



INTERNATIONAL JOURNAL OF PHARMACY & LIFE SCIENCES  
(Int. J. of Pharm. Life Sci.)

**Diversity of Some Wild Mushroom from Gorakhpur, Uttar Pradesh, India**

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**Abstract**

Species composition and diversity of mushroom were examined from different areas of Gorakhpur district. The fruiting bodies of mushrooms were collected between 2011-13 during different seasons. As a result of extensive field survey and microscopic studies in laboratory 12 taxa belonging to 8 families were identified. Frequency and distribution of collected samples were also calculated from data observed.

Key-Words: Mushroom diversity, Gorakhpur, Taxonomy

**Introduction**

Indian is sanctified with diverse agro climatic zones that harbour a wealth of macrofungal diversity. In India macrofungi are very diverse in nature but they are not explored completely till now (Thiribhuvanamala *et al.* 2011). The number of fungi recorded in India exceeds 27,000 (Manoharachary *et al.* 2005) species. Reproductive growth of mushroom occurs when the fruit bodies are formed. The appearance of fruiting bodies or mushroom varies according to the species, but in general they have a vertical stalk (stipe) and a head (pileus or cap). The underside of the cap has gills or pores from which mushroom spores are produced.

Mushrooms are of great economic importance to man; their occurrence is dated back to the time of the early man (Adenle, 1985). Mushrooms generally possess most of the attributes of nutritious food as they contain many essential nutrients in good quantity (Fukushima *et al.*, 2000). Medicinal mushrooms have become even more widely used as traditional medicinal ingredients for the treatment of various diseases and related health problems largely due to the increased ability to produce the mushrooms by artificial methods (Wasser and Weis, 1999). Many new species of macrofungi had been recently discovered from India like *Amanita avellaneosquamosa* from Uttaranchal by Semwal *et al.* (2006), *Entoloma viz- E.incanum* (Fr.) Hesler, *E.vulsum* Horak, *E.vernum* (Fr.) Lundell and *E. Niphoides* (Romagn) P.D.Orton by Upadhyay *et al.* (2002) from Himachal Pradesh, *Sinotermitomyces zang* by Atri and Kaur (2003) from Punjab.

Eastern part of Uttar Pradesh is endowed with a rich biodiversity of flora and fauna. It is situated in Terai region of Himalaya and hence provides suitable climatic and environmental condition for successful establishment of all types of flora especially the macrofungi. Gorakhpur is situated in Eastern part of state of Uttar Pradesh in India near the border with Nepal. It has area of 3483.8 square kilometers with latitude of 26° 13' N and 27° 29' N and longitude of 83° 05'E and 83 ° 56' E. Average annual temperature of Gorakhpur is 26° C and summer temperature varies from 30°-40° C and winter temperature 2°-18°C . Annual rainfall is 1393.1 mm and 87% of rainfall is recorded during period of June to September. Soil is simple Ordinary River borne alluvial which is not old. Mineral products few and unimportant and consist of kankar, brick and saltpeter.

**Material and Methods**

Macrofungi was collected periodically from Gorakhpur district between 2011 and 2013. Macroscopic and ecological characteristics of the samples were recorded and photographed in their natural habitats. Samples were brought to laboratory for further studies. Spore prints were prepared and microscopic studies were done in laboratory. Specimens were identified using the related literatures (Sibounnavong *et al.*, 2008, Pushpa and Purushathama, 2012, Thaug, 2007, Hattori, 2005, Tibuhwa *et al.*, 2011, Akata *et al.*, 2010, Demirel *et al.*, 2010, Doğan *et al.*, 2011, Chandulal *et al.*, 2013) and were wet preserved in 4% formaldehyde solution. The specimens were deposited at the herbarium of Botany department, DDU Gorakhpur University.

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**Data Analysis**

Frequency Study: Six sites of Gorakhpur district were selected for survey (Gogoi and Sarma 2012).

$$\text{Frequency of fungal species (\%)} = \frac{\text{No. of sites in which the sp. is present}}{\text{Total no. of sites}} \times 100$$

Density study: Density of the different species are evaluated by the following formula (Gogoi and Sarma 2012).

$$D = \frac{\text{Total no. of individual of a particular species}}{\text{Total no. of sites}}$$

**Results and Discussion**

12 macrofungi taxa belonging to eight families were identified. The species name, family, edibility and

host/substratum are given in Table 1. For each taxa, habitat, locality, collection date, macroscopic and microscopic studies were also given.

**Table 1: Species, family substratum frequency and density of collected samples**

S.No.	Species	Family	Host/ Substratum	Edibility	Frequency of occurrence (%)	Density
1	<i>Cantharellus minor</i>	Cantharellaceae	Under Bamboo	edible	33.33	0.83
2	<i>Clitocybe inversa</i>	Tricholomataceae	Litter	inedible	83.34	1.16
3	<i>Coprinopsis atramentarius</i>	Psathyrellaceae	Rotting stump	edible	66.67	3.33
4	<i>Coprinus disseminates</i>	Agaricaceae	Decaying wood log	edible	33.37	7.50
5	<i>Geastrum rufescens</i>	Geastraceae	soil	inedible	16.67	0.50
6	<i>Laetiporus sulphureus</i>	Polyporaceae	Cut wood log	edible	33.33	2.00
7	<i>Lepiota castaneidisca</i>	Agaricaceae	litter	inedible	58.00	0.66
8	<i>Lepiota ignivolvata</i>	Agaricaceae	litter	inedible	16.67	5.83
9	<i>Leucoagaricus rubrotinctus</i>	Agaricaceae	Under bamboo	inedible	66.67	2.00
10	<i>Schizophyllum commune</i>	Schizophyllaceae	<i>Mangifera indica</i>	inedible	83.33	6.66
11	<i>Trametes gibbosa</i>	Polyporaceae	Decaying wood log	inedible	33.33	1.33
12	<i>Trametes versicolor</i>	Polyporaceae	Decaying wood log	inedible	66.67	7.00

**Morphology of Collected samples**

***Cantharellus minor* PK.**

Family- Cantharellaceae

Common Name- Small Chanterelle

Description- Cap 2.5-3cm, convex becoming infundibuliform margin incurved, wavy, yellowish, waxy, lustrous. Stipe 3X0.5cm, yellowish, smooth, slender, tapering slightly at base, flesh yellow and firm. Gills absent, false gills present run down the stipe, yellow in colouration. Spore 5-7X4-5µm, smooth, ellipsoid, inamyloid, spore print yellow.

Edibility- Inedible

Habitat- Growing solitary or in groups under bamboo

Date of collection- 19/08/2011

***Clitocybe inversa* (Scop.) Qué!**

Family- Tricholomataceae

Common Name- None

Description- Cap 2-4cm, convex, expanding to plane, disc depressed in centre, margin slightly incurved, surface smooth, orange brown in colour, margin lighter colour, flesh thin. Stipe 3-4X0.5cm, thick, stuffed, equal, surface moist, apex lined with gill edges, orange brown, mycelia at base. Spore 4-5X2-3µm, spherical, nonamyloid, spore print yellowish light.

Edibility- Inedible

Habitat- Saprobic on litter, solitary or in groups

Date of collection- 18/08/2011

***Coprinopsis atramentarius* (Bull.:Fr.) Redhead,**

Vilgalys & Moncalvo

Family- Psathyrellaceae

Common Name- Inky cap

Description- Cap 2-2.5cm long X variable diameter, greyish white in colour, more darker at centre, bell shaped, conical, often split from margin, delicate, fragile, smooth, autodigestible. Stipe 4-7X 0.5cm, white, often curved, fragile and hollow, flesh white. Gills free crowded, black in colour, spore 7-8X5-5µm, smooth, ellipsoid, dark brown, spore print black.

Edibility- Edible but precaution with alcohol

Habitat- Saprobic from rotting tree stump in group.

Date of collection- 26/09/2011

***Coprinus disseminates* (Pers.:Fries) J.E. Lange**

Family- Agaricaceae

Common Name- Fairy Ink cap

Description- Cap 0.5-1cm, clay brown with dark colour tinge at center, ovoid, margin incurved, flesh thin, fragile, delicate. Stipe 1-2X0.1-0.2cm, hollow, delicate, fragile, white, minutely downy, ring absent. Gills white when young, at maturity changes to black, adnate, crowded, spore 6-10X4-5µm, spore print black.

Edibility- Edible but worthless

Habitat- Saprobic on rotting tree branch, in group.

Date of collection- 23/09/2011

***Geastrum rufescens* Pers.**

Family- Geastraceae

Common Name- Rosy Earthstar

Description- Bulb 2cm, fully expanded 3-5cm, creamy to greyish, coarsely scaly, bulb shaped, sessile, thick, brittle, outer peridium splitting at maturity in to 5-8 pointed starfish like rays which reflect back to reveal the cream inner flesh layer. Inner peridium (spore sac), sub spherical, thin and papery, sessile, opening by a slight elevated apical pore. Gleba (Spore mass) at first pallid and firm becoming brown. Spore 2-3µm, solitary and warty. Spore print brown.

Edibility- Inedible

Habitat- Solitary or in small groups of 2-3 on soil among leaf litters.

Date of collection- 24/08/2011

***Laetiporus sulphureus* (Bull.) Murrill**

Family- Polyporaceae

Common Name- Chicken of wood

Description- Fruiting body 7-10cm, consist of several individuals cap arranged in shelves forming rosette structure, fan shaped to semicircular, smooth, wrinkled, yellow in colour, irregularly wavy, sessile. Pores 1-3mm yellow, circular to ovoid. Spores 4-5X2-3µm, hyaline, smooth, subspherical with droplets. Spore print white

Edibility- Edible

Habitat- Saprobic on cut wood log forming shelves.

Date of collection- 26/09/2011

***Lepiota ignivolvata* Bousset & Joss.**

Family- Agaricaceae

Common Name- Orange girdled Parasol

Description- Cap 3-8cm, convex then expand and umbonate, flesh white, soft, centre yellowish brown, disrupting into tiny crowded ochraceous cream scales which become more dispersed towards the margin.. Stipe 3-10X0.3-1cm, slightly bulbous with yellow colour on edge of bulb, flesh white, ring present. Gills creamish, free, crowded, spore 9-11X5-6µm, fusiform.

Spore print white

Edibility- Inedible

Habitat- On soil under broad leaf trees.

Date of collection- 23/08/11

***Leucoagaricus rubrotinctus* (Peck) Singer**

Family- Agaricaceae

Common Name- Red tinged Lepiota

Description- Cap 1-2cm, flat with scattered orangish to reddish fibres over white background, centre dark in colour but often splitting in age. Stipe 0.5-1X0.3-0.4cm, more or less equal, dry smooth with tiny fibres,

orangish with white ring on upper stem. Gill free, white, close, spore 5-7X4-5µm, free, white, close, smooth, oval to elliptical, spore print white.

Edibility- Inedible

Habitat- Saprobic in group near bamboo culm.

Date of collection- 29/09/2011

***Schizophyllum commune* Fries**

Family- Schizophyllaceae

Common Name- Split gill

Description- 0.5-1.5X0.6-1.3, small, greyish white, fan shaped brackets, upper surface feathery, white irregularly lobed and wavy, lower surface bears ochraceous pseudogills radiating from the point of basal attachment, split lengthwise and reflexed back on themselves. Spores 6-6.5X1.5-2.5µm hyaline, smooth, narrowly ellipsoid, non amyloid, spore print white

Edibility- Inedible

Habitat- Saprobic on *Mangifera indica* tree in group

Date of collection- 11/08/2011

***Trametes gibbosa* (Pers.) Fr.**

Family- Polyporaceae

Common Name- Lumpy Bracket

Description- Fruiting body 6.5-14.5X4-8.5cm, round to semicircular in shape, margin little wavy, yellowish with concentric rings, hard, little spongy, sessile. Pores 0.1cm, dark, yellowish smooth, abundance, parallel, maze like. Spore 3-5X1.5-2.5µm, ellipsoid, smooth, hyaline, spore print white

Edibility- Inedible

Habitat- Saprobic from decaying wood log, forming rosettes on top of cut stump.

Date of collection- 05/12/2011

***Trametes versicolor* (L.:Fr.) Pil.**

Family- Polyporaceae

Common Name- Turkey tail

Description- Fruiting body 2-8X2-5cm, thick, dorsal surface with variable colour with concentric rings of white, yellow, red and black, at first downy then smooth, sessile, margin irregular, flesh white and tough. Pores 0.1-0.4cm yellowish, angular, thick. Spore 3-5X1-2.5µm smooth, hyaline, cylindrical, spore print white

Edibility- Inedible

Habitat- Saprobic from decaying wood log, forming rosettes on top of cut stump.

Date of collection- 13/09/12

In present study 12 macrofungi belonging to 8 families were identified from Gorakhpur district. Members of Agaricaceae was dominant containing 4 species viz. *Coprinus disseminates*, *Lepiota castaneidisca*, *Lepiota ignivolvata*, *Leucoagaricus rubrotinctus* followed by

Polyporaceae containing 3 species viz. *Laetiporus sulphureus*, *Trametes gibbosa*, *Trametes versicolor* while members of Cantharellaceae, Schizophyllaceae, Geastraceae, Tricholomataceae, Psathyrellaceae contain only one species viz. *Cantharellus minor*, *Clitocybe inversa*, *Coprinopsis atramentarius*, *Geastrum rufescens*, *Schizophyllum commune*. Great variation in climatic condition of Gorakhpur made it possible for the abundance and variability of macrofungi. Macrofungi play important role in nature, they have as nutrient source, medicinal importance and most important help in biodegradation and recycling of matter. Four fungal species viz., *Cantharellus minor*, *Coprinopsis atramentarius*, *Coprinus disseminates*, *Laetiporus sulphureus* were found edible and were used for medicinal and culinary purposes by tribals living near forest regions of the Gorakhpur. Thus present work reveals few uncommon but edible fungi found native to the region of survey; further work viz., other bioprospects of macrofungal species and attempts of its commercial cultivation needs to be worked out.

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**How to cite this article**

Vishwakarma P., Singh P, Mishra P and Tripathi N. N. (2014). Diversity of Some Wild Mushroom from Gorakhpur, Uttar Pradesh, India . *Int. J. Pharm. Life Sci.*, 5(7):3643-3647.

Source of Support: Nil; Conflict of Interest: None declared

**Received: 26.06.14; Revised: 03.07.14; Accepted:08.07.14**