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Survey on the distribution of Macrofungi in Mongolia

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Abstract

This paper reports the species of macromycetes collected in Mongolia: all the species are new to the area. Brief notes on taxonomy, ecology and distribution of the species are added. A total of 30 species of macromycetes were registered, 1 belonging to the division Ascomycota and 29 to the division Basidiomycota. It has been registered that 30 species belong to 25 genera, 17 families and occur in the flora fungus of Mongolia, until now. Specimen for 150 of samples macromycetes collected from June to August, 2015 in Tuv, Arkhangai and Huvsgul were enveloped. Macromycetes have been occured in 9 of 16 geographic regions. According to our studies 2 species in Khubsgul region, 2 species in Khangai region, 3 species in Khingan, 3 species in Dornod Mongol, 1 species in Khentei regions newly registered respectively. As a result of this work, determined 7 species (23%) of macromycetes in forest steppe and steppe regions and 23 species (77%) of them in forest region. The trophic structure for the fungal species is as follows: 2 species lignophite (7%), 4 species moss saprophyte (13%), 5 species soil saprophyte (17%), 15 species mycorrhiz (50%) of all species were respectively.

Key words: macrofungi, distribution, plant-geographical region, Mongolia

INTRODUCTION

The study of classification, species and distributions of macrofungus has not being completed yet in Mongolia (Petrov 1999, Uranchimeg et al. 1984 Kherlenchimeg 2009, 2013).

First registration and data piling was done in Department of Botany, Institute of General and Experimental Biology, MAS.

Mongolian researchers have been studying taxonomy of largest family. For example, the taxonomies of families Hygrophoraceae (Uranchimeg and Kovalenko 1987), Agaricaceae (Kherlenchimeg 2014) have been reported.

The purpose of this study is to the flora macrofungi of Mongolia and as well as to determine species composition of the macromycetes registered and compare their flora analysis, traditional knowledge, ecological groups, growing environment and occurrence.

Twenty nine species and one form belong to the division Basidiomycota, one species to the division Ascomycota.

MATERIALS AND METHODS

Specimens of the macromycetes taken from the Her-

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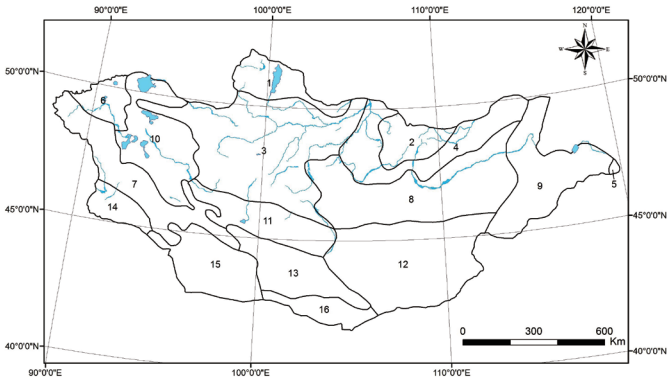

1. Khubsgul mountain taiga
2. Khentei mountain taiga
3. Khangai forest steppe
4. Mongol Daurian forest steppe
5. Khingan mountain meadow steppe
6. Khobdo mountain semidesert steppe
7. Mongolian Altai mountain steppe
8. Middle Khalkha dry steppe
9. East Mongolia steppe
10. Depression of Great Lakes semidesert steppe
11. Valley of Lakes semidesert steppe
12. East Gobi semidesert steppe
13. Gobi Altaimuontain semidesert steppe
14. Dzungarian Gobi desert
15. Transaltai Gobi desert
16. Alashan Gobi desert

Fig. 1. Map of phyto-geographical regions of the Mongolia (Grubov 1982).

barium, Ulaanbaatar Academy (UBA)of the Department of Botany, Institute of General and Experimental Biology, Mongolian Academy of Sciences, and an additional data

were used in this study. Specimen enveloped 150 of samples macromycetes collected from June, 2015 to August, 2015 in Tuv, Arkhangai and Huvsgul. The nomenclature and taxonomy are based on following works of (Singer 1986), (Moncalvo et al. 2000) and following professional taxonomic databases and wesites: indexfungorumorg.name (2015).

The sampling and herbarization of materials were done according to the classical methodologies (Bondartsev 1950).

The identification of pileus, basida and ring МБС-10 binocular (14x), Basida, cystide, sporus and further internal morphology was done by JEOL JSM-61008 an electron microscope and МБУ-15 microscope (10x, 40x).

The geographical distribution data was carried in phyto-geographical regionalization (Grubov 1982) of the Mongolia (Fig. 1).

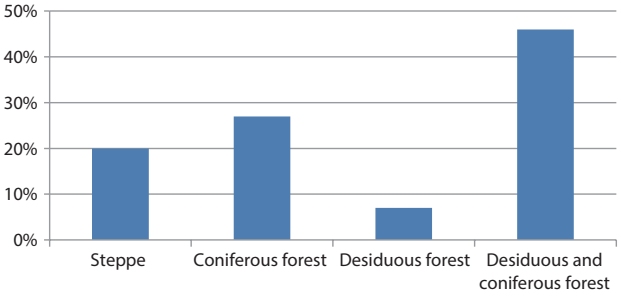

Fig. 2. Growing environment of macromycetes.

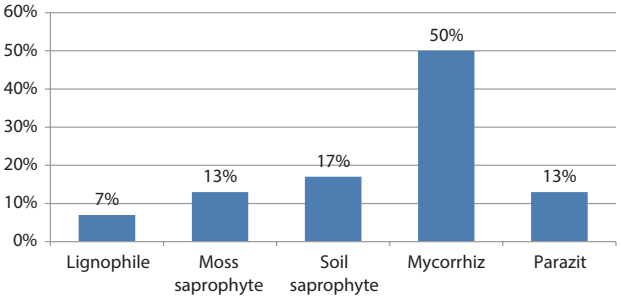

Fig. 3. Ecology-trophycal analysis of Macrofungi.

RESULTS

There have been registered that 30 species belonging to 25 genera, 17 families and occur in the flora fungus of Mongolia as present (Table 1).

Mongolian macromycetes have been registered in 9 of 16 geographic regions as a marked by red plus in Table 2. According to our studies from June 2015 to August 2015,

2 species in Khubsgul region, 2 species in Khangai region, 3 species in Khingan, 1 species in Khentei region and 1 species in Middle Khalkha dry steppe region newly registered respectively (Table 2).

There were growing 14 species (46%) in deciduous and coniferous forest, 8 species (27%) in coniferous forest, 2 species (7%) deciduous forest, 6 species (20%) steppe of macromycetes respectively (Fig. 2).

Leccinum aurantiacum, L. scabrum, Lactarius torminosus and *Russula cyanoxantha* growing in desiduous and coniferous forests or occurring only in mycorrhizal association with birch trees. *Cystodermella cinnabarina, Amanita muscaria, Cortinarius torvus, R. emetica* grow singly, scattered, or in groups in sphagnum moss near bogs, and in coniferous and mixed forests. *Pleurotus ostreatus, Gymnopilus aeruginosus, Panus neostrigosus, Fomes fomentarius* and *Trichaptum biforme* growing in birch, birch-larch, larch-aspen-birch forests. *Neolentinus lepideus, Laetiporus sulphureus* is a saprophyte and occa-

sionally a weak parasite, causing brown cubical rot in the heartwood in the roots, base and stem. *Gomphidius glutinosus*, *Suillus cavipes, S. viscidus* and *S. grevillei* is grows in the soil of coniferous or mixed forests, not always at the foot of larch (mycorrhizal) with which it lives in symbiosis. *Clitocybe gibba, Spathularia flavida, Coltricia perennis* and *Grifolia frondosa* are grows in coniferous forests, on needle or leaf litter, also on bare earth among grasses and mosses. *Agaricus arvensis, A. campestris, Calbovista subsculpta, Macrolepiota excoriata* and *Marasmius oreades* are grows in steppe, meadows and pastures. There are grows singly, in groups, or occasionally in clusters. *Protostropharia semiglobata* is grows in steppe on dung and *Panaeolus semiovatus* grows in horse dung (Table 3).

As a result of this work, 7 species (23%) of macromycetes in forest steppe and steppe regions and 23 species (77%) of them in forest region have been determined. There were 2 species of lignophile (7%), 4 species of moss saprophyte (13%), 5 species of soil saprophyte (17%), 15 species of mycorrhiz (50%) among all species (Fig. 3).

Table 1. Distribution of macromycetes in Mongolia by order, family and genus

Order name (genus/species)	Family name (genus/species)
Boletales (3/6)	Boletaceae (1/2), Gomphidiaceae (1/1), Suillaceae (1/3)
Agaricales (12/13)	Agaricaceae (4/5), Amanitaceae (1/1), Bolbitaceae (1/1), Cortinariaceae (1/1), Marasmiaceae (1/1), Pleurotaceae (1/1), Strophariaceae (2/2), Tricholomataceae (1/1)
Russulales (2/3)	Russulaceae (2/3)
Polyporales (5/5)	Meripilaceae (1/1), Polyporaceae (3/3), Fomitopsidaceae (1/1)
Hymenochaetales (2/2)	Hymenocheataceae (2/2)
Rhytismatales (1/1)	Cudoniaceae (1/1)

Table 2. Distribution of mushrooms in phyto-geographical regions

Species of mushroom \ Number of phyto-geographic regions	1	2	3	4	5	6	7	8	10
Leccinum aurantiacum (Bull.) Gray (Boletaceae)	+	+	+						
Leccinum scabrum(Bull.) Gray (Boletaceae)	+	+	+	+					
Gomphidius glutinosus (Schaeff.) Fr. (Boletaceae)		+	+	+					
Suillus cavipes (Opatowski) Smith & Thiers (Boletaceae)	+	+	+	+					
Suillus grevillei (Klotzsch) Sing. (Boletaceae)	+	+	+	+					
Suillus viscidus (L.) Roussel (Boletaceae)	+	+	+	+	+				
Agaricus arvensis Schaeff. (Agaricaceae)	+	+	+	+				+	
Agaricus campestris Fr. (Agaricaceae)	+	+	+	+	+	+	+		+
Cystodermella cinnabarina (Alb. & Schwein.) Harmaja (Agaricaceae)	+	+	+	+					
Macrolepiota excoriata (Schaeff.) Wasser (Agaricaceae)	+	+	+	+					
Calbovista subsculpta Morse ex M.T. Seidl (Agaricaceae)	+	+	+						
Amanita muscaria (L.) Lam. (Amanitaceae)	+	+	+						
Panaeolus semiovatus (Sowerby) S. Lundell & Nannf. (Bolbitaceae)	+	+	+	+					
Cortinarius torvus (Fr.) Fr. (Cortinariaceae)	+	+	+						
Marasmius oreades (Bolton) Fr. (Marasmiaceae)	+	+	+	+					
Pleurotus ostreatus (Jacq.) P. Kumm. (Pleurotaceae)	+	+	+	+					
Gymnopilus aeruginosus (Peck) Singer (Strophariaceae)	+	+	+	+					
Protostropharia semiglobata (Batsch) (Strophariaceae)	+	+	+	+					
Clitocybe gibba (Pers.) P. Kumm. (Tricholomataceae)	+	+	+	+					
Lactarius torminosus (Schaeff.) Gray (Russulaceae)	+	+							
Russula cyanoxantha (Schaeff.) Fr. (Russulaceae)	+	+	+						
Russula emetica (Schaeff.) Pers. (Russulaceae)	+	+	+						
Neolentinus lepideus (Fr) Redhead & Ginns (Polyporaceae)	+	+	+	+					
Fomes fomentarius (L.) Fr. (Polyporaceae)	+	+	+	+					
Laetiporus sulphureus (Bull.) Murrill (Fomitopsidaceae)	+	+	+	+					
Spathularia flavida Pers. (Cudoniaceae)		+	+						
Grifolia frondosa (Dicks.) Gray (Meripilaceae)	+	+							
Coltricia perennis (L.) Murril (Hymenocheataceae)	+	+	+		+				
Panus neostrigosus Drechsler-Santos & Wartchow (Polyporaceae)	+	+	+	+					
Trichaptum biforme (Fr.) Ryvarden (Hymenocheataceae)		+	+	+	+				

1. Khubsgul mountain taiga, 2. Khentei mountain taiga, 3. Khangai forest steppe, 4. Mongol Daurian forest steppe, 5. Khingan mountain meadow steppe, 6. Khobdo mountain semidesert steppe, 7. Mongolian Altai mountain steppe, 8. Middle Khalkha dry steppe, 10. Depression of Great Lakes semidesert steppe.

1. *Leccinum aurantiacum,* 2. *Leccinum scabrum,* 3. *Gomphidius glutinosus,* 4. *Suillus cavipes,* 5. *Suillus grevillei,* 6. *Suillus viscidus,* 7. *Agaricus arvensis,* 8. *Agaricus campestris,* 9. *Cystodermella cinnabarina,* 10. *Macrolepiota excoriate,* 11. *Calbovista subsculpta,* 12. *Amanita muscaria,* 13. *Panaeolus semiovatus,* 14. *Cortinarius torvus,* 15. *Marasmius oreades,* 16. *Pleurotus ostreatus,* 17. *Gymnopilus aeruginosus,* 18. *Protostropharia semiglobata,* 19. *Clitocybe gibba,* 20. *Lactarius torminosus,* 21. *Russula cyanoxantha,* 22. *Russula emetica,* 23. *Neolentinus lepideus,* 24. *Fomes fomentarius,* 25. *Laetiporus sulphureus,* 26. *Spathularia flavida,* 27. *Grifolia frondosa,* 28. *Coltricia perennis,* 29. *Panus neostrigosus,* 30. *Trichaptum biforme*

L. aurantiacum, L. scabrum, G. glutinosus, S. cavipes, S. viscidus and *S. grevillei* are a favorite species for eating and can be prepared as other edible boletes. Traditionally, there are (*A. arvensis, A. campestris, P. ostreatus, M. oreades*) frequently used in Japanese, Korean and Chinese cookery as a delicacy: it is frequently served on its own, in soups, stuffed, or in stir-fry recipes with soy sauce. *L. sulphureus* is quite medicinal, and it's the perfect way to let food be your medicine, and medicine your food. *S. flavida* has been described by authorities variously as inedible, of unknown edibility, or edible but tough. *C. perennis, G. frondosa* and *T. biforme* are a very recent study using human participants. *P. semiovatus* is while some guides list this species as edible, a few people experience gastric upset after consumption.

DISCUSSION

According to our research work, there have been identified macromycetes of 30 species, 25 genus and 17 families belong to 6 orders. According to our studies from June to August, 2015, 2 species in Khubsgul region, 2 species in Khangai region, 3 species in Khingan region, and 1 species in Khentei region have been newly registered. As a result of this work, 7 species (23%) of macromycetes in forest steppe and steppe regions, and 23 species (77%) of them in forest region have been determined. 2 species of lignophile (7%), 4 species of moss saprophyte (13%), 5 species of soil saprophyte (17%), 15 species of mycorrhiz (50%) were occurred respectively.

Table 3. Herbarium for "Traditional Knowledge" project of Mongolia (2015)

№	Scientific name	Place name	Location and altitude	Habitat	Collected date	Herbarium index/ number	Collected by / Determined by
1.	*Fomes fomentarius* (L.) Fr.	Tuv, Batsumber, Udlug research station,	N 48°16′19.7″ E 106°59′11.8″ 1540m	in deciduous and coniferous forests	24 June, 2015	UBA/TK-15001	Kherlenchimeg, Enkhbold, Tuvshintogtokh/ Kherlenchimeg
2.	*Laetiporus sulphureus* (Bull.) Murrill	Uvurkhangai, Bat-Ulzii, Tuvkhun xiid, Shireet mountain	N 47°00′35.7″ E 102°15′56.1″ 2090 m	in deciduous and coniferous forests	30 June, 2015	UBA/TK-15004	Urgamal, Lkhagva / Kherlenchimeg
3.	*S. grevillei* (Klotzsch) Sing.	Khovsgol, Khatgal , Khovsgol lake, Shankhai	N 50°31′24.7″ E 100°16′46.7″ 1370 m	in coniferous forests	19 July, 2015	UBA/TK-15021	Kherlenchimeg, Enkhsaikhan/ Kherlenchimeg
4.	*Neolentinus lepideus* (Fr) Redhead & Ginns	Khovsgol, Burentogtokh, Bayan bag to Sogootiin davaa (mountain pass)	N 49°46′07.5″ E 98°56′06.4″ 1874 m	in coniferous forests	21 July, 2015	UBA/T K-15006	Kherlenchimeg, Enkhsaikhan/ Kherlenchimeg
5.	*Grifolia frondosa* (Dicks.) Gray	Khovsgol, Tosontsengel, Bulnai high mountain, Sogootiin davaa	N 49°00′39.1″ E 97°53′12.0″ 2278 m	in coniferous forests	22 July, 2015	UBA/TK-15007	Kherlenchimeg, Enkhsaikhan/ Kherlenchimeg
6.	*Calbovista subsculpta* Morse ex M.T. Seidl	Khovsgol, Tsetserleg, Tunamal lake nearest	N 49°41′36.4″ E 98°38′50.0″ 1985 m	in steppe	22 July, 2015	UBA/TK-15009	Kherlenchimeg, Enkhsaikhan/ Kherlenchimeg
7.	*Marasmius oreades* (Bolton) Fr.	Khovsgol, Tosontsengel, South from Tosontsengel sum center, Burgastai	N 48°55′31.9″ E 98°27′05.8″ 1934 m	in forest steppe	25 July, 2015	UBA/TK-15013	Kherlenchimeg, Enkhsaikhan/ Kherlenchimeg
8.	*A. campestris* Fr.					UBA/ TK-15018	
9.	*Panaeolus semiovatus* (Sowerby) S. Lundell & Nannf.	Arkhangai, Tsenkher, Road to Tsenkheriin rashaan (spring-water)	N 47°21′43.0″ E 101°33′58.8″ 1733 m	in steppe	28 July, 2015	UBA/TK-15024	Enkhsaikhan, Urgamal/ Kherlenchimeg
10.	*Protostropharia semiglobata* (Batsch)	Tuv, Mungunmorit, Monitoring station, Baruunburkh	N 48°16′49.2″ E 108°17′33.6″ 2015 m	in deciduous forests	08 August, 2015	UBA/ TK-15041	Kherlenchimeg, Solongo, Tseveendari/ Kherlenchimeg
11.	*R. emetica* (Schaeff.) Pers.	Tuv, Mungunmorit, Monitoring station, Baruunburkh	N 48°13′18.6″ E 108°20′56.1″ 1570 m	in deciduous and coniferous forests	08 August, 2015	UBA/TK-15053	Kherlenchimeg, Solongo, Tseveendari/ Kherlenchimeg
12.	*Russula cyanoxantha* (Schaeff.) Fr.					UBA/ TK-15057	
13.	*Panus neostrigosus* Drechsler-Santos & Wartchow	Tuv, Mungunmorit, Monitoring station, Baruunburkh	N 48°13′18.6″ E 108°20′56.1″ 1570 m	in deciduous and coniferous forests	10 August, 2015	UBA/ TK-15040	Kherlenchimeg, Solongo, Tseveendari/ Kherlenchimeg
14.	*L. scabrum* (Bull.) Gray					UBA/TK-15047	
15.	*Amanita muscaria* (L.) Lam.					UBA/TK-15050	
16.	*Gomphidius glutinosus* (Schaeff.) Fr.	Tuv, Mungunmorit, Monitoring station, Baruunburkh	N 48°12′48.2″ E 108°25′04.4″ 1810 m	in deciduous and coniferous forests	10 August, 2015	UBA/ TK-15063	Kherlenchimeg, Solongo, Tseveendari/ Kherlenchimeg

Table 3. continued

№	Scientific name	Place name	Location and altitude	Habitat	Collected date	Herbarium index/ number	Collected by / Determined by
17.	*Lactarius torminosus* (Schaeff.) Gray					UBA/ TK-15064	
18.	*Cortinarius torvus* (Fr.) Fr.					UBA/TK-15065	
19.	*Cystodermella cinnabarina* (Alb. & Schwein.) Harmaja					UBA/ TK-15072	
20.	*Leccinum aurantiacum* (Bull.) Gray	Tuv, Mungunmorit, Monitoring station, Baruunburkh	N 48°13′18.6″ E 108°20′56.1″ 1570 m	in deciduous and coniferous forests	10 August, 2015	UBA/TK-15052	Kherlenchimeg Purevdulam, Solongo/ Kherlenchimeg
21	*Pleurotus ostreatus* (Jacq.) P. Kumm.					UBA/ TK-15066	
22.	*Gymnopilus aeruginosus* (Peck) Singer	Tuv, Mungunmorit, Monitoring station, Baruunburkh	N 48°16′49.2″ E 108°17′33.6″ 2015 m	in deciduous forests	11 August, 2015	UBA/ TK-15032	Kherlenchimeg, Solongo, Tseveendari/ Kherlenchimeg
23.	*S. viscidus* (L.) Roussel	Tuv, Mungunmorit, Monitoring station, Zuunburkh	N 48°19′56.3″ E 108°35′30.3″ 1525 m	in coniferous forests	11 August, 2015	UBA/ TK-15080	Kherlenchimeg, Solongo, Tseveendari/ Kherlenchimeg
24.	*Trichaptum biforme* (Fr.) Ryvarden			in deciduous and coniferous forests		UBA/ TK-15099	
25.	*Suillus cavipes* (Opatowski) Smith & Thiers	Tuv, Mungunmorit, Monitoring station, Zuunburkh	N 48°13′15.0″ E 108°29′38.8″ 1529 m	in coniferous forests	12 August, 2015	UBA/ TK-15068	Kherlenchimeg, Solongo, Tseveendari/ Kherlenchimeg
26.	*Clitocybe gibba* (Pers.) P. Kumm.					UBA/ TK-15087	
27.	*Coltricia perennis* (L.) Murril					UBA/ TK-15090	
28.	*Spathularia flavida* Pers.					UBA/ TK-15097	
29.	*Agaricus arvensis* Schaeff.	Tuv, Mungunmorit, Monitoring station, Baruunburkh river	N 48°13′13.6″ E 108°20′50.1″ 1520 m	in steppe	13 August, 2015	UBA/ TK-15101	Kherlenchimeg / Kherlenchimeg
30.	*Macrolepiota excoriata* (Schaeff.) Wasser	Khentii, Delgerkhaan , Avarga tosongoos xoish, Bayan Khairkhan	N 47°17′39.5″ E 108°59′22.5″ 1624 m	in steppe	13 August, 2015	UBA/TK-15103	Urgamal, Erdenetuya, Lkhagva /Kherlenchimeg

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