SOME POTENTIAL WILD EDIBLE MACROFUNGI OF JAMMU PROVINCE (JAMMU AND KASHMIR), INDIA

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Abstract: Seven species of edible macrofungi namely *Cantharellus cibarius, Coprinus comatus, Geopora arenicola, Ramaria formosa, Ramaria flavo-brunnescens, Sparassis crispa* and *Termitomyces striatus* belonging to Ascomycetes and Basidiomycetes have been illustrated and are being described for the first time from Jammu Province of Jammu and Kashmir state. Their habitat description, taxonomic features, edibility and economic status and ethnomycological details have been incorporated in the present communication. Out of these seven species, *Termitomyces striatus* is new report from Jammu and Kashmir state, whereas remaining six species constitute the first authentic report from the Jammu Province.

INTRODUCTION

Jammu and Kashmir state, is stretched between 32°17'-37°03' N latitude and 72°03'-80°20' E longitude, with an average annual rainfall between 60-80 cm. It is bordered to the North and East by the main Himalayan ranges and Punjab plains to the South. The State exhibits varied climatic and topographic conditions and provide congenial environment for the luxurious growth of diverse group of plants. However, information on the species of macrofungi from this state is limited. In this backdrop, a systematic study of mushroom diversity from Jammu province of Jammu and Kashmir was undertaken. During the course of intensive field research over the last three years in the forests of some regions of Jammu province, the authors collected a number of wild macrofungi belonging to Ascomycetes and Basidiomycetes. In this communication, general distribution (locality and habitat), brief morphological description, macro and microscopic details, edibility and economic status of some interesting macrofungi have been presented.

MATERIALS AND METHODS

The collected specimens have been described and illustrated based on the field study of the fresh specimens. Collection was mainly concentrated in the dense coniferous and mixed forest of *Cedrus deodara* (Roxb.) G. Don, *Pinus wallichiana* A.B.Jackson, *Picea smithiana* (Wallich.) Boiss. *Abies pindrow* Royle, *Quercus* sp. L., *Juglans regia* L., *Alnus nepalensis* D.Don, *Ulmus wallichiana* Planch. etc. For the collection of these fungi, standard methods of collection, preservation, macro and microscopic studies were followed (Atri *et al.*, 2003; Kumar *et al.*, 1990; Major 1974; Smith *et al.*, 1981) and the shape, size, and colour of fresh specimens were recorded before preservation. Colour terms and notations are from Ridgeway (1912). All the measurements were taken and illustrations were made with the aid of Camera Lucida (Erma, Japan) and field photography was done using digital camera (Sony DSC-P92). Reagents used during microscopic analysis were KOH 3%, Lactophenol, Cotton Blue, 1% Phloxine, 1% Congo Red and Melzer's Reagent. Crystals of 1,4-dichlorobenzene were used against insect infestation. The examined specimens have been deposited in the herbarium of Botany Department, University of Jammu, Jammu with accession numbers.

RESULTS AND DISCUSSION

1. *Cantharellus cibarius* Fr.

Collection examined: Humicolous, gregarious to caespitose, coniferous forests of *Pinus wallichiana* and *Cedrus deodara*, Sungli area, Bhadarwah, Jammu and Kashmir, JUH 9651, Sanjeev Kumar and Y.P.Sharma, 30-07-2005 (Figs. 1a & 2a-d).

Pileus 4.0 - 6.5 cm in diameter, depressed in the centre, irregular in shape, margins involuted, surface

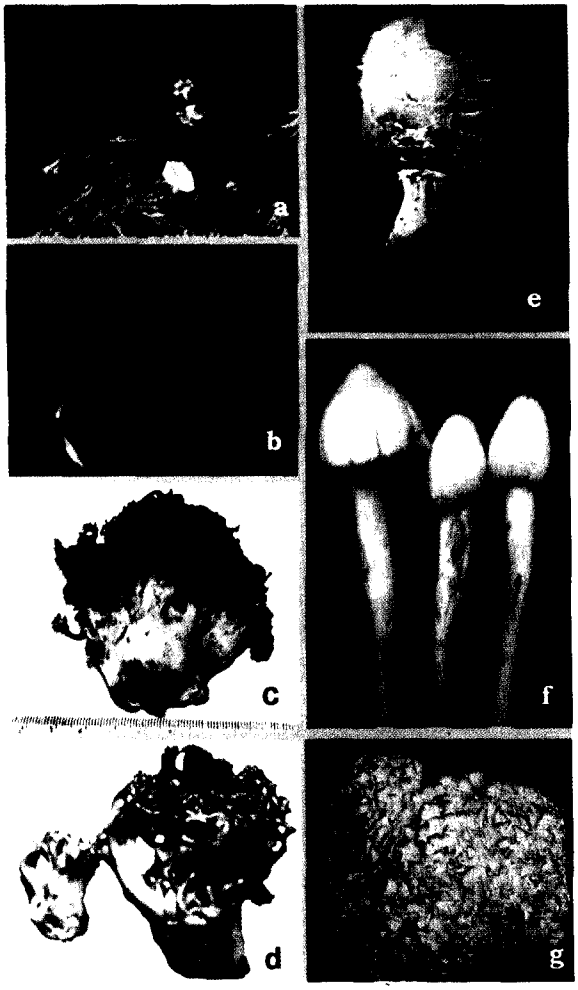

Fig. 1: a. *Cantharellus cibarius* in natural habitat **b.** Developmental stages of *Geopora arenicola*, **c.** Fruiting body of *Ramaria flavo-brunnescens*, **d.** Fruiting body of *Ramaria formosa*, **e.** Carpophore of *Coprinus comatus*, **f.** Developmental stages of *Termitomyces striatus*, **g.** Carpophore of *Sparassis crispa*.

moist, smooth, yellowish (Canary yellow); stipe- 3.0 -8.0 cm long and 0.8 -1.5 cm in diameter, central, somewhat glabrous, tapering towards the base, solid, concolourous with pileus; gills- decurrent, unequal, distant, not in series, concolourous; flesh- pale yellow, thick; odour mild; basidia- 3.6-14.4 µm x 4.0 - 5.6 µm, clavate with 2-4 sterigmata; basidiospores- 4.8 - 9.6 µm x 4.0 - 6.4 µm, ellipsoidal, apiculate, smooth, non-amyloid, globular oil content present; pieleipellis- 3.2- 8.0 µm, wide, branched, hyaline, septate, clamp connection present; stipitipellis - 6.4 -12.8 µm, wide, branched, septate.

Edibility: Cantharellus cibarius is locally known as Haildii Chaltii (Bhadarwahi) in Bhadarwah. Although its edibility has been reported from other parts of India but its edibility status in the study area is doubtful.

Distribution: Earlier this fungus was reported on ground under *Pinus longifolia* from Mussoorie, Uttarakhand (Hennings, 1901; Lloyd, 1904-1919; Butler and Bisby, 1931) on soil from Shillong, Assam (Ghosh *et al.*, 1974); on soil with dead organic matter from Solan, H.P. (Sohi *et al.*, 1965a); on soil from Gulmarg, Kashmir J&K (Abraham *et al.*, 1980).

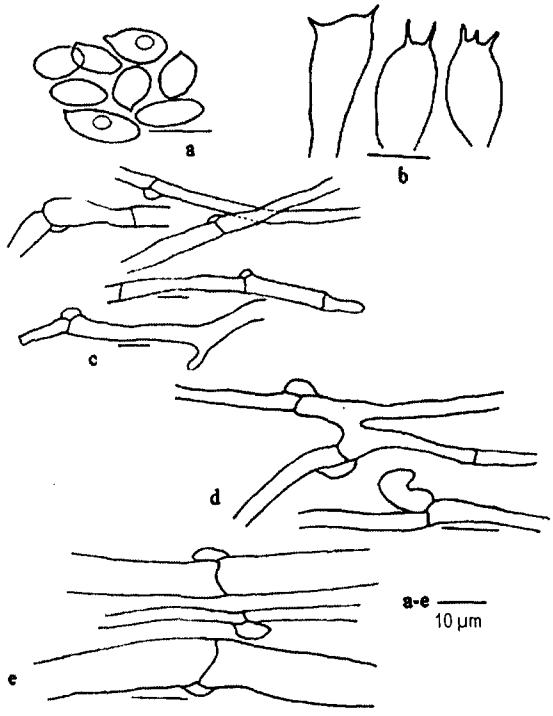

Fig. 2: *Cantharellus cibarius:* **a.** Basidiospores, **b.** Basidia, **c.** Pileus context, **d.** Pileus cuticle, **e.** Stipe context.

2. *Coprinus comatus* (Mull.ex Fr.) S.F.Gray

Collection examined: Humicolous, scattered, mixed orchards of *Pyrus malus* and *Juglans regia*, Bera bhata, Kishtwar, Jammu and Kashmir, JUH 9661, Sanjeev Kumar and Y.P.Sharma, 28-08-2006 (Figs. 1e and 3a-f).

Pileus 3.5- 9.0 x 2.5 - 4.5 cm, conical, ivory white when young , becoming blackish brown to black from margin because of autodigestion, shaggy scales

present; margins striate; gills- free, crowded densely, whitish or ivory white, finally black, easily separable from flesh with entire margin; stipe- 6.0-8.0 cm long and 0.7 - 1.8 cm in diameter, central, cylindrical, white, smooth, minutely cracked with age, hollow, fleshy; annulus- present, central, double; spore print- black; basidia- 16.0 -32.0 µm x 4.8 - 11.2 µm , clavate, hyaline, bearing four sterigmata; basidiospores- 6.4 - 12.8 µm x 4.8 - 6.4 µm , ellipsoid, blackish in water, brownish black in 2% KOH, dark brown in congo-red; pileus hyphae: 4.8 - 6.4 µm wide; stipe hyphae: 6.4 - 16.0 µm wide.

Edibility: *Coprinus comatus* is edible, locally known as 'Chaitar' Kishtwari in Kishtwar, due to its quick perishable nature and not seen to be sold in the market, consumed only by the house holds.

Distribution: Earlier this fungus was reported on grassy earth from Darjeeling, W.B. and Bombay (Berkeley 1856); on lawns in gardens from Calcutta, W.B. (Banerjee, 1947); on dung from Delhi (Saxena *et al.*, 1969); on soil from Lucknow, U.P. (Gosh *et al.*, 1974). On comparing taxonomic details, the above examined specimen is close to the description given by (Abraham *et al.*, 1984 ; Purkayastha and Chandra, 1976) except some minor differences.

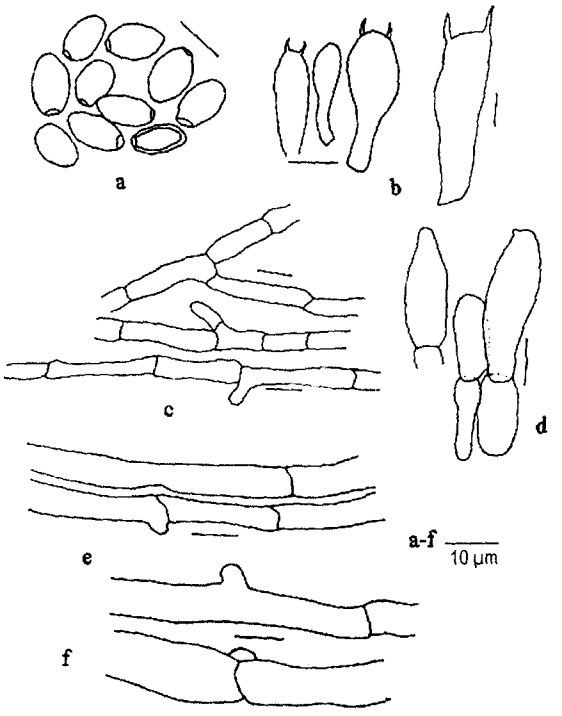

Fig. 3: *Coprinus comatus:* **a.** Basidiospore, **b.** Basidia, **c.** Context hyphae, **d.** Caulocystidia, **e.** Pileus hyphae, **f.** Stipe hyphae.

3. *Geopora arenicola* (Lev.) Kers.

Collection examined: Humicolous, gregarious to caespitose, coniferous forests of *Pinus wallichiana* and *Cedrus deodara*, Sungli and Kansar area, Bhadarwah, Kishtwar, Jammu and Kashmir, JUH 9625, Sanjeev Kumar and Y.P.Sharma, 30-03-2005 & 30-03-2006 (Figs. 1b and 4a-d).

Apothecia 1-4 cm in diameter, sessile, near about 3 cm deep inside soil. External surface dark brown to light brown, minutely roughned, flexuous hairs present which bind the apothecium to the substratum so that the whole exterior of it is encrusted with soil. The inner surface creamish to pure white; asci- 216 – 308 µm long, 12 – 14 µm wide at top, 10 -18 µm wide at middle and 10 -12 µm wide at the base, cylindrical, apex rounded, narrow below; ascospores- 16 - 30 µm x 8 - 12.8 µm, ellipsoid with narrow ends, hyaline, smooth; eight in each ascus,

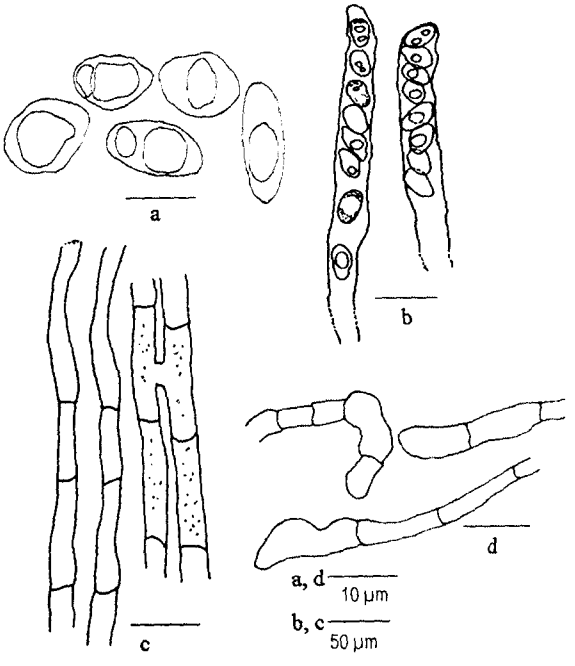

Fig. 4: *Geopora arenicola*: **a.** Ascospores, **b.** Asci, **c.** Paraphysis, **d.** Pubescent hairs.

uniseriate and oblique; paraphysis- 84.8-131.2 µm x 3.2 -4.8 µm, septate; pubescent hairs- 32 – 73 µm x 8.0 -12.8 µm, septate, branched.

Edibility: *Geopora arenicola* is locally called as Kundii (Bhadarwahi) in Bhadarwah, Gav Padur or Khuduz (Kashmiri) in Kashmir and is widely consumed by the local population. It is also sold in the market @ Rs.50/ per/kg.

Distribution: This fungus was earlier reported on sandy soil from Nichar, H.P. (Thind and Seth, 1957) and from Kashmir (Abraham, 1991).

4. *Ramaria formosa* (Pers.) Quel.

Collection examined: Humicolous, scattered, coniferous forests of *Pinus wallichiana* and *Cedrus deodara*, Sungli, Dugga nallah, Bhadarwah, Jammu and Kashmir, JUH 9653, Sanjeev Kumar and Y.P.Sharma, 30-07-2005 & 30-03-2006 (Figs. 1d and 5a-d).

Fruting body- 4.5 - 10.0 cm x 3-6 cm, erect; trunk conspicuously present 1.8-3.0 cm wide, profusely branched, smooth, creamish at the base; branches polychotomous below and dichotomous above, unequal; primary branches- 0.5-1.8 cm wide, yellowish; Flesh: white; taste bitter; odour distinct; basidia- 17.2 - 32.0 µm x 6.4-9.6 µm, clavate, 2-4 spored, sterigmata upto 6.5 µm long; basidiospores- 8.0 -14.4 µm x 3.2-6.4 µm smooth to slightly rough, ellipsoidal to cylindrical, papillate, upto 1.6 µmlong papilla, multiguttulate; hyphae- 3.2 - 9.6 µm wide, septate, branched, slightly clamped, swollen at the top forming sac like structure upto 14.4 µm wide.

Edibility: *Ramaria formosa* is edible and people inhabiting the study area name it as Shairee (Bhadarwahi) in Bhadarwah and sold in the market @ Rs. 40-50 per/kg.

Distribution: It was earlier reported from Khasi hills, Assam, (Butler and Bisby 1960). On compairing taxonomic details, the above examined specimens is more close to the description given by Purkayastha and Chandra (1976) except some minor differences and length of Basidia.

5. *Ramaria flavo-brunnescens* (G.F. Atk.) Corner.

Collection examined: Humicolous, scattered, Forest of *Pinus wallichiana*, *Abies pindrow*, *Picea smithiana* and *Quercus* sp., Seoz Dhar, Bhadarwah, Jammu and Kashmir, JUH 9641, Sanjeev Kumar and Y.P.Sharma, 20-07-2006 (Figs. 1c and 6a-c).

Frutingbody- 10.0 x 12.0 cm, erect, highly branched, fleshy, smooth, yellowish; trunk present upto 5.0 cm wide, much thickened, profusely branched, smooth, creamish at the base; branches

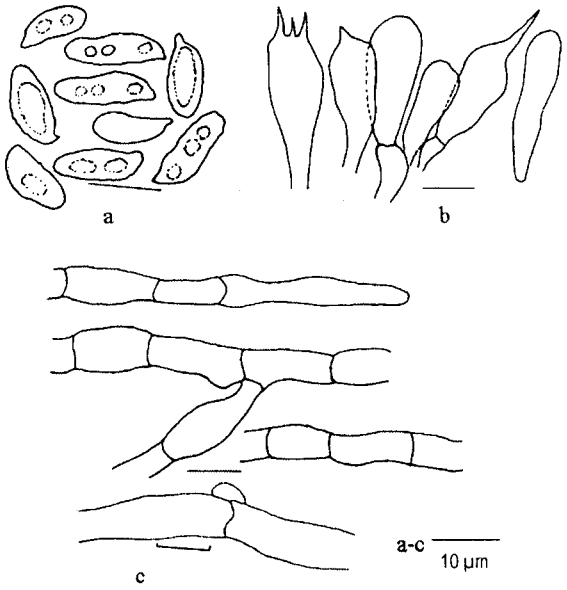

Fig. 5: *Ramaria formosa*: **a.** Basidiospores, **b.** Basidia, **c.** Hyphae.

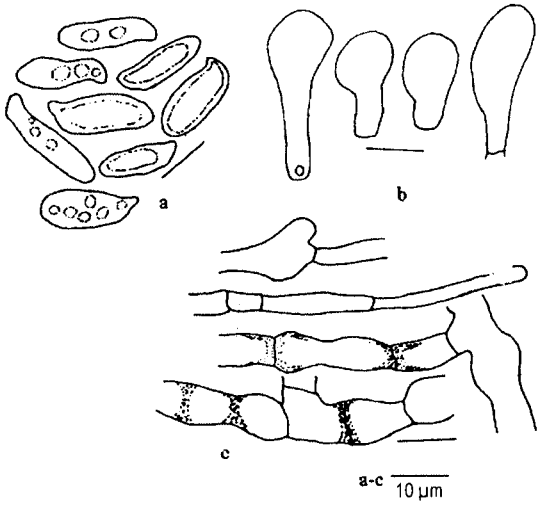

Fig. 6: *Ramaria flavo-brunnescens*: **a.** Basidiospores, **b.** Basidia, **c.** Hyphae.

polychotomous below and dichotomous above, unequal; primary branches: 0.5-1.8 cm wide, yellowish; flesh- white; taste- bitter; distinct- odour; basidiospore- 6.4 - 19.2 µm x 4.0-7.2 µm, smooth, ellipsoidal to cylindrical, papillate upto 2.4 µm long, uni - multiguttulate; hyphae- 2.4 - 8.0 µm wide, septate, hyaline, branched, clamped.

Edibility: It is edible and locally called as 'Shairee' (Bhaderwahi) in Bhadarwah. It is also sold in the market @ Rs.30/ per/kg.

Distribution: It has been reported earlier by (Thind and Sukhdev 1957) from Oak forests in Mussoorie (Uttarakhand).

6. ***Sparassis crispa*** (Wulfen) Fr.

Collection examined: Humicolous, scattered, coniferous forests of *Cedrus deodara* and *Picea smithiana*, Seoz Dhar, Bhadarwah, Jammu and Kashmir, JUH 9647, Sanjeev Kumar and Y.P.Sharma, 20-07-2006 (Figs. 1g and 7a-c).

Basidiocarp- 12 - 25 cm wide and 9.0 - 14.0 cm high large, rounded, cauliflower like, composed of several broad flattened crimped like branches usually wavy, dull white to pale yellow, small to large; branches: fleshy- 2.3 - 4.0 cm wide, irregularly lobed; basidia-15 - 36 µm x 5.0 - 8.0 µm, clavate, bearing four sterigmata upto 3.0 µm long; basidiospores - 3.2-5.6 µm x 3.2-4.0 µm, ellipsoid to subglobose, hyaline, mono-guttulate; hyphae-monomitic, 4.0-9.6 µm, hyaline loosely arranged, irregularly swollen and inflated with swollen portion upto 9.0 µm.

Edibility: It is locally known as 'Bedth Shairee' (Bhadarwahi) in Bhadarwah and is sold in the market @Rs. 50-60 per/kg.

7. ***Termitomyces striatus*** (Beeli) Heim.

Collection examined: Humicolous, scattered, on ground, Botanical Garden, University of Jammu, Jammu and Kashmir, JUH 9660, Sanjeev Kumar and Y.P.Sharma, 20-08-2006 (Figs. 1f and 8a-g).

Pileus- 2.5 - 6.0 cm in diameter, convex than plane, whitish, surface smooth, papilllate, papilla not sharply pointed, margins incurved when young, slightly uplifted when mature; gills- free, equal, crowded, concolourous, edge smooth; stipe- 18.0 – 25.5 cm long, 1.7 cm wide at top and 0.5 cm at the base, central, cylindrical, slightly swollen in the middle, with pseudorhiza (9.0-23.0 cm), solid, fleshy

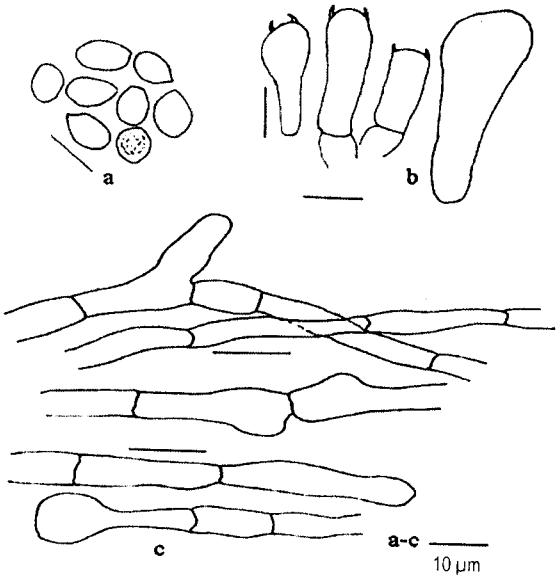

Fig. 7: *Sparassis crispa*: **a**. Basidiospore, **b**. Basidia, **c**. Hyphae.

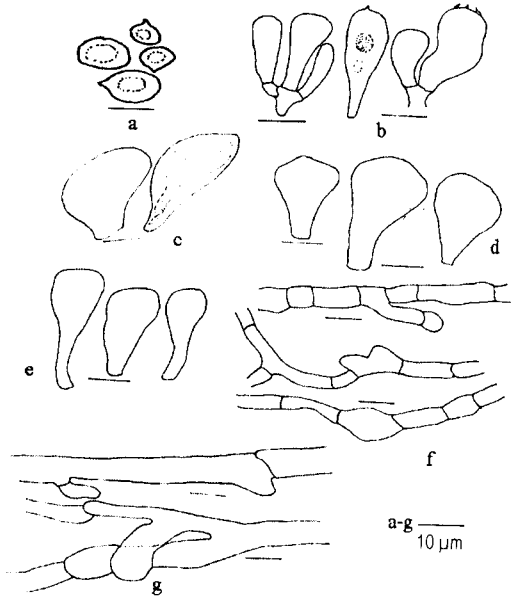

Fig. 8: *Termitomyces striatus*: **a**. Basidiospore, **b**. Basidia, **c**. Pileocystidia, **d**. Cheilocystidia, **e**. Pleurocystidia, **f**. Pileus hyphae, **g**. Stipe hyphae.

fibrillose, whitish to creamish; annulus- present, single, superior, persistant, concolourous; flesh-white; odour- fruity; basidia- 12.8 – 28.8 µm (30.4) x 4.8 – 8.0 µm (14.4), clavate, bearing four sterigmata upto 2.4 µm long; basidiospores- 4.0 – 6.4 µm x 3.2 - 4.8 µm, ellipsoid, hyaline, inamyloid, thin walled with one guttules; cheilocystidia- 25.6 - 36.8 µm x 12.8-20.8 µm, claviform or capitate hyaline, thin walled; pleurocystidia- 24.0 - 34.2 µm x 7.2- 11.2 µm, clavate; context hyphae- 3.2 – 8.0 µm, with swollen cells upto 19.2 µm, septate, branched; stipe hyphae-4.0 - 11.2 µm wide, septate, slightly clamped, with inflated cells upto 18.8 µm.

Edibility: It is edible and sold in the market @Rs.70 per/kg.

On compairing taxonomic details, the above examined specimens is more close to the description given by Rawla *et al.*, 1984 and Leelavathy *et al.*, 1983 except some minor differences and presence of pleurocystidia, which were not observed by them.

Survey of literature (Jamaluddin *et al.*, 2004) shows that out of these seven species *Termitomyces striatus* is a new addition to the macrofungal flora of Jammu and Kashmir state, whereas remaining six constitute the first authentic report from the study area.

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