

# Two hitherto unreported macro-fungi from Kashmir; Himalaya

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## Abstract

The Jammu and Kashmir state is stretched between 32°17'-37°03'N latitude 72°03',-80°20'E longitude, with an average annual rainfall of 60-80cm. The state exhibits varied climatic and topographic conditions and provide a congenial environment for the luxurious growth of diverse groups of plants and fungi. However, information regarding the macro-fungal inventorization from this state is limited. In this backdrop, a systematic study of mushroom diversity from Western Kashmir Himalaya was undertaken. During the course of field survey from March 2009 to December 2010, two new species *Mutinus caninus* (Huds.) Fr. and *Gyromitra sphaerospora* (Peck) Sacc. were reported from the surveyed area. These species were identified on the basis of macro and microscopic characteristics and are first records from Kashmir Himalaya.

## Introduction

Fungi are most diverse organisms after insects on this biosphere. Fungal kingdom has been estimated to be six times larger than the plant kingdom. Defining the exact number of fungi on the earth has always been a point of discussion and several studies have been focussed on enumerating the world's fungal diversity<sup>7</sup>. Current studies estimate that 1.5 million species of fungi may actually exist on this biosphere<sup>12</sup> of which there may be 140,000 species to be considered as mushrooms, but only 14,000 species are known to man, which would account for 10% of the estimated mushroom species<sup>5</sup>. One third of this fungal diversity of globe exists in India of which only 50% has been characterised till now<sup>19</sup>. Only a fraction of total fungal wealth has been subjected to scientific scrutiny and mycologists continue to unravel the unexplored and hidden wealth, as many macro-fungi are becoming extinct or facing threat of extinction because of habitat destruction and global climate change<sup>24</sup>. The 1991 red list for the former republic of Germany listed 1,037 species of macrofungi (mushrooms) threatened<sup>6</sup>. Jammu and Kashmir, posses a prime place in the variety and galaxy of macro-fungi due to wide agro-climatic variations, diverse physiography and undulating topography, but understanding of the macro-fungal flora of the Kashmir is still in an exploratory or pioneer stage and undoubtedly there are many more species to be recorded<sup>27</sup>. Watling and Gregory<sup>28</sup> recorded 119 taxa of macro-fungi from Kashmir. The list has been extended to 145 species<sup>3</sup> and 250 from whole Jammu and Kashmir<sup>8</sup>. Watling and Abraham<sup>27</sup> reported 53 species of macrofungi from Kashmir showing mycorrhizal property. Four new species viz. *Russula aurea*, *Russula atropurpurea*, *Suillus variegates* and *Boletus rhodoxanthus* has been added to the list<sup>9</sup>. The Kashmir Himalaya still needs exploration for mushroom flora as large area of Kashmir Himalaya is still unexplored for mushroom diversity. With this objective, the present study describes the general distribution, brief morphological description, macro and microscopic details and edibility of two newly reported species of macro-fungi from Kashmir Himalaya.

## Materials and Methods

Field trips were carried to Gulmarg, Doodhpathri, Uri, Yusmarg and Kellar forests representing different places/sites of Western Kashmir Himalaya. These field trips were organised according to the method given by R E Hailing<sup>11</sup>. Standard method of collection, preservation, macro and microscopic studies were followed<sup>142</sup> and the shape, size and colour of fresh specimen were recorded before preservation. The spore prints were taken according to the guidelines given by Michel Kud<sup>15</sup>, then their morphology, such as shape and size of species were recorded with the aid of Olympus BH<sub>2</sub> microscope. Reagents used for preparation of spore slides were 3% KOH, cotton blue, lactophenol and Melzer,s reagent. Photographs were taken using digital Sony 10.1 megapixel Camera. The fungal specimens were also preserved in FAA (Formaldehyde acetic acid) for herbarium purposes, in fungal collection of KASH Herbarium of Plant Taxonomy, Division of Botany Kashmir University.

## Results

During the survey of different places/sites of Western Kashmir Himalaya, two species of macrofungi, *Gyromitra sphaerospora* (Peck) Sacc. and *Mutinus caninus* (Huds.) Fr. were reported. The distribution and description of the fungi is given below:

Name of species	Distribution	Accession No.
<i>Gyromitra sphaerospora</i>	Gulmarg, Doodhpathri, Usmarg and Kellar	SH.KASH-28740
<i>Mutinus caninus</i>		SH KASH-

***Mutinus caninus* (Huds.) Fr.**

**Common name:** Dog Stinkhorn

**Classification**

Kingdom: Fungi

Division: Basidiomycota

Class: Basidiomycetes

Order: Phallales

Family: Phallaceae

Genus: *Mutinus*

Species: *M. caninus*

**Description:**

**Immature Fruiting Body:** It is partially submerged in the ground, appearing like a whitish to pinkish or purplish egg, which is 2-4 cm high, 1-2 cm wide. White mycelial cords (rhizomorphs), are often visible beneath this egg, by which it is attached to ground. The egg has a tough outer skin (peridium), which covers a gelatinous inner layer, which in turn protects the fully formed, but unexpanded fruiting body.

**Mature Fruiting Body:** Spike-like with a saclike volva at the base, 10–12cm high, .5-1.5 cm wide, white to pinkish white below, surrounded by the narrow conical orange-red head covered in dark olive slime which contains the spores and has a very slight sickly smell; Spore: Dark brown, Elliptical with 3.5-5 x 1.5-2  $\mu$  in size.

**Habitat:** Found growing in small groups or singly in coniferous forests, usually close to rotting stumps (saprobic);

**Season:** Summer to late autumn;

**Edibility:** Inedible, although there are reports of the immature 'eggs' being consumed<sup>1</sup>.

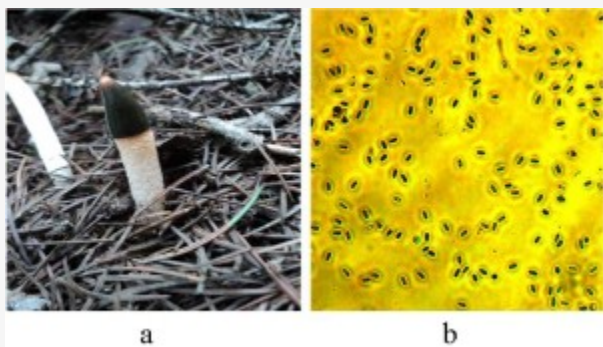


Fig. 1: a- Fruiting body of *Mutinus caninus*, b- spores (400x) of *Mutinus caninus*.

***Gyromitra sphaerospora* (Peck) Sacc.**

**Classification**

Kingdom: Fungi

Division: Ascomycota

Class: Ascomycetes

Order: Pezizales

Family: Discinaceae

Genus: *Gyromitra*

Species: *G. sphaerospora*

## Description:

**Fruiting body:** Fruiting body is differentiated into cap and sulcate stipe; Cap: 3-8 cm, broadly spreading, cushion like or convoluted or puffy in shape, pale brown to blackish brown in color and undersurface paler and ribbed ; Flesh: Thin and fragile; Stem: 3-10 cm, stuffed, longitudinally ribbed, the prominent ribs that begin on the stem continue to the undersurface of the cap, the ribs are white to purplish red.

**Spore:** Round, 8.5-12  $\mu$  diameter, smooth, typically with only one oil drop.

**Habitat:** Usually found singly or in groups in coniferous forests on rotting wood logs or debris as saprobic but there are reports of its mycorrhizal potential<sup>16</sup>.

**Season:** Late spring to early summer.

**Edibility:** May prove fatal when eaten raw but can take after cooking.

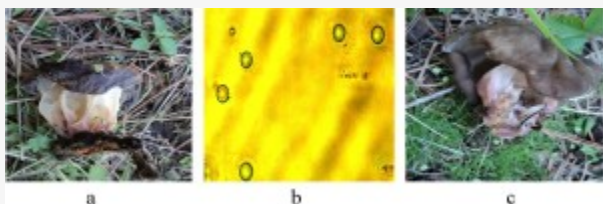


Fig. 2: a,b-Fruiting body of *Gyromitra sphaerospora*, c- Spores (400x) of *Gyromitra sphaerospora*.

## Discussion

The present study clearly indicates two species, *Gyromitra sphaerospora* (Peck) Sacc. and *Mutinus caninus* (Huds.) Fr. as new recorded species from Kashmir Himalayas, but survey of literature<sup>27,13</sup> indicate that they are new additions to the macrofungal flora of India too. The *Mutinus caninus* commonly known as Dog stinkhorn was described initially by William Hudson (1730–1793), a noted British botanist. Its common names in French are Phallus de Chien, Satyre des chiens. The genus name *Mutinus* was a phallic deity, *Mutinus Mutunus*, one of the Roman di indigetes placated by Roman brides<sup>1</sup> and *caninus* means “dog-like” in Latin<sup>22</sup>. It is wide spread in distribution and commonly found in North America Europe and Asia. The species which are very much similar to *Mutinus caninus* include *Mutinus ravenelii* which is pinker in coloration, with a red tip; *Mutinus elegans*, *M. ravenelii*, having short and stocky, with a more pointed apex<sup>21</sup>. European and North American suggest that *Mutinus elegans*, *Mutinus caninus*, and *Mutinus ravenelii* appear to differ somewhat, and some authors<sup>20</sup> suggest that *Mutinus caninus* and *Mutinus ravenelii* are synonyms. Smith et al.,<sup>23</sup> observed that *Mutinus caninus* differs from *Mutinus elegans* in that later takes longer to “hatch” from its “egg”.

In the present survey a false morel, *Gyromitra sphaerospora* was reported during the survey. The false morel, *Gyromitra sphaerospora* is less frequently encountered in distribution than some of their cousins like *Gyromitra esculenta* and *Gyromitra californica* and is most commonly found in North America<sup>17</sup>. Weber<sup>26</sup> described *G. sphaerospora* on the basis of morphology of cap and stem as was described in the present study. In a similar study, Wani et al<sup>25</sup> have reported *Gyromitra esculenta* while exploring morels and pseudomorels from Southern Kashmir Himalayas. The *Pseudorhizina californica* and *Pseudorhizina sphaerospora* are synonyms of *Gyromitra sphaerospora*<sup>17</sup>. The *Gyromitra sphaerospora* although mostly recommended as poisonous but here we come across its edible nature as it is taken in large quantity by tribal's after cooking. The possible reason that supports its edible nature after cooking is detoxification of gyrometrin (principal toxin present in the fungus), which is thermolabile and gets decomposed when subjected to high temperature<sup>184</sup>. The mushrooms produce billions of microscopic spores that are easily dispersed over a distance of thousands of meters by wind which in turn helps them to spread to different corners of the world<sup>10</sup>. This strategy adopted by macrofungi seems to be quite applicable in support of our findings, indicating wind the possible source for dispersal of their spores to the area of our survey.

## Conclusion

It is concluded from the study that during exploration of Western Kashmir Himalaya for mushroom flora, two new species of mushrooms, *Mutinus caninus* (Huds.) Fr. and *Gyromitra sphaerospora* (Peck) Sacc. were reported. The present study represents a potent step in documentation of macrofungal flora of Kashmir Himalaya which has not been explored yet fully for mushroom flora.

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