

NEW RECORDS OF ORDER BOLETALES FROM PAKISTAN

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Abstract

During a survey of basidiomycetous fungi, eight species belonging to order Boletales were collected from different parts of Gilgit-Baltistan, Pakistan. The collected members of phylum Basidiomycota included *Aureoboletus gentilis*, *Boletus reticulatus* and *B. subtomentosus* belonging to family Boletaceae, and *Suillus bovinus*, *S. granulatus*, *S. luteus*, *S. placidus* and *S. viscidus* belonging to family Suillaceae. Of these, *Aureoboletus gentilis*, *Boletus reticulatus*, *B. subtomentosus*, *S. bovinus*, *S. luteus* and *S. viscidus* appeared to be new records from Pakistan not hitherto reported.

Key words: Basidiomycota, *Aureoboletus*, *Boletus*, *Suillus*, New records, Gilgit-Baltistan, Pakistan.

Introduction

Phylum Basidiomycota belongs to Kingdom Fungi. This phylum is a large and diverse group that comprises of mushrooms, boletus, puffballs, earthstars, stink horns, birds nest fungi, jelly fungi, bracket or shelf fungi, rust and smut fungi (Alexopolus *et al.*, 1996). So far, more than 31,000 species have been described from different parts of the world (Kirk *et al.*, 2010). Several members of Basidiomycota are well known plant pathogens, whereas others are important for their food value or because of scents, tastes, colours, and toxic properties of a wide variety of secondary products (Gallois *et al.*, 1990).

Hawksworth *et al.* (1995) reported that there were about 22,000 species of basidiomycetous fungi. The number increased to more than 31,000 within 13 years. This increase of about 9,000 species indicates that there may be a large numerous species of fungi that are still unknown to science. In contrast to more than 31,000 species reported from different parts of the world, only about 700 species have been reported from Pakistan (Ahmad *et al.*, 1997; Sultana *et al.*, 2011). It shows that there is a potential of recording several new species or new records from the unexplored areas of Pakistan like Gilgit-Baltistan that has excellent environment for the growth of mushrooms.. The present report describes six new records of the members of the order Boletales from Pakistan.

Materials and Methods

Samples of basidiomycetous fungi collected from different areas of Gilgit-Baltistan were photographed in their natural habitat and macroscopic details along with altitude and latitude were recorded using a GPS. The samples were brought to the Department of Biological Sciences, Karakoram International University, Gilgit and identified up to species level after reference to Ahmad *et al.* (1997), Demoulin & Mirriott (1981), Surcek (1988), Buczacki (1989), Leelavathy & Ganesh (2000), Swann & Taylor (1993), Shibata (1992), Murakami (1993) and Sultana *et al.* (2011). The synonymy of the recorded species was confirmed from

www.speciesfungorum.org. The specimens were dried at room temperature to make a herbarium for future reference.

Results

During the present work, eight species viz., *Aureoboletus gentilis*, *Boletus reticulatus* and *B. subtomentosus* belonging to family Boletaceae, and *Suillus bovinus*, *S. granulatus*, *S. luteus*, *S. placidus* and *S. viscidus* belonging to family Suillaceae (Fungi: Basidiomycota) were collected for the first time from Gilgit-Baltistan. It included six species viz., *Aureoboletus gentilis*, *Boletus reticulatus*, *B. subtomentosus*, *S. bovinus*, *S. luteus* and *S. viscidus*, as new records from Pakistan. These species are described and illustrated herein.

Aureoboletus gentilis (Quél.) Pouzar, *Česká Mykol.* 11: 48 (1957)

Synonymy:

Boletus sanguineus subsp. *gentilis* (Quél.) Quél., Assoc. Franç. Avancem. Sci., Congr. Rouen 1883 12: 510 (1883)

Boletus sanguineus var. *gentilis* Quél., Assoc. Franç. Avancem. Sci., Congr. Rouen 1883 12: 504 (1884)

Viscipellis gentilis (Quél.) Quél., *Enchir. fung.* (Paris): 156 (1886)

Ixocomus gentilis (Quél.) Quél., *Fl. mycol.* France (Paris): 413 (1888)

Boletus gentilis (Quél.) Sacc., *Syll. fung.* (Abellini) 6: 8 (1888)

Xerocomus gentilis (Quél.) Singer, *Annls mycol.* 40(1/2): 43 (1942)

Pulveroboletus gentilis (Quél.) Singer, *Farlowia* 2: 300 (1945)

Boletus cramesinus Secr., *Mycogr. Suisse* 3: 39 (1833)

Boletus granulatus var. *tenuipes* Cooke, *Grevillea* 12(no. 62): 43 (1883)

Boletus tenuipes (Cooke) Masee, *Brit. Fung.-Fl.* (London) 1: 281 (1892)

Aureoboletus cramesinus Secr. ex Watling, *Trans. & Proc. Bot. Soc. Edinb.* 40(1): 118 (1965)

Aureoboletus cramesinus (Secr.) Sing, *Secreten bibliography*: 1. Secretan, L., 1833

Pulveroboletus cramesinus (Secr. ex Watling) M.M. Moser ex Singer, *Pilze Mitteleuropas* (Stuttgart) 6: 12 (1966)



Fig. 1. A-C: *Aureoboletus gentilis*, D-F: *Boletus reticulatus*, G-I: *Boletus subtomentosus*, J-L: *Suillus bovinus*, M-N: *Suillus luteus*, O-Q: *Suillus viscidus*.

Distinguishing characters: Cap 5-12cm wide, sticky then streaked and wrinkled when drying, Stem 5-8cm, tapering towards base, cylindrical, sticky and with watery droplets when wet. Tubes and pores golden yellow. Tubes decurrent. Pores large and angular. Smell pleasant. Flesh soft, whitish. Spores sub-spindle-shaped, smooth, 11-15x4-5µm in size (Fig. 1A-C).

Habit/Habitat: Usually in small groups, on soil in old fire sites.

Season: June- July.

Occurrence: It was collected from Mushkin forest, District Astore, alt 2722m, N=35°18, E=74°42, and Dichal nalla, District Astore, alt 3144m, N=35°39, E=74°55.

Ethnic uses/Importance: Edible.

Boletus reticulatus Schaeff., *Fung. bavar. palat. nasc.* (Ratisbonae) 4: 78 (1774)

Synonymy:

Suillus reticulatus (Schaeff.) Kuntze, *Revis. gen. pl.* (Leipzig) 3(2): 535 (1898)

Boletus edulis subsp. *reticulatus* (Schaeff.) Konrad & Maubl., *Icon. Select. Fung.* 4(2): pl. 398 (1926)

Boletus edulis f. *reticulatus* (Schaeff.) Vassilkov, *Bekyi Grib:* 18 (1966)

Boletus reticulatus Schaeff., *Fung. bavar. palat. nasc.* (Ratisbonae) 2: tab. 108 (1763)

Boletus reticulatus Schaeff., *Fung. bavar. palat. nasc.* (Ratisbonae) 4: 78 (1774) subsp. *reticulatus*

Boletus reticulatus Schaeff., *Fung. bavar. palat. nasc.* (Ratisbonae) 4: 78 (1774) var. *reticulatus*

Tubiporus aestivalis Paulet, *Traité sur les Champignons Comestibles* (Paris) 2: 371 (1793)

Boletus aestivalis (Paulet) Fr., *Epicr. syst. mycol.* (Upsaliae): 422 (1838)

Boletus aestivalis (Paulet) Fr., *Epicr. syst. mycol.* (Upsaliae): 422 (1838) var. *aestivalis*

Versipellis aestivalis (Paulet) Quél., *Enchir. fung.* (Paris): 158 (1886)

Suillus aestivalis (Paulet) Kuntze, *Revis. gen. pl.* (Leipzig) 3(2): 535 (1898)

Boletus carpinaceus Velen., *Novitates Mycologicae:* 158 (1939)

Boletus reticulatus subsp. *carpinaceus* (Velen.) Hlaváček, *Mykologický Sborník,* 71(2): 54 (1994)

Distinguishing characters: Cap 6-12cm, first dome shaped then convex with some scratches appearing on surface. Stem 5-15cm, stout, swollen below, white with brown or black scales on surface. Tubes and pores whitish. Tubes depressed. Pores small and round. Spore print brown. Smell pleasant. Flesh firm and white. Spores sub-spindle-shaped, smooth, 12-16x 5-6µm in size (Fig. 1D-F).

Habit/Habitat: Usually in small groups, on soil.

Season: June- July.

Occurrence: It is collected from Dichal nalla, District Astore, alt 3135m, N=35°39, E=74°55.

Ethnic uses/Importance: Edible.

Boletus subtomentosus L., *Sp. pl.* 2: 1178 (1753)

Synonymy:

Leccinum subtomentosum (L.) Gray, *Nat. Arr. Brit. Pl.* (London) 1: 647 (1821)

Rostkovites subtomentosus (L.) P. Karst., *Revue mycol., Toulouse* 3(no. 9): 16 (1881)

Versipellis subtomentosus (L.) Quél., *Enchir. fung.* (Paris): 158 (1886)

Xerocomus subtomentosus (L.) Quél., *Fl. mycol.* France (Paris): 418 (1888)

Xerocomus subtomentosus (L.) Quél., *Fl. mycol.* France (Paris): 418 (1888) f. *subtomentosus*

Xerocomus subtomentosus (L.) Quél., *Fl. mycol.* France (Paris): 418 (1888) var. *subtomentosus*

Xerocomus subtomentosus (L.) Quél., *Fl. mycol.* France (Paris): 418 (1888) subsp. *subtomentosus*

Suillus subtomentosus (L.) Kuntze, *Revis. gen. pl.* (Leipzig) 3(2): 535 (1898)

Ceratomyces subtomentosus (L.) Murrill, *Mycologia,* 1(4): 153 (1909)

Xerocomops subtomentosus (L.) Reichert, *Palest. J. Bot., Rehovot Ser.* 3: 229 (1940)

Boletus subtomentosus var. *virescens* Bres., in Clus.-Istvanffy.

Distinguishing characters: Cap 5-11cm, downy, then flat with cracks appearing on the cap surface. Stem 3-8cm, slender, no dots or faint ribbing. Tubes and pores yellow, then olive-green. Tubes adnate. Pores large and angular. Spore print brown. Smell indistinct. Flesh soft, Lemon-yellow, brownish in stem. Spores sub-spindle shaped, smooth, 10-13x4-5µm in size, pale yellow (Fig. 1G-I).

Habit/Habitat: Usually in small groups, on soil in broad-leaved trees and mixed woods.

Season: September- October

Occurrence: Specimens were collected from Dashkin (panote col), District Astore (Gilgit), alt 2711m, N=35°29, E=74°47.

Ethnic uses/Importance: Edible.

Key to species of *Suillus*

1. Spores up to 4µm wide-----2
- Spores 4 or more µm wide-----3
2. Cap 3-5cm in diameter-----*S. luteus*
- Cap 4-9cm in diameter-----*S. bovinus*
3. Tubes lemon yellow-----*S. granulatus*
- Tubes not lemon yellow-----4
4. Cap whitish to lemon yellow-----*S. placidus*
- Cap brownish-----*S. viscidus*

Suillus bovinus (L.) Roussel, *F. Calvados*: 34 (1796)

Synonymy:

Boletus bovinus L., *Sp. pl.*: 1177 (1753)
Agaricus bovinus (L.) Lam., *Encycl. Méth. Bot.*, 1(1): 52 (1783)
Viscipellis bovina (L.) Quél., *Enchir. fung.*, (Paris): 157 (1886)
Ixocomus bovinus (L.) Quél., *Fl. mycol. France* (Paris): 413 (1888)
Mariaella bovina (L.) Šutara, *Česká Myko.*, 41(2): 76 (1987)

Distinguishing characters: Cap 4-9cm, smooth and sticky, with a distinct pale margin. Stem 6cm long and 2cm thick, generally smooth except at apex when young, equal, and cylindrical. Tubes decurrent, grayish wine-red. Pores large and angular. Spore print brown. Smell pleasant, sweet or fruity. Flesh soft and whitish. Spores ellipsoid-spindle shaped, smooth, 8-10x3-4µm in size, pale yellow (Fig. 1J-L).

Habit/Habitat: In small groups on soil close to coniferous trees.

Season: July- August.

Occurrence: Mushkin forest, District Astore alt 2639m, N=35°66, E=74°42.

Ethnic uses/Importance: Edible.

Suillus luteus (L.) Roussel, *F. Calvados*: 34 (1796)

Synonymy:

Boletus luteus L., *Sp. pl.*, 2: 1177 (1753)
Cricunopus luteus (L.) P. Karst., *Revue mycol.*, Toulouse 3(9): 16 (1881)
Viscipellis luteus (L.) Quél., *Enchir. fung.* (Paris): 155 (1886)
Ixocomus luteus (L.) Quél., *Fl. mycol. France* (Paris): 414 (1888)
Boletopsis lutea (L.) Henn., in Engler & Prantl, *Nat. Pflanzenfam., Teil. I* (Leipzig) 1: 195 (1898)

Distinguishing characters: Cap 3-5cm wide, yellow-brown, readily peeling cuticle, slimy and glossy when moist, radially fibrillose when dry. Cap first dome shaped but soon convex. Tubes pale yellow, with relatively small pores. Stipe cylindrical, sheathed with leathery veil. Flesh yellowish. Smell pleasant, fruity taste. Spores ellipsoid, smooth, pale yellow, 7-10x3-3.5µm in size (Fig. 1M-N).

Habit/Habitat: On soil, along sides of canals.

Season: July- August.

Occurrence: Dashkin, District Astore, alt 3010m, N=35°28, E=74°46.

Ethnic uses/Importance: Edible, with pleasant taste.

Suillus viscidus (L.) Roussel, *F. Calvados*: 34 (1796)

Synonymy:

Boletus viscidus L., *Sp. pl.* 2: 1177 (1753)

Suillus viscidus (L.) Roussel, *F. Calvados*: 34 (1796) var. *viscidus*

Suillus viscidus (L.) Roussel, *F. Calvados*: 34 (1796) f. *viscidus*

Viscipellis viscida (L.) Quél., *Enchir. fung.* (Paris): 156 (1886)

Ixocomus viscidus (L.) Quél., *Fl. mycol. France* (Paris): 416 (1888) f. *viscidus*

Ixocomus viscidus (L.) Quél., *Fl. mycol. France* (Paris): 416 (1888)

Ixocomus viscidus (L.) Quél., *Fl. mycol. France* (Paris): 416 (1888) var. *viscidus*

Boletopsis viscida (L.) Henn., in Engler & Prantl, *Nat. Pflanzenfam., Teil. I* (Leipzig) 1: 195 (1898)

Fuscoboletinus viscidus (L.) Grund & K.A. Harrison, *Bibliotheca Mycol.*, 47: 134 (1976)

Distinguishing characters: Cap 8-12cm, first convex then flattened, with brownish, slimy and glossy surface, fibrillose-scaly when dry. In young fruit body the cap is connected with the stipe by a whitish membrane veil but with age the veil is disappears. Tubes whitish, then brown, with relatively large angular pores. Stem 6-8cm long and 1.5-2cm thick, rather thin, yellow towards the pore surface, with a transitory ring. Flesh white, but latter brownish. Smell pleasant, fruity taste. Spore 8-14x4-5µm in size, ellipsoid, pale yellow (Fig. 1O-Q).

Habit/Habitat: The species grows in a mycorrhizal relationship with various trees especially pine trees.

Season: August- September.

Occurrence: Mushkin forest, District Astore alt 2538m, N=35°44, E=74°23.

Ethnic uses/Importance: Edible.

Suillus granulatus (L.) Roussel, *F. Calvados*: 34 (1796)

Synonymy:

Boletus granulatus L., *Sp. pl.*: 1177 (1753)
Agaricus granulatus (L.) Lam., *Encycl. Méth. Bot.* 1(1): 51 (1783)
Suillus granulatus (L.) Roussel, in Sipp. & Snell, *F. Calvados*: 34 (1796) subsp. *granulatus*
Rostkovites granulatus (L.) P. Karst., *Revue mycol.*, Toulouse 3(no. 9): 16 (1881)
Viscipellis granulatus (L.) Quél., *Enchir. fung.* (Paris): 156 (1886)
Ixocomus granulatus (L.) Quél., *Fl. mycol. France* (Paris): 412 (1888)
Boletus granulatus var. *violaceopunctatus* J. Blum & Azéma, (1967)
Boletus violaceopunctatus (J. Blum & Azéma) J. Blum, (1969)

Distinguishing characters: Cap 2-7 cm, sticky, becoming shiny and later slightly wrinkled. Stem 3.5-6cm long and 2-3cm thick, slightly swollen at base, no ring present, granular towards apex, the granules exuding pale watery liquid when wet. Tubes and pores are lemon-

yellow. Tubes adnate. Pores small. Smell pleasant. Flesh soft, straw colored, yellowish in the stem. Spores ellipsoid, yellowish, smooth 8-10x4-5µm in size.

Habit/Habitat: Usually in small groups on soil.

Season: June- July

Occurrence: Lashtang forest (Dashkin), District Astore alt 2756m, N=35°34, E=74°49.

Ethnic uses/Importance: Edible.

Previous Report from Pakistan: On ground in coniferous forest, Murree, Malakakundi, Pirchinacsi (Ahmad, 1969; Shibata, 1992; Murakami, 1993).

Suillus placidus (Bonord.) Singer, *Farlowia*, 2: 42 (1945)

Synonymy:

Boletus placidus Bonord., *Beitr. Mykol.* 19: 204 (1861)

Gyrodon placidus (Bonord.) Fr., *Hymenomyc. eur.* (Upsaliae): 518 (1874)

Ixocomus placidus (Bonord.) E.-J. Gilbert, *Les Livres du Mycologue Tome I-IV, Tom. III: Les Bolets*: 134 (1931)

Suillus plorans subsp. *Placidus* (Bonord.) *Pilát, Naše Houby* 2: pl. 7 (1959)

Suillus plorans subsp. *Placidus* (Bonord.) *Pilát, Mushrooms and Other Fungi*: pl. 7 (1961)

Viscipellis fusipes (Heufl.) Quél., *Enchir. fung.* (Paris): 156 (1886)

Suillus placidus f. *fusipes* (Heufl.) Klofac, *Öst. Z. Pilzk.*, 16: 257 (2007)

Distinguishing characters: Cap 4-5cm, first convex then flattened, white brown or yellowish. Tubes whitish yellow, later lemon yellow. Stipe whitish, covered with brown granules. Veil not developed. Flesh soft, white. Spores 8-10x4-5µm in size, ellipsoid-fusiform, pale yellowish.

Habit/Habitat: Solitary or in small groups under the pine trees.

Season: May-June.

Occurrence: Mushkin forest, Dashkin, District Astore, alt 2513m, N=35°28, E=74°46.

Ethnic uses/Importance: Edible.

Previous Report from Pakistan: Dhirkot (AJK), Sharan (Murakami, 1993).

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