

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 occurred 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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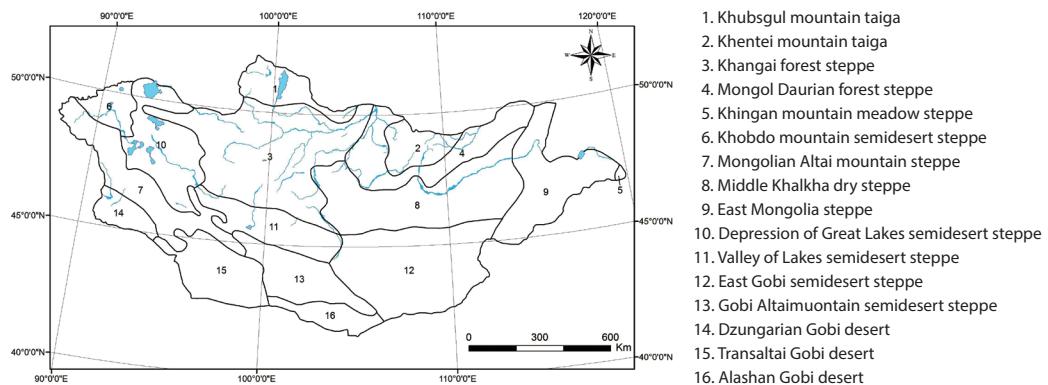


Fig. 1. Map of phyto-geographical regions of the Mongolia (Grubov 1982).

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. Specimens enveloped 150 of samples macromycetes collected from June, 2015 to August, 2015 in Tuy, 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 websites: indexfungorum.org (2015).

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

The identification of pileus, basidiospores and ring MBC-10 binocular (14x), Basidiospores, cystide, spores and further internal morphology was done by JEOL JSM-61008 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).

RESULTS

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

Mongolian macromycetes have been registered in 9 of 16 geographic regions as 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

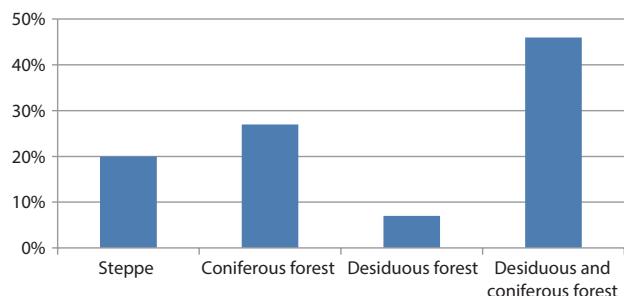


Fig. 2. Growing environment of macromycetes.

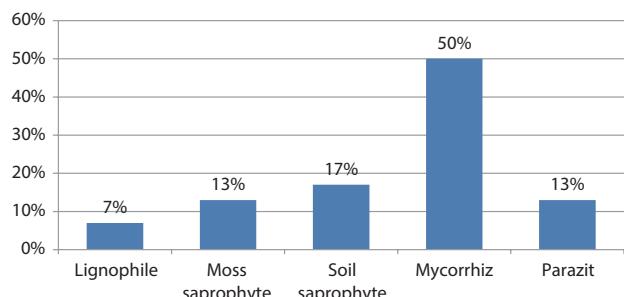


Fig. 3. Ecology-trophic analysis of Macrofungi.

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 cinnabarinina*, *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 neostrigulosus*, *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 flava*, *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).

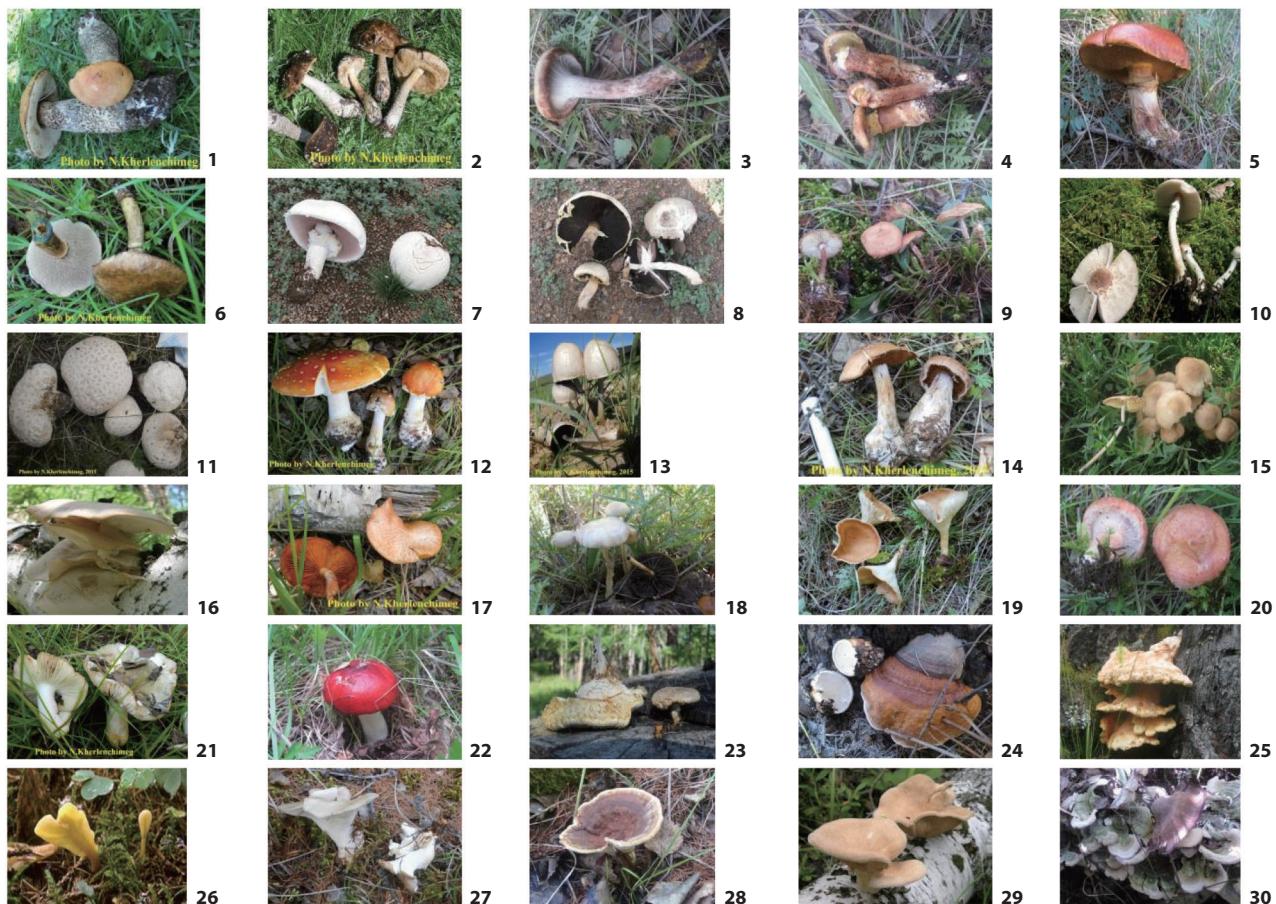
Table 1. Distribution of macromyces in Mongolia by order, family and genus

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)	Hymenochaetaceae (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	
<i>Leccinum aurantiacum</i> (Bull.) Gray (Boletaceae)	+	+	+							
<i>Leccinum scabrum</i> (Bull.) Gray (Boletaceae)	+	+	+	+						
<i>Gomphidius glutinosus</i> (Schaeff.) Fr. (Boletaceae)		+	+	+						
<i>Suillus cavipes</i> (Opatowski) Smith & Thiers (Boletaceae)	+	+	+	+						
<i>Suillus grevillei</i> (Klotzsch) Sing. (Boletaceae)	+	+	+	+						
<i>Suillus viscidus</i> (L.) Roussel (Boletaceae)	+	+	+	+	+	+				
<i>Agaricus arvensis</i> Schaeff. (Agaricaceae)	+	+	+	+						+
<i>Agaricus campestris</i> Fr. (Agaricaceae)	+	+	+	+	+	+	+	+		+
<i>Cystodermella cinnabarina</i> (Alb. & Schwein.) Harmaja (Agaricaceae)	+	+	+	+						
<i>Macrolepiota excoriata</i> (Schaeff.) Wasser (Agaricaceae)	+	+	+	+						
<i>Calbovista subsculpta</i> Morse ex M.T. Seidl (Agaricaceae)	+	+	+	+						
<i>Amanita muscaria</i> (L.) Lam. (Amanitaceae)	+	+	+							
<i>Panaeolus semiovatus</i> (Sowerby) S. Lundell & Nannf. (Bolbitaceae)	+	+	+	+						
<i>Cortinarius torvus</i> (Fr.) Fr. (Cortinariaceae)	+	+	+							
<i>Marasmius oreades</i> (Bolton) Fr. (Marasmiaceae)	+	+	+	+						
<i>Pleurotus ostreatus</i> (Jacq.) P. Kumm. (Pleurotaceae)	+	+	+	+						
<i>Gymnopilus aeruginosus</i> (Peck) Singer (Strophariaceae)	+	+	+	+						
<i>Protostropharia semiglobata</i> (Batsch) (Strophariaceae)	+	+	+	+						
<i>Clitocybe gibba</i> (Pers.) P. Kumm. (Tricholomataceae)	+	+	+	+						
<i>Lactarius torquatus</i> (Schaeff.) Gray (Russulaceae)	+	+								
<i>Russula cyanoxantha</i> (Schaeff.) Fr. (Russulaceae)	+	+	+							
<i>Russula emetica</i> (Schaeff.) Pers. (Russulaceae)	+	+	+							
<i>Neolentinus lepidus</i> (Fr.) Redhead & Ginns (Polyporaceae)	+	+	+	+						
<i>Fomes fomentarius</i> (L.) Fr. (Polyporaceae)	+	+	+	+						
<i>Laetiporus sulphureus</i> (Bull.) Murrill (Fomitopsidaceae)	+	+	+	+						
<i>Spathularia flava</i> Pers. (Cudoniaceae)		+	+							
<i>Grifolia frondosa</i> (Dicks.) Gray (Meripilaceae)	+	+								
<i>Coltricia perennis</i> (L.) Murrill (Hymenochaetaceae)	+	+	+		+					
<i>Panus neostrigulosus</i> Drechsler-Santos & Wartchow (Polyporaceae)	+	+	+	+	+					
<i>Trichaptum biforme</i> (Fr.) Ryvarden (Hymenochaetaceae)	+	+	+	+	+	+				

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. *Cystoderma cinnabarinum*, 10. *Macrolepiota excoriata*, 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 torninosus*, 21. *Russula cyanoxantha*, 22. *Russula emetica*, 23. *Neolentinus lepideus*, 24. *Fomes fomentarius*, 25. *Laetiporus sulphureus*, 26. *Spathularia flava*, 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. flava* 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)

Nº	Scientific name	Place name	Location and altitude	Habitat	Collected date	Herbarium index/ number	Collected by/ Determined by
1.	<i>Fomes fomentarius</i> (L.) Fr.	Tuv, Batsumber, Urdlug research station,	N 48°16'19.7" E 106°59'11.8" 1540m	in deciduous and coniferous forests	24 June, 2015	UBA/TK-15001	Kherenchimeg, Enkhbold, Tuvshintogtokh/ Kherenchimeg
2.	<i>Laetiporus sulphureus</i> (Bull.) Murrill	Uvurkhangai, Bat-Ulzi, 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 / Kherenchimeg
3.	<i>S. grevillei</i> (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	Kherenchimeg, Enksaikhan/ Kherenchimeg
4.	<i>Neolentinus lepidens</i> (Fr) Redhead & Gimins	Khovsgol, Burenhotgokh, 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/TK-15006	Kherenchimeg, Enksaikhan/ Kherenchimeg
5.	<i>Grijolia frondosa</i> (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	Kherenchimeg, Enksaikhan/ Kherenchimeg
6.	<i>Calbovista subsculpta</i> Morse ex M.T. Seidl	Khovsgol, Tsetselerleg, Tunamal lake nearest	N 49°41'36.4" E 98°38'50.0" 1985 m	in steppe	22 July, 2015	UBA/TK-15009	Kherenchimeg, Enksaikhan/ Kherenchimeg
7.	<i>Marasmius oreades</i> (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	Kherenchimeg, Enksaikhan/ Kherenchimeg
8.	<i>A. camppestris</i> Fr.					UBA/ TK-15018	
9.	<i>Panaeolus semiovatus</i> (Sowerby) S. Lundell & Namff.	Arkhangai, Tsenker, Road to Tsenkeriin rashaan (spring-water)	N 47°21'43.0" E 101°33'58.8" 1733 m	in steppe	28 July, 2015	UBA/TK-15024	Enksaikhan, Urgamal/ Kherenchimeg
10.	<i>Protostropharia semiglobata</i> (Batsch)	Tuv, Mungunmorit, Monitoring station, Baruunburkhi	N 48°16'49.2" E 108°17'33.6" 2015 m	in deciduous forests	08 August, 2015	UBA/ TK-15041	Kherenchimeg, Solongo, Tsevendari/ Kherenchimeg
11.	<i>R. emetica</i> (Schaeff.) Pers.	Tuv, Mungunmorit, Monitoring station, Baruunburkhi	N 48°13'18.6" E 108°20'56.1" 1570 m	in deciduous and coniferous forests	08 August, 2015	UBA/TK-15053	Kherenchimeg, Solongo, Tsevendari/ Kherenchimeg
12.	<i>Russula cyanoxantha</i> (Schaeff.) Fr.					UBA/ TK-15057	
13.	<i>Panus neostrigosus</i> Drechsler-Santos & Wartchow	Tuv, Mungunmorit, Monitoring station, Baruunburkhi	N 48°13'18.6" E 108°20'56.1" 1570 m	in deciduous and coniferous forests	10 August, 2015	UBA/ TK-15040	Kherenchimeg, Solongo, Tsevendari/ Kherenchimeg
14.	<i>L. scabrum</i> (Bull.) Gray					UBA/TK-15047	
15.	<i>Amanita muscaria</i> (L.) Lam.					UBA/TK-15050	
16.	<i>Gomphidius glutinosus</i> (Schaeff.) Fr.	Tuv, Mungunmorit, Monitoring station, Baruunburkhi	N 48°12'48.2" E 108°25'04.4" 1810 m	in deciduous and coniferous forests	10 August, 2015	UBA/ TK-15063	Kherenchimeg, Solongo, Tsevendari/ Kherenchimeg

Table 3. continued

No	Scientific name	Place name	Location and altitude	Habitat	Collected date	Herbarium index/ number	Collected by / Determined by
17.	<i>Lactarius torninosus</i> (Schaeff.) Gray					UBA/ TK-15064	
18.	<i>Corticarius torvus</i> (Fr.) Fr.					UBA/ TK-15065	
19.	<i>Cystodermella cinnabarinina</i> (Alb. & Schwein.) Harmaja					UBA/ TK-15072	
20.	<i>Leccinum aurantiacum</i> (Bull.) Gray	Tuv, Mungummorit, Monitoring station, Barunburkh	N 48°13'18.6" E 108°20'56.1"	in deciduous and coniferous forests 1570 m	10 August, 2015	UBA/TK-15052	Kherlenchimeg Purevdulam, Solongo/ Kherlenchimeg
21	<i>Pleurotus ostreatus</i> (Jacq.) P. Kumm.					UBA/ TK-15066	
22.	<i>Gymnopilus aeruginosus</i> (Peck) Singer	Tuv, Mungummorit, Monitoring station, Barunburkh	N 48°16'49.2" E 108°17'33.6"	in deciduous forests 2015 m	11 August, 2015	UBA/ TK-15032	Kherlenchimeg, Solongo, Tseveendai/ Kherlenchimeg
23.	<i>S. viscidus</i> (L.) Rousse	Tuv, Mungummorit, Monitoring station, Zuunburkh	N 48°19'56.3" E 108°35'30.3"	in coniferous forests 1525 m	11 August, 2015	UBA/ TK-15080	Kherlenchimeg, Solongo, Tseveendai/ Kherlenchimeg
24.	<i>Trichaptum biforme</i> (Fr.) Ryvarden			in deciduous and coniferous forests		UBA/ TK-15099	
25.	<i>Suillus cavipes</i> (Opatowski) Smith & Thiers	Tuv, Mungummorit, Monitoring station, Zuunburkh	N 48°13'15.0" E 108°29'38.8"	in coniferous forests 1529 m	12 August, 2015	UBA/ TK-15068	Kherlenchimeg, Solongo, Tseveendai/ Kherlenchimeg
26.	<i>Clitocybe gibba</i> (Pers.) P. Kumm.					UBA/ TK-15087	
27.	<i>Coltricia perennis</i> (L.) Murrill					UBA/ TK-15090	
28.	<i>Spathularia flavidula</i> Pers.					UBA/ TK-15097	
29.	<i>Agaricus arvensis</i> Schaeff.	Tuv, Mungummorit, Monitoring station, Barunburkh river	N 48°13'13.6" E 108°20'50.1"	in steppe 1520 m	13 August, 2015	UBA/ TK-15101	Kherlenchimeg / Kherlenchimeg
30.	<i>Macrolepiota excoriata</i> (Schaef.) Wasser	Khentii, Delgerkhaan, Avarga tosongoos xoish, Bayan Khairkhan	N 47°17'39.5" E 108°55'22.5"	in steppe 1624 m	13 August, 2015	UBA/TK-15103	Urgamal, Erdeneuya, Lkhagva /Kherlenchimeg

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