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## New regional records and conspectus of the order Boletales (Agaricomycetidae) in Mongolia

## Новые местонахождения и конспект порядок Boletales (Agaricomycetidae) в Монголии

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**Summary.** This is revision of the taxonomic composition of the Mongolian Boletales order, at present that 24 species and 10 genera, 4 families of the fungi flora of Mongolia. The 4 species, 4 genera and 3 families have been added and 11 new combinations on the species level have been made since 1980. The most number of additions made to the following families: Suillaceae (3 genera, 12 species), Boletaceae (4 genera, 7 species). The species composition of the order Boletales in the fungi flora of Mongolia is revealed and their taxonomic position is revised. For the mycobiota of Mongolia, a new ordering system for Boletales at the level of families and genera is presented, which differs from systems published earlier (Singer, 1986; Moncalvo et al., 2002; Matheny et al., 2006).

**Реферат.** В результате исследований на территории Монголии выявлено 25 видов болетовых базидиомицетов, которые относятся к 10 родам и 4 семействам. С 1980 года было сделано 11 новых комбинаций на уровне видов и добавлены 4 вида, 4 рода и 3 семейства. Наибольшее количество дополнений было в следующих ведущих семействах порядка Boletales: Suillaceae (3 рода, 12 видов), Boletaceae (4 рода, 7 видов). Выявлен видовой состав порядка Boletales во флоре грибов Монголии, и пересмотрена их таксономическая позиция. Для микобиоты Монголии представлена новая система порядка Boletales на уровне семейств и родов, которая отличается от систем, опубликованных ранее (Зингер, 1986; Moncalvo et al., 2002; Matheny et al., 2006).

### Introduction

The Boletales is an order of Agaricomycetes containing over 1300 species with a diverse array of fruiting body types. G. Uranchimeg (1983, 1984,) firstly registered 15 species in the order Boletales. A. N. Petrov (1979, 1981) reported 15 species and N. Kherlenchimeg et al. (2008, 2009, 2011, 2013, 2016) to 30 species, in addition to previous concluded the information of taxonomy, distribution and ecology on the 24 species (table 1).

Table 1

History of the Boletales species number to the fungi flora of Mongolia

Sources and references	Species	New records of species
Uranchimeg G. (1983, 1984)	15	–
Petrov A. N. (1979, 1981, 1999)	15	9
Kherlenchimeg N. (2001, 2008, 2011, 2013, 2016)	30	10
At present (in this paper)	–	6

### Materials and Methods

The order Boletales specimens from the Herbarium (UBA) of the Institute of Botany, Mongolian Academy of Sciences, Herbarium (LE) of the Institute of Botany, Russian Academy of Sciences and as well as additional data, were used for the study. In a total, over 170 sheets of specimens were collected from 1980 to 2016. The nomenclature and taxonomy were based on followed works of Singer (1986), Matheny et al. (2006), Moncalvo et al. (2000) and following professional taxonomic databases and websites:

indexfungorum.org.name (2016). The geographical distribution data was carried in phyto-geographical regionalization (by Grubov, 1982) of the Mongolia (fig.).

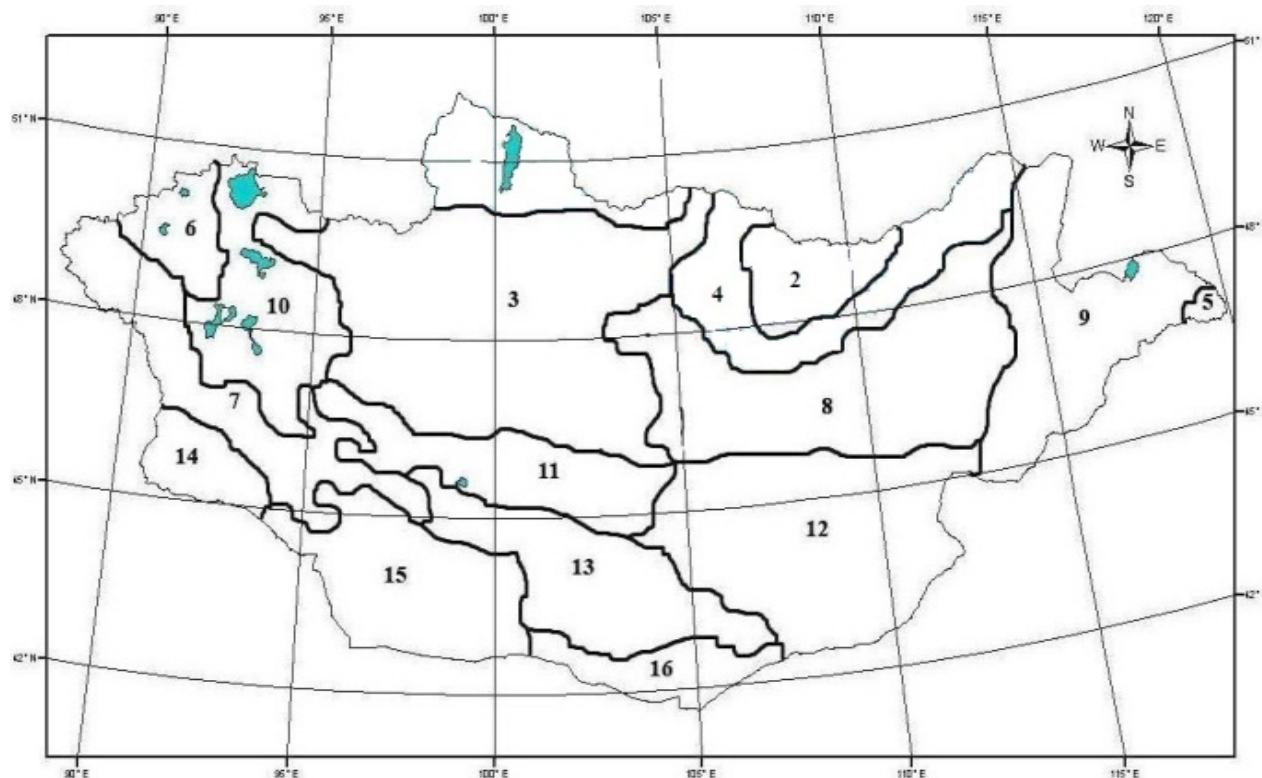


Fig. Map of phyto-geographical regions of the Mongolia (Grubov, 1982): 1 – Khubsgul mountain taiga; 2 – Khentei mountain taiga; 3 – Khangai forest steppe; 4 – Mongol Daurian forest steppe; 5 – Khingan mountain meadow steppe; 6 – Khobdo mountain semidesert steppe; 7 – Mongolian Altai mountain steppe; 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 Altai mountain semidesert steppe; 14 – Dzungarian Gobi desert; 15 – Transaltai Gobi desert; 16 – Alashan Gobi desert.

**Results**

It is revealed that 24 species belonging to 10 genera, 4 families occur in the fungi flora of Mongolia as present. 3 species have been added, and 4 species are new combinations since 1980. We updated new conspectus and classification system (Singer, 1986; Moncalvo et al., 2002; Matheny et al., 2006).

Mongolian boletiod macromycetes have been registered in 5 of 16 geographic regions (table 2). According to our studies in 1997–2016 years 15 species in Khentei region, 4 species in Khangai region, 4 species in Khingan regions are respectively newly registered.

Table 2

**Boletales in the fungi flora of Mongolia**

References	Number of geographic regions					
	Khubs.	Khent.	Khang.	Mong. Dag.	Khing.	
Uranchimeg G. (1983, 1984)	15	2	13			
Petrov A. N. (1979, 1981,)	15	8	7			
Kherlenchimeg N. (2008, 2009, 2010, 2011, 2013, 2016)	30	5	12	6	4	4
This paper	6		5			1
<b>Total</b>		<b>15</b>	<b>37</b>	<b>6</b>	<b>4</b>	<b>5</b>

**CONSPECTUS OF ORDER BOLETALES E.-J. GILBERT, 1931 (10/24)**

Les Livres du Mycologue Tome I–IV, Tom. III: Les Bolets: 83.

Symbols: # – new combination;

+ – new species added;

3+ – new regions records

**1. Boletaceae Chevall., 1826 (4/7)**

Fl. Gen. Env. Paris (Paris) 1: 248.

**1. Boletus L., 1753**

Sp. Pl. 2: 1176.

+ **B. edulis Bull.**, 1782, Herb. Fr. (Paris) 2: tab.60. – [2+ (Tuv, Mungunmorit sum, Baruunburkh), (Kherlenchimeg, Burenbaatar, 2016)].

**# 2. Chalciporus Bataille, 1908**

Bull. Soc. Hist. nat. Doubs 15: 39.

**# Ch. piperatus (Bull.) Bataille, 1908**, Bull. Soc. Hist. Nat. Doubs 15: 39; syn. *Suillus piperatus* (Bull.) Kuntze, 1898, Revis. Gen. Pl. (Leipzig) 3(2): 535. – *Boletus piperatus* Bull., 1790, Herb. Fr. 10: 451, 2. – [2 (Tuv, Mungunmorit sum, Zuunburgastai)].

**3. Leccinum Gray, 1821**

Nat. Arr. Brit. Pl. (London) 1: 646.

**L. aurantiacum (Bull.) Gray, 1821**, Nat. Arr. Brit. Pl. (London) 1: 646. – *Boletus aurantiacus* Bull. Hist. Champ. France (Paris): 320. – [2 (Darkhan-Uul, Shariin gol, Monostoin am), (Kherlenchimeg et al., 2008, 2016)].

**L. holopus (Rostk.) Watling, 1960**, Trans. Br. mycol. Soc. 43(4): 692. *Boletus holopus* Rostk. 1844, in Sturm, Deutschl. Fl., 3 Abt. (Pilze Deutschl.) 5: 131. – [1 (Khubsgul, Darkhadiin khotgor); 2 (Tuv, Mungunmorit sum, Zuunburgaltain gol); 3+ (Zavkhan, Tarvagatain nuruu, Nariinii am), (Kherlenchimeg, Burenbaatar, 2016)].

**L. scabrum (Bull.) Gray, 1821**, Nat. Arr. Brit. Pl. (London) 1: 646. – *Boletus scaber* Bull., 1783, [1782–83], Herb. Fr. 3: 132. – [1+ (Khubsgul, Munkh-Sardig), (Petrov, 1981); 2 (Khentii, Onon gol, LE 202289; Tuv, Mungunmorit sum, Baruunburkh; Darkhan-uul, Shariin gol, Khuinii davaa) (Petrov, 1999; Kherlenchimeg et al., 2008)].

+ **L. versipelle (Fr. & Hök) Snell, 1944**, Lloydia 7(1): 58. – *Boletus versipellis* Fr. & Hök, 1835, Boleti, Fungorum Generis, Illustratio: 13. – [1+ (Khubsgul, Munkh-Sardig), (Petrov, 1981); 2+ (Onon gol, LE 202267), (Petrov, 1999); (Khentii, Noyon Uul), (Kherlenchimeg, Burenbaatar, 2016)].

4. Xerocomus Quel., 1887

Fl. Vosges, Champ.: 477.

**X. subtomentosus (L.) Quel., 1888**, Fl. Mycol. France (Paris): 418. – *Boletus subtomentosus* L., 1753, Sp. Pl. 2: 1178. – [2 (Darkhan-Uul, Shariin gol, Monostoin am), (Kherlenchimeg et al., 2008); 1 (Khubsgul, Darkhadiin khotgor), (Kiyozo Sumiya, et al., 2010)].

**# 2. Gomphidiaceae Maire ex Julich, 1982 (2/4)**

Bibliotheca Mycol. 85: 369.

**# 1. Chroogomphus (Singer) O.K. Mill., 1964**

Mycologia 56(4): 529.

**# Ch. rutilus (Schaeff.) O.K. Mill., 1964**, Mycologia 56(4): 543; syn. *Gomphidius rutilus* (Schaeff.) S. Lundell, 1937, Fungi Exsiccati Suecici: 409. – *A. rutilus* Schaeff., 1774, Fung. Bavar. Palat. 4: 24. – [2+ (Khentii, Onon gol, Bayan-Uul, LE 202296; Binder, Yangi Uul) (Petrov, 1999); 5+ (Dornod, Khalkh-gol sum, Ar sumiin khooloi)].

**2. Gomphidius Fr., 1836**

Fl. Scan.: 339.

**G. glutinosus (Schaeff.) Fr. 1838**, Epicr. Syst. Mycol. (Upsaliae): 319. – *Agaricus glutinosus* Schaeff., 1774, Fung. Bavar. Palat. 4: 17. – [2 (Khentii, Binder, Ikh Shaazgait Uul); 5+ (Dornod, Khakh gol sum, Ar sumiin khooloi), (Kherlenchimeg, Burenbaatar, 2016)].

**G. maculatus (Scop.) Fr., 1838**, Epicr. Syst. Mycol. (Upsaliae): 319. – *Agaricus maculatus* Scop., Fl. Carniol., 1772, Edn 2 (Wien) 2: 448. – [ 2 (Khentii, Tsenkhermandal sum, Yudgiin gol) ].

**G. roseus (Fr.) Fr., 1838**, Epicr. Syst. Mycol. (Upsaliae): 319. – *Agaricus glutinosus* Fr., 1821, Syst. Mycol. (Lundae) 1: 315. – [ 2 (Tuv, Mungunmorit sum, Ujuunii am), (DarkhanUul, Shariin gol, Monostoin am), (Kherlenchimeg, Burenbaatar, 2016) ].

### # 3. Hygrophoropsidaceae Kühner, 1980 (1/1)

Bull. mens. Soc. Linn. Lyon 49: 900.

# 1. Hygrophoropsis (J. Schröt.) Maire ex Martin-Sans, 1929

L'Empoisonnem. Champ.: 99.

# **H. aurantiaca (Wulfen) Maire, 1921**, L'Empoisonnem. Champ.: 99. – *Agaricus aurantiacus* Wulfen, 1781, in Jacquin, Miscell. Austriac. 2: 107. – [ 2 + (Selenge, Khuder sum, Selenge gol, LE 202271) (Petrov, 1999); 3+ (Zavkhan, Tarvagatain nuruu), (Kherlenchimeg, Burenbaatar, 2016) ].

### # 4. Suillaceae Besl & Bresinsky., 1997 (3/12)

Pl. Syst. Evol. 206(1–4): 239.

#### 1. Boletinus Kalchbr., 1967

Bot. Ztg. 25: 182.

**B. asiaticus Singer, 1938**, Rev. Mycol. France 5, 3: 164. – [ 2+ (Onon gol), (Petrov, 1999); 2 (Khentii, Khan Khentii uul, Kherlen goliin ekh), (Kherlenchimeg & Burenbaatar, 2016); 3+ (Zavkhan, Tarvagatain nuruu, Biluutiin shil), (Kherlenchimeg & Burenbaatar, 2016) ]

# 2. Fuscoboletinus Pomerl. & A.H. Sm., 1962

Brittonia. 14: 157. # **F. spectabilis (Peck) Pomerl. & A.H. Sm., 1962**, Brittonia 14: 161; syn. *Boletinus spectabilis* (Peck) Murrill, 1909, Mycologia 1(1): 6. – *Boletus spectabilis* Peck, 1872, Ann. Rep. Reg. N.Y. St. Mus. 23: 128. – [ 2 (Tuv, Mungunmorit sum, Ujuunii am) ]

#### 3. Suillus Gray, 1821

Nat. Arr. Brit. Pl. (London) 1: 646.

**S. bovinus (Pers.) Roussel, 1796**, F. Calvados: 34. – *Boletus bovinus* L., 1753, Sp. pl. 2: 1177. – [ 1 (Khubsgul, Darkhadiin khotgor), (Kherlenchimeg, 2009); 2 (Khentii, Yangi uul) ]

**S. cavipes (Opat.) A.H. Sm. & Thiers, 1964**, Monogr. North Amer. Species Suillus: 30. – *Boletinus cavipes* (Opat.) Kalchbr., 1867, Icon. Sel. Hymenomyc. Hung. 25: 52. – [ 2+ (Bulgan, Bugat sum; Bayan-Uul, LE 202251), (Uranchimeg, 1983; Petrov, 1999); 3+ (Zavkhan, Tarvagatain nuruu, Nariinii am), (Kherlenchimeg & Burenbaatar, 2016) ]

**S. flavidus (Fr.) J. Presl., 1846**, Wšobecne rostl. (Praha) 2: 1917. – *Boletus flavidus* Fr., 1815, Observ. Mucol. (Havniae) 1: 110. – [ 1 (Khubsgul, Khubsgul dalain baruun ereg), (Bulgan, Bugat sum, Bayan-Uul, LE 202251), (Kherlenchimeg, 2009; Petrov, 1999); 2 (Khentii, Ikh Shaazgait uul, Temeen huzuu uul) ]

+ **S. granulatus (L.) Roussel, 1796**, F. Calvados: 34. – *Boletus granulatus* L., 1753, Sp. Pl. 2: 1177. – [ 1 (Khubsgul, Darkhadiin khotgor); 2 (Darkhan-uul, Shariin gol, Khuitnii davaa), (Kherlenchimeg, 2008; 2009); 4 (Tuv, Bogd Khan uul), (Kherlenchimeg & Burenbaatar, 2016); 5+ (Dornod, Khakh gol sum, Ar sumiin khooloi), (Kherlenchimeg & Burenbaatar, 2016) ]

**S. grevillei (Klotzsch) Singer, 1945**, Farlowia 2: 259. – *Boletus grevillei* Klotzsch., 1832, Linnaea 7: 198. – [ 1 (Khubsgul, Darkhadiin khotgor), (Petrov, 1981); 2 (Darkhan-Uul, Shariin gol, Monostoin am), (Kherlenchimeg et al, 2008); 3, 4 (Kherlenchimeg, 2009, 2011, 2016) ]

**S. luteus (L.) Roussel, 1796**, F. Calvados: 34. – *Boletus luteus* L., 1753, Sp. Pl. 2: 1177. – [ 1, 2 (Khentii, Onon gol, Ikh Shaazgait uul; Bayan-Uul), (Petrov, 1999; Kherlenchimeg, 2009); 4 (Tuv, Bogd Khan uul), (Kherlenchimeg & Burenbaatar, 2016) ]

**S. sibiricus (Singer) Singer, 1945**, Farlowia 2: 260. – *Ixocomus sibiricus* Singer, 1938, Revue Mycol., Paris 3: 46. – [ 1+ (Khubsgul, Munkh Sardig), (Petrov, 1981); 2 (Tuv, Mungunmorit sum, Borkhoninii gol) ]

**S. tridentinus (Bres.) Singer, 1945**, Farlowia 2: 260. – *Boletus tridentinus* Bres., 1881, Fung. Trident. 1(1): 13. – [ 1+ (Khubsgul, Munkh Sardig), (Petrov, 1981); 2 (Tuv, Mungunmorit, Borkhoninii gol) ]

**S. variegatus (Sw.) Kuntze, 1898**, Revis. Gen. Pl. (Leipzig) 3(2): 536. – *Boletus variegatus* Sw., 1810, K. Vetensk-Acad. Nya Handl. 31: 8. – [ 1, 2 (Khentii, Binder sum, Ikh Shaazgait uul), (Kherlenchimeg, 2009) ].

# *S. viscidus* (L.) Roussel, 1796, F. Calvados: 34. – *Boletus viscidus* L., 1753, Sp. Pl. 2: 1177; syn. *S.aeruginascens* Secr. ex Snell., 1944, in Slipp ex Snell, Lloydia 7: 25. – *B.aeruginascens* Secr., 1833, Mycogr. Suisse 3 : 6. – [ 1 (Bulgan, Buteeliin nuruu); 2 (Tuv, Mungunmorit sum, Bugiin Eruu uul, Arkhaya uul); 3 (Zavkhan, Bulnai nuruu), (Kherlenchimeg, 2009, 2016); 5+ (Dornod, Khakh gol sum, Ar sumiin khooloi), (Kherlenchimeg & Burenbaatar, 2016)].

### Discussion

From 1980 3 species have been newly added (*Boletus edulis* Bull., *Leccinum versipelle* (Fr. & Hök) Snell, *Suillus granulatus* (L.) Roussel). In addition to that 4 genera (*Chalciporus*, *Chroogomphus*, *Hygrophoropsis*, *Fuscoboletinus*) and 4 species (*Chalciporus piperatus* (Bull.) Bataille, *Chroogomphus rutilus* (Schaeff.) O.K.Mill., *Hygrophoropsis aurantiaca* (Wulfen) Maire, *Fuscoboletinus spectabilis* (Peck) Pomerl. & A.H. Sm.) were new a combinations.

Therefore, rare 2 species have been newly found (*Boletinus asiaticus* Singer, *Leccinum aurantiacum* (Bull.) Gray) from the Mongolian fungal flora (Kherlenchimeg, 2013).

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