

## Larger Fungi from the Pir Panjal Himalayan range in Poonch district of Jammu and Kashmir state, India

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### Abstract

Nine macrofungal species belonging to seven families collected from temperate forests of district Poonch, Jammu and Kashmir have been described. All these species constitute new report of their occurrence from the study area.

**Keywords:** Poonch, Mycodiversity, Taxonomy, Edible

### Introduction

The State of Jammu and Kashmir falls in the great north-western complex of the Himalayan ranges (between 32° 17' N–36° 58' N latitude and 73° 26' E–80° 30' E longitude) and possess great snow-clad mountains, altitudinal variation, diverse geological structures, different climatic zones, antecedent drainage and rich temperate flora and fauna. The presence of interesting mycodiversity in this Himalayan region has been attracting many enthusiastic investigators over the years. From Jammu and Kashmir, different researchers have contributed to the study of mushroom flora and a total of about 340 macrofungal species have been reported so far (Abraham *et al.*, 1981, 1984; Abraham and Kaul, 1985; Watling and Abraham, 1986, 1992; Abraham, 1991; Dar *et al.*, 2009; Wani *et al.*, 2010; Beig *et al.*, 2011; Kumar and Sharma, 2008, 2009, 2011a, b, c; Sharma and Sharma, 2012; Sharma *et al.*, 2012; Dorjey *et al.*, 2013a, b; Kour *et al.*, 2013; Kumar *et al.*, 2014; Kour *et al.*, 2015) and still rich mycoflora is hidden in these regions which need to be explored. Our laboratory is also engaged in survey of macrofungal diversity of the state for the last ten years. In this communication, we are reporting nine mushroom species collected from the temperate forests of district Poonch.

### Materials and Methods

Collections were made from different locations of district Poonch of Jammu and Kashmir during

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the monsoon season. The specimens were photographed in the field and extensive notes were made from the fresh fruit bodies before they were dried. Colour terms and notations are from Ridgway (1912). The microscopic details were studied from thin sections made from dried specimen, revived in 5% KOH and stained in 1% Congo red and Melzer's reagent. The spore Quotient (Q) was obtained by mean spore length divided by spore width. Identification was carried out by making use of taxonomic keys, field manuals and help of mushroom experts. The examined specimens have been deposited in the Herbarium of Botany Department, University of Jammu with accession numbers (HBJU).

### Study area

District Poonch (73° 58' - 74° 35' E longitude and 33° 25' - 34° 01' N latitude), Jammu and Kashmir, from where the present collections have been made fall in the temperate climatic zone with an altitudinal range of 600-4,750 m. It is characterised by the forests comprising of *Pinus roxburghii*, *P. wallichiana*, *Abies pindrow*, *Cedrus deodara*, *Juniperus communis*, *J. recurva*, *Picea smithiana*, *Taxus wallichiana*, *Juglans regia*, *Quercus semecarpifolia*, *Populus ciliata*, *Platanus orientalis*, *Pyrus pashia*, *Prunus padus*, *P. armeniaca*, *Eucalyptus globulus*, *Vitex negundo*, *Morus alba* and *Dalbergia sisoo*. Apart from this, medicinally important herbs and shrubs including *Adhatoda vasica*, *Asparagus sp.*, *Atropa belladonna*, *Berberis sp.*, *Dodonaea viscosa*, *Ocimum sanctum*, *Podophyllum hexandrum*, *Woodfordia floribunda* and



*Zanthoxylum alatum* etc. are also found in the area.

## Results and Discussion

**1. *Lepiota sistrata*** (Fr.) Quel., *Mem. Soc. Emul. Montbelliard*, Ser. 2 5: 231 (1872)

**Synonymy:** *Agaricus sistratas* Fr., *Syst. Mycol.* (Lundae) 1: 24 (1821)

*Lepiota sistrata* (Fr.) Quel., *Mem. Soc. Emul. Montbelliard*, Ser. 2 5: 231 (1872)

**Pileus:** 1.8-3.2 cm in diameter, white at margins and yellow in the centre, globose when very young and campanulate at later stages, hemispherical when mature; **Gills:** creamy white, sub-distant, unequal; **Stipe:** 0.3 cm in diameter and 4.5-6.0 cm in length, brittle; **Veil:** present in the form of cortina in young stages; **Basidiospores:** 4.0-7.2 x 4.0-4.8  $\mu\text{m}$ , a<sub>L</sub>= 5.6, a<sub>W</sub>= 4.4, Q= 1.0-1.5, smooth, thick walled, uni- to multiguttulated, apiculate, broadly elliptical; **Apiculus:** 0.8-1.6  $\mu\text{m}$  in length; **Basidia:** 15.2-27.2 x 5.6-8.0  $\mu\text{m}$ , clavate, hyaline; **Sterigmata:** 3.2-4.8  $\mu\text{m}$  long, four in number; **Pileus cuticle hyphae:** hyaline, 8.0-18.0  $\mu\text{m}$  wide, septate, hyaline, branched; **Inflated hyphae:** 28.0-32.0  $\mu\text{m}$  wide; **Pileus context hyphae:** 8.0-18.0  $\mu\text{m}$  wide, hyphae branched, septate, hyaline; **Pileocystidia:** clavate to pyriform, 36.0-88.0  $\mu\text{m}$  long; **Stipe hyphae:** 8.0-26.0  $\mu\text{m}$  wide, hyaline, septate, less branched, clamp connections absent.

**Collection examined:** Jammu and Kashmir, Poonch, Dara Dullian, fasciculate, humicolous, in mixed forests of *Quercus semecarpifolia* and wild *Punica granatum*, Harpreet Kour and Y. P. Sharma, HBJU 214, October 2012.

**Distribution:** Reported on ground of botanical Garden, Saharanpur, U.P (Hennings, 1901).

**2. *Panaeolus campanulatus*** (L.) Quel., *Mem. Soc. Emul. Montbelliard*, Ser. 25: 151 (1872)

**Synonymy:** *Agaricus campanulatus* Fr., *Syst. mycol.* (Lundae) 1: 295 (1821)

**Pileus:** 1.0-2.5 cm long and 1.0-2.5 cm wide, grayish-black, conico-convex; **Gills:** black in colour, free; **Stipe:** 6.5-8.0 cm long and 0.3 cm wide, equal, brown; **Odour:** agreeable; **Basidiospores:** 12.0-16.0 x 10.0-12.0  $\mu\text{m}$ , hyaline, broad at centre narrow towards both the ends, double walled, smooth; **Basidia:** 6.4-12.8 x 4.8-7.2  $\mu\text{m}$ , hyaline, clavate, small in size, guttulated; **Sterigmata:** 2 to 4 in number, 1.6-3.2  $\mu\text{m}$  long; **Pileus hyphae:** hyaline, septate, branched, clamp connections absent; **Pileocystidia:** 32.0-36.0  $\mu\text{m}$  wide and 40.0-108.0  $\mu\text{m}$  long, hyaline; **Stipe hyphae:** hyaline, septate, unbranched, 10.0-24.0  $\mu\text{m}$  wide.

**Collection examined:** Jammu and Kashmir, Poonch, Krishna Ghat, single, gregarious, humicolous, Harpreet Kour and Y.P. Sharma, HBJU 225, August 2012.

**Distribution:** On ground of botanic garden Saharanpur, U.P (Hennings, 1900; Bose, 1920) and in forests of Kashmir (Beig et al., 2011).

**3. *Lycoperdon pedicellatum*** Peck, *Bull. Buffalo Soc. Nat. Hist.* 1(2): 63 (1873) [1873-1874]

**Synonymy:** *Bovistella pedicellata* Lloyd, *Mycol. Writ.* 2 (Letter 23): 284, pl. 88, fig. 5-10 (1906)

**Carpophore:** 1.5-3.4 cm in diameter, Dresden brown (17°O-Y.k) in colour, soft, with aperture at apex; **Stipe:** 4.5 cm long and 1.6 cm in diameter, fused at base to form groups, creamish; **Exoperidium:** dark brown with an apical pore; **Basidiospores:** globose, 4.0-5.6  $\mu\text{m}$  in diameter, echinulate, double walled, pale yellow in Congo red; **Pedicel:** 2.4-9.6  $\mu\text{m}$  long; **Capillitium threads:** hyaline to light yellow in color, branched; **Exoperidial hyphae:** 4.0-7.2  $\mu\text{m}$  wide, septate, double walled, branched; **Inflated hyphae:** 10.4-28.8 x 11.2- 22.4  $\mu\text{m}$ , thin walled.

**Collection examined:** Jammu and Kashmir, Poonch, Kanuyan, fasciculate, gregarious, humicolous, Harpreet Kour and Y.P. Sharma, HBJU 217, September 2012.





Figure 1: a= Fruit bodies of *Lepiota sistrata* b= *Lycoperdon pedicellatum* in natural habitat c= Fruit bodies of *Lactarius deliciosus* d= Sporophores of *Panaeolus campanulatus* e= *Lepiota procera* growing in nature f= Undersurface of fruit body of *L. procera* showing lamellae and annulus.





Figure 2: a= Sporocarps of *Suillus granulatus* b= *Amanita vaginata* in natural habitat c= Carpophores of *Astraeus hygrometricus* d= Carpophores of *A. hygrometricus* showing reticulate pattern on exoperidium e= Carpophores of *Scleroderma citrinum* in natural habitat.



**Distribution:** Earlier reported from conifer dominated forests of Kashmir (Beig *et al.*, 2011).

**4. *Scleroderma citrinum*** Pers., *Syn. Meth. Fung.* (Gottingen) 1: 153 (1801)

**Synonymy:** *Scleroderma vulgare* Hornem., *Syst. Mycol.* (Lundae) 3: 46 (1829)

**Carpophore:** 1.1-1.6 cm wide, light brown in colour with reticulate pattern on it, on maturity cracks into lobes to form an irregular pore, profusely branched rhizomorphs present; **Gleba:** dark black (in preservative); **Stipe:** short; **Basidiospores:** 6.4-10.4 x 6.4-9.6  $\mu\text{m}$ ,  $a_L= 8.4$ ,  $a_W= 8.0$ ,  $Q= 1.0-1.1$ , light brown (in Congo red), yellowish green in KOH and iodine, echinulated, double walled; **Pedical:** absent; **Exoperidial hyphae:** 4.8-8.8  $\mu\text{m}$  in width, septate, branched; **Endoperidial hyphae:** hyaline, thin, 4.0- 5.6  $\mu\text{m}$  wide.

**Collection examined:** Jammu and Kashmir, Poonch, Islamabad, humicolous, Harpreet Kour and Y.P Sharma, HBJU 233, July 2012.

**Distribution:** Recorded from the forests of Kashmir (Beig *et al.*, 2011).

**5. *Lepiota procera*** (Scop.) Gray, *Nat. Arr. Brit. Pl.* (London) 1: 601 (1821)

**Synonymy:** *Agaricus colubrinus* Bull., *Herb. Fr.2:* tab. 78 (1782) [1781-82]  
*Agaricus procerus* Scop., *Fl. carniol.*, Edn 2 (Wien) 2: 418 (1772)

**Pileus:** creamy white, 6.5-10.5 cm wide, soft spongy in texture, convex and sub-umbonate with brown appressed scales on it; **Gills:** creamy white, crowded, sinuate; **Stipe:** creamy white, 15.0-20.0 cm long and 1.5-2.5 cm wide, solid, brittle, equal, centric; **Basidiospores:** hyaline, ovate, thick walled, apiculate, 10.4-15.2 x 8.0-11.2  $\mu\text{m}$ ,  $a_L= 12.8$ ,  $a_W= 9.6$ ,  $Q= 1.3-1.4$ ; **Basidia:** clavate, hyaline, 29.6-40.0 x 11.2-14.4  $\mu\text{m}$ ; **Sterigmata:** 2-3 in number and 4.8-6.4  $\mu\text{m}$  long; **Pileus hyphae:** hyaline, septate, branched occasionally, 6.0-10  $\mu\text{m}$  wide; **Stipe**

**hyphae:** hyaline, septate, branched, clamp connections present, 7.2-28.0  $\mu\text{m}$  in width.

**Collection examined:** Jammu and Kashmir, Poonch, Krishna Ghati, gregarious, fasciculate, humicolous, mixed forest of *Pinus roxburghii* and *P. wallichiana*, Harpreet Kour and Y.P. Sharma, HBJU 213, July 2012.

**Edibility:** Edible in the study area.

**Distribution:** Earlier reported from Calcutta (Banerjee, 1947); Saharanpur (U.P) (Chopra and Chopra, 1955).

**6. *Amanita vaginata*** Encycl. Meth. Bot. (Paris) 1: 109 (1783)

**Synonymy:** *Agaricus plumbeus* Schaeff., *Fung. Bavar. Palat.* 4: 37 (1774)  
*Amanita vaginata f. battarrae* (Boud.) Vesely, *Annl. Mycol.* 31(4): 279 (1933)

**Pileus:** 3.5-4.5 cm wide, plane, smooth, grayish white with white patches on pileus; margins plicate-sulcate, thin, crenate, entire; **Gills:** free, close to sub-distant, entire, whitish; **Stipe:** 4.5-6.5 x 0.7-0.9 cm, central, cylindrical, smooth, white, slightly bulbous at the base, volva forming a cup at the base of stipe, soft, brittle, solid, becoming hollow at maturity; **Spore print:** white; **Annulus:** absent; **Basidiospores:** globose to slightly ellipsoidal, 8.0-11.2 x 7.2-12.0  $\mu\text{m}$ ,  $a_L= 9.6$ ,  $a_W= 9.6$ ,  $Q= 1.1-0.9$ , smooth, oil drops present, biguttulate, hyaline (3% KOH), amyloid with prominent apiculus; **Basidia:** clavate, 30.4-51.2 x 17.6-19.2  $\mu\text{m}$ , sterigmata 2 to 4 in number, ranges upto 3.2  $\mu\text{m}$  long; **Pileus hyphae:** 2.4-4.8  $\mu\text{m}$  wide, thick-walled; **Stipe hyphae:** 4.8-8.0  $\mu\text{m}$  wide, septate, hyaline, unbranched.

**Collection examined:** Jammu and Kashmir, Poonch, Kanuyian, forests predominated by *Quercus semecarpifolia*, solitary, humicolous, Harpreet Kour and Y.P. Sharma, HBJU 219, September 2012.

**Edibility:** Not eaten in the study area. However its edibility has been reported across the world



(Christensen, 1955; Purkayastha and Chandra, 1985).

**Distribution:** On soil from Chattisgarh, Himachal Pradesh, Assam, Nagpur, Uttar Pradesh, Tamil Nadu and from Kashmir region (Trivedi, 1972; Ghosh *et al.*, 1974; Sathe and Sasangan, 1977; Watling and Gregory, 1980; Shukla *et al.*, 2009).

**7. *Astraeus hygrometricus*** (Pers.) Morgan, J. Cincinnati Soc. Nat. Hist. 12: 20 (1889)

**Synonymy:** *Astraeus hygrometricus* f. decaryi (Pat.) Pat., *Mem. Acad. Malgache* 6: 35 (1928) (1927)

*Lycoperdon stellatus* Scop., *Fl. carniol.*, Edn 2 (Wien) 2: 489 (1772)

**Exoperidium:** 1.0-2.5 cm long and 0.8-2.0 cm wide at the base, splitted into 8-12 rays, hygroscopic, pale yellow, with reticulate pattern; **Endoperidium:** forming spore sac, open by irregularly torn aperture, sessile, depressed; **Gleba:** dark brown; **Basidiospores:** yellow greenish (in Congo red), 8.0-15.2 x 6.4-12.8  $\mu\text{m}$ ,  $a_vL=11.6$ ,  $a_vW=9.6$ ,  $Q=1.2$ , broadly ellipsoidal, monoguttulated, thick walled, ornamented, faint concentric rings seen in the centre; **Capillitium threads:** hyaline, septate, 8.0-10.0  $\mu\text{m}$  wide, branched, clamped; **Exoperidial hyphae:** light green in colour, some hyaline (in Congo red), septate, branched, clamp connections present.

**Collection examined:** Jammu and Kashmir, Poonch, Krishna Ghati, solitary to scattered, humicolous, coniferous forests of *Pinus wallichiana*, Harpreet Kour and Y.P. Sharma, HBJU 231, July 2013.

**Edibility:** Not eaten in the study area but reported to be edible from other regions (Thakur, 1980).

**Distribution:** Earlier reported from Western Himalayas, West Bengal (Thakur, 1980).

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

**Synonymy:** *Agaricus granulatus* (L.) Lam., *Encycl. Meth. Bot.* 1 (1): 51 (1783)

*Boletus lactifluus* (With.) J. Blum, *Bull. trimest. Soc. Mycol. Fr.* 85: 43 (1969)

**Pileus:** 5.5-8.0 cm wide, convex, mustard yellow (19.YO-Y.b), on bruising changes colour to brown, surface sticky; **Pores:** present, yellow in colour; **Stipe:** 4.8-5.5 cm long and 20.5-1.5 cm thick, laterally attached, yellow, solid; **Basidiospores:** 7.2-14.4 x 4.0-6.4  $\mu\text{m}$ ,  $a_vL=10.8$ ,  $a_vW=5.2$ ,  $Q=1.8-2.25$ , elliptical, hyaline (in Congo red), yellowish (in 2% KOH), mono- to multiguttulated; **Basidia:** clavate, 17.6-23.2 x 6.4-8.8  $\mu\text{m}$ , hyaline, guttulated; **Pileus cuticle hyphae:** 8.0-14.0  $\mu\text{m}$  wide, septate, hyaline, branched; **Pileus context hyphae:** 10.0-18.0  $\mu\text{m}$  wide, septate, branched, hyaline, guttulated; **Pileocystidia:** clavate, 33.6-56.0 x 4.8-6.4  $\mu\text{m}$ . **Stipe hyphae:** 8.0-12.0  $\mu\text{m}$  wide, hyaline, less branched.

**Collection examined:** Jammu and Kashmir, Poonch, Krishna Ghati, solitary, gregarious, humicolous, Harpreet Kour and Y.P. Sharma, HBJU 234, August 2012

**Distribution:** Reported from the forests of Kashmir (Beig *et al.*, 2011).

**9. *Lactarius deliciosus*** (L.) Gray, *Nat. Arr. Brit. Pl.* (London) 1: 624 (1821)

**Synonymy:** *Agaricus deliciosus* L., *Sp. pl.* 2: 1172 (1753)

*Galorrhoeus deliciosus* (L.) P. Kumm., *Führ. Pilzk.* (Zerbst): 126 (1871)

*Lactifluus deliciosus* (L.) Kuntze, *Revis. gen. pl.* (Leipzig) 2: 856 (1891)

**Pileus:** 1.8-2.8 cm wide, depressed convex in young specimens and infundibuliform at later stages, grenadine pink colour (7.R-O.D), margins inrolled when young; **Gills:** grenadine pink in colour, arcuate, unequal, sub-distant, became greenish later; **Stipe:** 2.0-2.5 cm long and 0.5-1.1 cm wide, equal, smooth, concolorous, solid, geniculate; **Odour:** mushroomy, agreeable; **Basidiospores:** 8.0-11.2 x 7.2-8.0  $\mu\text{m}$ ,  $a_vL=9.6$ ,  $a_vW=7.6$ ,  $Q=1.1-1.4$ , globose to sub-globose, thick walled, forms partial reticulate pattern, uni- to multiguttulated; **Basidia:** 48.0-55.2 x 10.4-13.6  $\mu\text{m}$ , hyaline,



guttulated; **Sterigmata:** 4 in number, 4.8-9.6  $\mu\text{m}$  long, some sterigmata contained guttations; **Pileus hyphae:** 10.0-18.0  $\mu\text{m}$  wide and inflated upto 44.0  $\mu\text{m}$ ; **Stipe hyphae:** upto 24.0  $\mu\text{m}$ , septate, branched, hyaline, clamp connections absent.

**Collection examined:** Jammu and Kashmir, Poonch, Krishna Ghati and Kanuyian, gregarious in *Pinus roxburghii* forests, fasciculate, humicolous, Harpreet Kour and Y.P. Sharma, HBJU 236, September 2012.

**Distribution:** It has earlier been reported from Sikkim (Butler and Bisby, 1931) Himachal Pradesh, Uttar Pradesh (Saini and Atri, 1982).

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