УДК 635.8

Разнообразие грибов в Монголии

A survey of fungal diversity in Mongolia

Херленчимег Н., Буренбатор Г.

Kherlenchimeg N., Burenbaatar G.

Институт общей и экспериментальной биологии АН Монголии, г. Улан-Батор, Монголия.
E-mail: nkherlenchimeg@gmail.com; burenbaatarg@gmail.com

Department of Botany, Institute of General and Experimental Biology, MAS, Ulaanbaatar, Mongolia

Реферат. В результате исследований на территории Монголии выявлен 631 вид высших грибов, которые относятся к 237 родам и 88 семействам, 31 порядку 11 классам и 2 типам. Наибольшее количество находок сделано для следующих семейств: Pucciniaceae – самое большое семейство, включающее 82 вида, за ним следуют Agaricaceae (61 вид) и Russulaceae (39 видов). Другие семейства во флоре Монголии, включающие более десяти видов – Tricholomataceae, Polyporaceae, Erysiphaceae, Strophariaceae, Cortinariaceae, Hygrophoraceae, Hymenochaetaceae, Geastraceae, Fomitopsidaceae, Suillaceae и Marasmiaceae. Рода *Puccinia* (66 видов), *Russula* (22 вида), *Lactarius* (17 видов), *Cortinarius* (17 видов), *Uromyces* (16 видов) и *Geastrum* (11 видов) являются крупнейшими в микофлоре Монголии. Типы, классы и порядки приводятся в статье в соответствии с системой S. Garnica (Garnica et al., 2016), тогда как семейства, рода и виды размещаются в алфавитном порядке.

Summary. The annotated checklist of higher fungi for Mongolia is presented. The revision of the taxonomic composition of the Mongolian higher fungi shows that it includes 631 species and 237 genera from 88 families, 31 orders, 11 classes and 2 phyla. The most number of additions made to the following families: the Pucciniaceae is by far the largest family with 82 species, followed by the Agaricaceae (61 species) and the Russulaceae (39 species). Other species-rich families with more than 10 species in the Mongolian flora include the Tricholomataceae, Polyporaceae, Erysiphaceae, Strophariaceae, Cortinariaceae, Hygrophoraceae, Hymenochaetaceae, Geastraceae, Fomitopsidaceae, Suillaceae and Marasmiaceae. *Puccinia* (66 species), *Russula* (22 species), *Lactarius* (17 species), *Cortinarius* (17 species), *Uromyces* (16 species) and *Geastrum* (11 species) are the largest genera of the Mongolian fungus flora. Phylum, class and order were put in accordance with system (Garnica et al. 2016), whereas family, genus and species were in alphabetical order.

Introduction

Dikarya is a subkingdom of Fungi that includes the divisions Ascomycota and Basidiomycota. T. Puntsag conducted research works on plant pathogenic fungi and published “Plant pathogenic in Mongolia” (1976), “Mycoflor in People’s Republic of Mongolia” (1976) respectively. He recorded 196 pathogenic fungi species belong to 20 genera on 255 host plant species and also indicated their classification, distribution, biological and ecological features as well as identification keys.

Study on species composition of higher fungi in Mongolia had begun since 1980s. As a result of research works in Khuvsgul, Bulgan and Tuv province, A. Pilat determined 80 fungi species belong to over 10 genera. A. N. Petrov collected higher fungi from Khankh, Khuvsgul province and he recorded over 100 species including Agaricoid, Woody fungi, Puffball (Petrov, 1981).

G. Doerfelt (University of Halle, Republic of Germany), D. Bumjaa (National University of Mongolia) made about 300 collections of fungi and recorded *Geastrum flariforme, G. hungricum, Clathrus cancellatus,* occurred only in Europe, first time for Mongolia and Central Asia.

38 species of Agaricoid, 19 species of woody fungi were discovered from pine-larch forest, larch forest and taiga in Khentii, Khuvsgul. 264 species of higher fungi and 126 genera were recorded in the wake of study on species composition of macromycete fungi in Mongol-Daguur and Khentii regions. Systematic of higher fungi in Mongolia was conducted solely by Dr. G. Uranchimeg until 1998s. She found herbarium of

fungi, contains about 500 sample of fungi collection of over 250 species, in Laboratory of the Flora and Plant Systematics, Institute of General and Experimental Biology.

However it has been almost 40 years since study on species composition of higher fungi in Mongolia was started, conspectus are still not compiled. Species information on genera and species number, nomenclature, distribution, endemism, whether rare or very rare of fungi is left behind.

Methods and Materials

The name of the author was taken in the form of an Index Fungorum (www.indexfungorum.org) with reference to the published title. Endemic and subendemic species of Mongolia were bolded. Phylum, class and order were put in accordance with system (Garnica et al. 2016), whereas family, genus and species were in alphabetical order.

We follow the division of Mongolia into 16 phytogeographical regions, which have been introduced by Grubov (1982) for regionalization of the information of the occurrence of fungi species in Mongolia. The phytogeographical regions are defined in Fig. 1.

Nowadays, making conspectus of fungi species, genera and family that is composition of Dikarya kingdom in Mongolia is required with scientific base as well as putting in appropriate position larger taxons of higher fungi that identified based on genetic informations and approved from International Mycological Association according to phylogenetic classification system is required.

The Index of Fungi is a publication from Centre for Agriculture and Biosciences International (CABI) and currently provides most of the names published in 'non main-stream' publications and the 'grey' literature, MycoBank provides the majority.

Larger taxons (phylum, class, order) of higher fungi distributed in Mongolia are written according to international classification system followed in worldwide and that determine accurately nomenclature (www.indexfungorum.org, www.mycobank.org) as well as integrate distribution informations recorded newly in this conspectus.

For the following orders, we used the following references for nomenclature: Botryosphaeriales, Mycosphaerellales, Pleosporales: Nergui (1978.); Erysiphales, Pucciniales, Ustilaginales, Urocystidales, Micro-

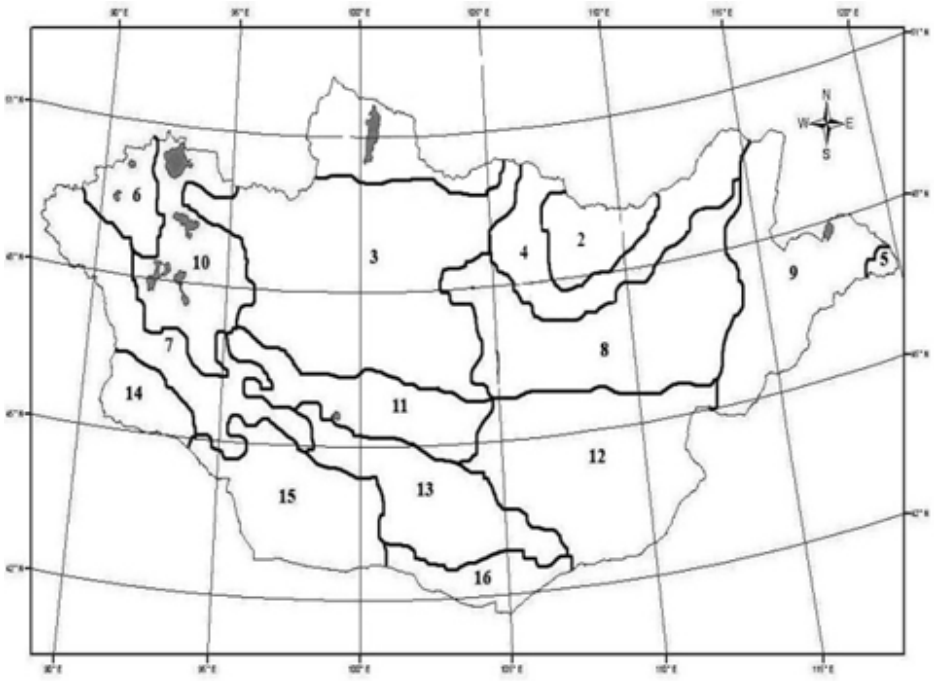

Figure 1. Phytogeographical regions of Mongolia (after Grubov 1982):
1 – Khovsgol, 2 – Khentei, 3 – Khangai, 4 – Mongolian Dauri, 5 – Foothills of Great Khingan, 6 – Khovd, 7 – Mongolian Altai, 8 – Middle Khalkha, 9 – East Mongolia, 10 – Depression of Great Lakes, 11 – Valley of Lakes, 12 – Valley of Lakes, 13 – Gobi Altai, 14 – Dzungarian Gobi, 15 – Transaltai Gobi, 16 – Alashan Gobi.

botryales: Puntsag (1976); Geastrales: Dörfelt, Bumžaa (1986); Agaricales, Russulales, Boletales: Holstetter et al. (2002), Moncalvo et al. (2000), Pilát (1972), Petrov (1981, 1999).

The herbaria at the Laboratory of the Flora and Plant Systematics (LFPS) of Institute of General and Experimental Biology (IGEB) of Mongolian Academy of Sciences (UBA) were checked for new findings and the material was partly critically revised. UBA contains more than 3 000 specimens. The total 3 000 specimens in both herbaria represent 535 species of higher fungi.

Results

Nowadays this conspectus of higher fungi of Mongolia includes 631 species and infraspecific taxa, belonging to 237 genera, 88 families and 31 orders.

Affiliation of the 31 higher fungi orders with species occurring in Mongolia to higher taxonomic units is compiled in Table 1.

Table 1

Classification of the higher fungus known from Mongolia in higher taxonomic units

Sub-kingdom	Division	Class	Order	Number of Families
Dikarya	Ascomycota	Dothideomycetes	Botryosphaeriales	1
			Mycosphaerellales	1
			Pleosporales	1
		Pezizomycetes	Pezizales	3
		Leotiomycetes	Helotiales	2
			Rhytismatales	2
			Erysiphales	1
		Sordariomycetes	Xylariales	2
			Hypocreales	1
	Basidiomycota	Tremellomycetes	Tremellales	1
		Pucciniomycetes	Pucciniales	8
		Ustilaginomycetes	Ustilaginales	3
			Urocystidales	1
		Microbotryomycetes	Microbotryales	1
		Exobasidiomycetes	Tilletiales	1
		Agaricomycetes	Cantharellales	4
			Phallales	1
			Auriculariales	1
			Gomphales	2
			Geastrales	1
			Hymenochaetales	3
			Russulales	6
			Amylocorticiales	1
			Polyporales	6
			Gloeophyllales	1
			Sebacinales	1
			Thelephorales	1
			Trechisporales	1
			Boletales	6
			Agaricales	23
		Dacrymycetes	Dacrymycetales	1
Total	**2**	**11**	**31**	88

The 20 largest families as well as the 20 largest genera of the Mongolian higher fungus flora are listed in Table 2. The Pucciniaceae are by far the largest family with 82 species, followed by the Agaricaceae (61 species) and the Russulaceae (39 species). Other species-rich families with more than 10 species in the Mongo-

lian flora include the Tricholomataceae, Polyporaceae, Erysiphaceae, Strophariaceae, Cortinariaceae, Hygrophoraceae, Hymenochaetaceae, Geastraceae, Fomitopsidaceae, Suillaceae and Marasmiaceae. *Puccinia* (66 species), *Russula* (22 species), *Lactarius* (17 species), *Cortinarius* (17 species), *Uromyces* (16 species) and *Geastrum* (11 species) are the largest genera of the Mongolian fungus flora.

Table 2

The twenty largest genera and families of the higher fungi of Mongolia

№	Family	Number of species	Percent of total	Genus	Number of species	Percent of tota
1	Pucciniaceae Chevall.	82	13.0	*Puccinia* Pers.	66	10.4
2	Agaricaceae Chevall.	61	9.7	*Russula* Pers.	22	3.4
3	Russulaceae Lotsy	39	6.2	*Lactarius* Pers.	17	2.6
4	Tricholomataceae R. Heim	31	4.9	*Cortinarius* (Pers.) Gray	17	2.6
5	Polyporaceae Fr. Ex Corda	30	4.8	*Uromyces* (Link) Unger	16	2.5
6	Erysiphaceae Tul. & C. Tul.	28	4.4	*Lycoperdon* P. Micheli	12	1.9
7	Strophariaceae Singer & A.H. Sm.	18	2.9	*Geastrum* Pers.	11	1.7
8	Cortinariaceae R. Heim ex pouzar	17	2.7	*Suillus* Gray	10	1.5
9	Hygrophoraceae Lotsy	16	2.5	*Leveillula* G. Arnaud	9	1.4
10	Hymenochaetaceae Tul. & C. Tul.	16	2.5	*Melampsora* Castagne	9	1.4
11	Fomitopsidaceae Jülich	13	2.1	*Clitocybe* (Fr.) Staude	9	1.4
12	Suillaceae Besl & Bresinsky.	12	1.9	*Erysiphe* R. Hedw. Ex DC.	8	1.2
13	Geastraceae Corda	11	1.7	*Ustilago* (Pers.) Roussel	8	1.2
14	Marasmiaceae Roze Ex Kuhner	10	1.6	*Agaricus* L.	8	1.2
15	Melampsoraceae Dietel	9	1.4	*Tricholoma* (Fr.) Staude	8	1.2
16	Mycenaceae Overeem	9	1.4	*Tulostoma* Pers.	7	1.1
17	Ustilaginaceae Donk	8	1.3	*Inocybe* (Fr.) Fr.	7	1.1
18	Inocybaceae Julich	8	1.3	*Bovista* Pers.,	6	0.9
19	Boletaceae Chevall.	8	1.3	*Amanita* Pers.	6	0.9
20	Meruliaceae P. Karst.	8	1.3	*Laccaria* Berk. et Broome	6	0.9

REFERENCES

Dörfelt H., Bumžaa D. Die Gasteromyceten (Bauchpilze) der Mongolischen // Volksrepublik. Nova Hedwigia, 1986. – № 43. – S. 87–111.

Garnica S., Riess K., Schön M. E., Oberwinkler F., Setaro S. D. Divergence Times and Phylogenetic Patterns of Sebacinales, a Highly Diverse and Widespread Fungal Lineage // PLoS ONE, 2016. – Vol. 11, №3. – P. 1–16.

Grubov V. I. Key to the vascular plants of Mongolia. – Leningrad: Nauka, 1982. – 442 pp.

Holstetter V., Clemencon H., Vilgalys R., Moncalvo J. M. Phylogenetic analyses of the Lyophylleae (Agaricales, Basidiomycota) based on nuclear and mitochondrial rDNA sequences // Mycol. Res., 2002. – Vol. 106, №9. – P. 1043–1059.

Moncalvo J. M., Lutzoni F. M., Rehner S. A., Johnson J., Vilgalys R. Phylogenetic Relationships of Agaric Fungi Based on Nuclear Large Subunit Ribosomal DNA Sequences // Syst. Biol., 2000. – Vol. 49. №2. – P. 278–305.

Nergui K. New species of plant pathogenic in Mongolia. – Ulaanbaatar, 1978. – № 4. – C. 160–164.

Petrov A. N. Macromycetes to the Hubsgul // Natural conditions and resources in Khuvsgul area. – Irkutsk, 1981. – C. 70–77.

Petrov A. N., Belova N. B. Flora macromycetes to the Mongolia // Mycology and phytopatalogy, 1999. – Vol. 33, №1. – P. 25–29.

Pilát A. Agaricus Contribution a I'étude des Basidiomycetes de la Mongolie bernardii (Quél.) Sacc. In Mongolia // Ceska Mykologie, 1972. – Vol 26, №2. – P. 65–69.

Puntsag T. Plant pathogenic fungi of Mongolia // Proc. of the Institute of General and Experimental Biology, 1976.

Urgamal M., Oyuntsetseg B., Nyambayar D., Dulamsuren C. Conspectus of the vascular plants of Mongolia. – Ulaanbatar, 2014. – 334 p.