonkova T.M., Lapshina E.D. 2015. Fleshy fungi forays in the vicinities of the YSU Mukhrino field station (Western Siberia) // Environmental dynamics and global climate change. V. 6. № 1 (11).

Filippova N.V., Thormann M.N. 2014. Communities of larger fungi of ombrotrophic bogs in West Siberia // Mires and Peat. V. 14. P. 1-22.

Kirk P.M., Cannon P.F., Minter D.W., Stalpers J.A. (eds.) 2008. Ainsworth & Bisby’s dictionary of the fungi. Wallingford, Oxon, UK: CABI. 771 p.

Knudsen H., Vesterholt J. 2008. Funga Nordica: agaricoid, boletoid and cyphelloid genera. Nordsvamp, Copendhagen. 965 pp.

Lodge D.J., Ammirati J.F., O'Dell T.E., Mueller G.M., Huhndorf S.M., Wang C.J., Stokland J.N., Schmit J.P., Ryvarden L., Leacock P.R., Mata M.I. 2004. Terrestrial and lignicolous macrofungi // Biodiversity of fungi. Inventory and monitoring methods / Mueller G.M. et al. (eds.) Amsterdam, Boston: Elsevier Academic Press. P. 127-172.

Marina L.V. 2006. Agarikoidnye bazidiomitsety Visimskogo zapovednika [Agaricoid basidiomycetes of Visimskiy Nature Reserve]// Folia Cryptogamica Petropolitana. # 4. P. 1-102. [in Russian]

Phillips R. 2006. Mushrooms. A comprehensive guide with over 1250 detailed photographs of mushrooms and other fungi. London: Pan Macmillan ltd. 384 p.

Stavishenko I.V. 2008a. Vidovoe raznoobrazie derevorazrushayushchikh bazidial'nykh gribov lesov urochishcha «Shapshinskoe» [Species diversity of lignicolous fungi of "Shapshinskoe urochishche"] // Biologicheskie resursy i prirodopol'zovanie. V. 11. P. 101-116. [in Russian]

Stavishenko I.V. 2008b. Paraziticheskie i poluparaziticheskie bizadial'nye griby prirodnogo parka «Samarovskiy Chugas» [Parasitic and weak-parasitic basidiomycetes in Nature Park "Samarovskiy Chugas"] // Vestn. Mosk. Gos. Un-ta lesa - Lesn. Vestn. V. 3. № 60. P. 79-84. [in Russian]

Stavishenko I.V., Zalesov S.V. 2008. Ksilotrofnye bazidial'nye griby: Flora i fauna prirodnogo parka "Samarovskiy chugas" [Lignicolous basidiomycetes: Flora and Fauna of the Nature Park "Samarovskiy Chugas"]. Ekaterinburg: Ural. gos. lesotekhn. un-t. 102 p. [in Russian]

Vasin A.M., Vasina A.L. (eds.). 2013. Krasnaya kniga Khanty-Mansiyskogo avtonomnogo okruga – Yugry [Red book of Khanty-Mansiysk okrug – Ugra]. Ekaterinburg: Izdatel'stvo Basko. 460 p. [in Russian]

Zvyagina E.A. 2012. New records of rare and endangered macromycees in Khanty-Mansiysk region // Environmental dynamics and global climate change. V. 3. № 1 (5). EDCCrar0004.

Zvyagina E.A., Baykalova A.S. 2008. Izuchenie vidovogo raznoobraziya gribov s tsel'yu vyyavleniya redkikh i osobo okhranyaemykh vidov (The study of macrofungi for fungal conservation programs) // Otchet po bioraznoobraziyu v Yuganskom zapovednike (The biodiversity research report in Yuganskiy Nature Reserve). Unpublished data. [in Russian]

Zvyagina E.A., Baykalova A.S. 2017. New records to the fungal biodiversity list of the Yuganskiy Nature Reserve (Western Siberia) // Environmental dynamics and global climate change. V. 8. No. 1. P. 25-42.

Zvyagina E.A., Baykalova A.S., Gorbunova I.A. 2007. Macromycetes of the reserve "Yuganskiy" // Mycology and Phytopathology. V. 41. № 1. P. 29-40. [in Russian]

Zvyagina E.A., Baykalova A.S., Kondrashov A.S., Dzheyms T.I. 2009. Raznoobrazie gribov roda Suillus s.l. v zapovednike «Yuganskiy» (Suillus s.l. in Yuganskiy Nature Reserve) // Ekologiya i prirodopol'zovanie v Yugre. Materialy nauchno-prakticheskoy konferenzii, Surgut, 2009. P. 34-35. [in Russian]

ВИДОВОЕ РАЗНООБРАЗИЕ МАКРОМИЦЕТОВ В ОКРЕСТНОСТЯХ ХАНТЫ-МАНСИЙСКА (СРЕДНЯЯ ТАЙГА ЗАПАДНОЙ СИБИРИ)

Филиппова Н.В.[1]***, Бульонкова Т.М.***[2]

[1] *Югорский государственный университет, г. Ханты-Мансийск*
[2] *Институт систем информатики им. А.П. Ершова СО РАН, г. Новосибирск*

Публикация посвящена таксономическому анализу сообщества макромицетов в окрестностях г. Ханты-Мансийска (пос. Шапша, бореальная зона Западной Сибири). Площадки постоянного мониторинга были заложены в темнохвойных смешанных лесах и их послерубочных производных в начале лета 2015 года. Суммарная площадь наблюдения на площадках составила 1000 м^2. Кроме того, в тех же типах растительности были проложены маршруты для выявления редких видов. Площадки посетили 6 раз в течение сезона с мая по сентябрь 2015 года.
В настоящей публикации проведен таксономический анализ выявленной микобиоты. Мы определили 460 видов из 6 классов, 14 порядков, 55 семейств и 130 родов. Микобиота окрестностей пос. Шапша богаче описанной ранее в районе Ханты-Мансийска на стационаре Мухрино по числу видов, и существенно отличается по составу (около половины видов каждого списка – уникальны). Выявленный список видов в значительной степени расширяет список микобиоты ХМАО: 224 вида указывается впервые для территории. Восемь видов, зарегистрированных в окр. Шапши, занесены в Красную книгу ХМАО.
Обобщенная таксономическая структура выявленной микобиоты приводится в таблице. Полные сведения о находках содержатся в электронном приложении к публикации.

Ключевые слова: микология, грибы, микота, биоразнообразие, охрана грибов, Красная книга, Западная Сибирь, Россия

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