

# SYSTEMATICS STUDIES ON *GEASTRUM* SPECIES FROM JAMMU PROVINCE

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**Abstract:** During exploration of wild mushrooms from some locations of Jammu province of Jammu and Kashmir state. The present paper deals with six species of *Geastrum* namely *G. campestre*, *G. drummondii*, *G. fimbriatum*, *G. pectinatum*, *G. triplex* and *G. velutinum*. Their habitat description, macro and microscopic features has been described and illustrated in the present communication. Survey of literature reveals that out of these *Geastrum drummondii* have not been earlier reported from the state of Jammu and Kashmir and thus constitutes new record for the state and remaining constitute first authentic report from Jammu province.

**Keywords:** Mushrooms, *Geastrum*, Jammu and Kashmir

## INTRODUCTION

The Gasteromycetes is a large and interesting group of wild mushrooms with much diversity and comprise of commonly known puffballs, earthstars, stinkhorns and bird's nest fungi. Initially, the hymenium is not distinct and is angiocarpic, being formed within a closed basidiome, which either remains closed or open only after the basidiospores are mature. The spore producing tissue, the gleba, is enclosed by a wall or peridium, which may be composed of one or more distinct layers. The consistency of the gleba varies from powdery to pill-like to slimy in different groups. The gleba in some forms includes sterile threads called capillitium threads. The basidiospores in the Gasteromycetes are not forcibly ejected, in contrast to holobasidiomycetes. Gasteromycetes has been divided into five orders: Hymenogastrales, Nidulariales, Phallales, Lycoperdales and Sclerodermatales (Gwynne-Vaughan and Barnes, 1965; Hawker, 1968; Webster, 1970). However, Hawksworth *et al.* (1995) raised the number of orders to 14 spread over 56 families consisting of 1169 species distributed among 164 genera in this group. Therefore, the present communication deals with six species of *Geastrum* belonging to family Geastreaceae of order Lycoperdales. The species includes *G. campestre*, *G. drummondii*, *G. fimbriatum*, *G. pectinatum*, *G. triplex* and *G. velutinum*.

## MATERIALS AND METHODS

Specimens were collected from different locations of Jammu province during collection foray 2009. 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; Smith, *et al.*, 1981; Arora, 1986; Kaul, 1997) the shape, size, and colour of fresh specimens were recorded before preservation. 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). Colour notations were noted as per Ridgway (1912). The examined specimens have been deposited in the Herbarium of Botany Department, University of Jammu, Jammu with accession numbers.

## RESULTS AND DISCUSSION

**1. *Geastrum campestre*** Morgan [as '*Geaster*'], *Am. Nat.* 21: 1027 (1887)

**Collection examined:** Jammu and Kashmir, Bhadarwah, Kalinaag area, humicolous, solitary to scattered, coniferous forests of *Pinus wallichiana* and *Cedrus deodara*, BHJU 065, Sanjeev Kumar and Y.P. Sharma, November, 2009 (Plate I-1 a,b).

**Exoperidium:** splitted into 5 rays, 1.8 cm long and upto 2.0 cm wide at the base, strongly hygroscopic, smooth on exterior; mycelial layer thin to thick, smooth, paler and composed of aseptate, hyaline hyphae of 3.0-5.0  $\mu$ m width; **Fibrillose layer:** 2.4-4.0  $\mu$ m wide, thick, paler, septate, unbranched, clamped; **Fleshy layer:**

3.2-5.6  $\mu\text{m}$  wide, dark brown, septate, clamped, breaking into irregular area by deep grooves; **Endoperidium:** globose, forming spore sac, open by irregularly torn aperture, sessile, depressed, composed of septate hyphae, upto 3.2  $\mu\text{m}$  wide; **Gleba:** dark brown; **Columella:** absent; **Basidiospores:** globose, dark brown, verrucose, 8.0-12.8  $\mu\text{m}$  in diameter; **Capillitium threads:** 4.0-7.2  $\mu\text{m}$  wide, septate, branched, clamped, hyaline.

**Distribution:** Earlier reported from Kashmir (Abraham, 1991).

**Remarks:** A new record from Jammu Province.

**2. *Geastrum drummondii* Berk.** [as 'Geaster'], *J. Bot.*, London 4: 63 (1845)

**Collection examined:** Jammu and Kashmir, Bhadarwah, Kishtwar, scattered, mixed forest of *Quercus* sp. and conifers, BHJU 066, Sanjeev Kumar and Y.P. Sharma, November, 2009/ September 2009 (Plate I-2 a-e).

**Exoperidium:** splitted into 6-7 acute rays, 1.5-2.0 x 0.3-0.6 cm broad at the base; **Mycelial layer:** smooth, pale brown, composed of septate, branched, hyaline hyphae with yellowish tinge, ranges upto 2.4  $\mu\text{m}$  width; **Fibrillose layer:** pale yellow, made up of 2.4-5.6  $\mu\text{m}$  wide, aseptate and un-branched hyphae; **Fleshy layer:** upto 9.6  $\mu\text{m}$  wide, smooth, dark brown, hyaline with yellow shade; **Endoperidium:** forming spore sac, composed of aseptate, unbranched hyaline hyphae of 5.6-6.4  $\mu\text{m}$  width; **Gleba:** dark brown; **Columella:** indistinguishable; **Basidiospores:** globose, 4.0-5.6  $\mu\text{m}$ , echinulate, verrucose, dark brown.

**Remarks:** Recorded for the first time from Jammu and Kashmir.

**3. *Geastrum fimbriatum* Fr.,** *Syst. Mycol.* (Lundae) 3(1): 16 (1829)

**Synonymy:** *Geastrum rufescens* var. *minor* Pers., *Syn. Meth. Fung.* (Göttingen) 1:134(1801) *Geastrum sessile* (Sowerby) Pouzar, *Folia Geobot. Phytotax. Bohemoslov.* 6: 95(1971) **Collection examined:** Jammu and Kashmir, Bhadarwah and Kishtwar, on humus among pine litter, solitary to scattered, coniferous forests of *Pinus wallichiana* and *Cedrus deodara*, BHJU 067, Sanjeev Kumar and Y.P. Sharma, October 2008/ September 2009 (Plate I-3 a-d).

**Exoperidium:** splitted into five to six rays, revolute, broad, saccate, 1.0-2.3 x 1.5-2.0 cm wide at the base; **Mycelial layer:** thin, encrusted with debris, peeling off with age and composed of septate, branched, slightly thick-walled hyphae upto 7.2  $\mu\text{m}$  wide with clamps; **Fibrillose layer:** thin and composed of interwoven, aseptate, unbranched hyphae upto 5.6  $\mu\text{m}$  wide; **Fleshy layer:** cracked, rust colour; **Endoperidium:** globose, forming sac, sessile, depressed, composed of interwoven aseptate, unbranched, hyaline, 5.6-7.2  $\mu\text{m}$  width; **Peristome:** apical, broadly conical, concolorous with endoperidium; **Gleba:** dark brown; **Basidiospores:** globose, 4.0-5.6  $\mu\text{m}$  in diameter, yellowish brown, verrucose; **Capillitium threads:** upto 7.2  $\mu\text{m}$  aseptate, unbranched, encrusted with debris.

**Distribution:** Earlier reported associated with roots of *Pinus wallichiana*, *P. roxburghii*, *Cedrus deodara* and *Abies pindrow* from Dehradun, U.P. (Bakshi, 1974); on ground from Punjab (Cunningham, 1942).

**Remarks:** A new report from Jammu Province.

**4. *Geastrum pectinatum* Pers.,** *Syn. Meth. Fung.* (Göttingen) 1: 132 (1801)

**Synonymy:** *Geastrum tenuipes* Berk. [as 'Geaster'], *London Journal of Botany* 7: 576 (1848)

*Geastrum pectinatum* var. *tenuipes* (Berk.) Cleland & Cheel, (1915)

**Collection examined:** Jammu and Kashmir, Bhadarwah and Kishtwar, on humus, solitary to scattered, coniferous forests of *Pinus wallichiana* and *Cedrus deodara*, BHJU 068, Sanjeev Kumar and Y.P. Sharma, August 2008/ October 2009 (Plate I-4 a-d).

**Exoperidium:** splitted about mid point between middle and base into 7-8 sharply acute non-hygroscopic rays, 1.5-2.5 cm long, pointed, unequal, recurved to spreading, usually bending backward and raising endoperidium to a height of 1.0-2.0 cm from the ground level and breaking all its connections with the mycelium in soil to which rays are attached; **Mycelial layer:** thin-walled, pale brown, composed of interwoven, aseptate, unbranched hyphae upto 5.6  $\mu\text{m}$  wide; **Fibrillose layer:** light brown, thick-walled, septate, inflated upto 10.4  $\mu\text{m}$ ;

**Endoperidium:** forming spore-sac, consisting of interwoven, aseptate, unbranched hyphae upto 5.6  $\mu\text{m}$  wide; concolorous; **Gleba:** powdery, ferruginous; **Columella:** distinct, clavate; **Basidiospores:** globose, 6.4-7.2  $\mu\text{m}$  in diameter, verrucose; **Capillitium threads:** aseptate, 5.6-8.0  $\mu\text{m}$  in diameter, yellowish, unbranched.

**Distribution:** On humicolous soil from Tamil Nadu and Shimla (Thind and Thind, 1982).

**Remarks:** On comparing details, the examined specimens were close to Zoberi (1972). A new report from Jammu Province.

**5. *Geastrum triplex*** Jungh. [as 'Geaster'], *Tijdschr. Nat. Gesch. Physiol.* 7: 287 (1840)

**Synonymy:** *Geastrum tunicatus* var. *michelianus* (W.G. Sm.) Sacc. [as 'Geaster'], *Erb.critt.Ital.*, Ser.1: no.879 (1862)

*Geastrum michelianum* W.G. Sm. [as 'Geaster'], *Gard. Chron.*, London 18: 608 (1873)

**Collection examined:** Jammu and Kashmir, Bhadarwah and Kishtwar, on humus among pine litter, solitary to scattered, coniferous forests of *Pinus wallichiana* and *Cedrus deodara*, BHJU 069, Sanjeev Kumar and Y.P. Sharma, October, 2008/ September 2009 (Plate I-5 a-d).

**Gasterocarp:** sub-globular with pointed beak and cup enclosing base of endoperidium, reddish brown; **Exoperidium:** 2.0-3.5 x 1.0-1.5 cm broad at the base, split beyond middle into 5-6 rays, each ray narrowly acuminate; **Mycelial layer:** papery, smooth consisting of septate, branched, yellowish, hyaline hyphae upto 5.6  $\mu\text{m}$  wide; **Fibrillose layer:** leathery, thin and composed of aseptate, unbranched hyphae upto 6.4  $\mu\text{m}$  wide; **Fleshy layer:** forming colour at the base of endoperidium, rust coloured, composed of texture upto 30.4  $\mu\text{m}$  wide, splitting and cracking with cracked edges tending to curve away from fibrillose layer; **Endoperidium:** forming spore sac, sub-globular, pale brown, consisting of interwoven hyphae, aseptate, unbranched, 3.2-5.6  $\mu\text{m}$  wide;

**Peristome:** broad with fimbriate margin lighter than rest of the endoperidium; **Gleba:** amber coloured, ferruginous; **Basidiospores:** globose, 4.0-5.6  $\mu\text{m}$  in diameter, verrucose, oil drops present; **Capillitium threads:** 3.2-7.2  $\mu\text{m}$  wide, yellowish, unbranched, septate, encrusted with debris.

**Distribution:** on ground from from Western Himalaya, U.P. and H.P. (Ahmad, 1941; Cunningham, 1942).

**Remarks:** A new report from Jammu Province.

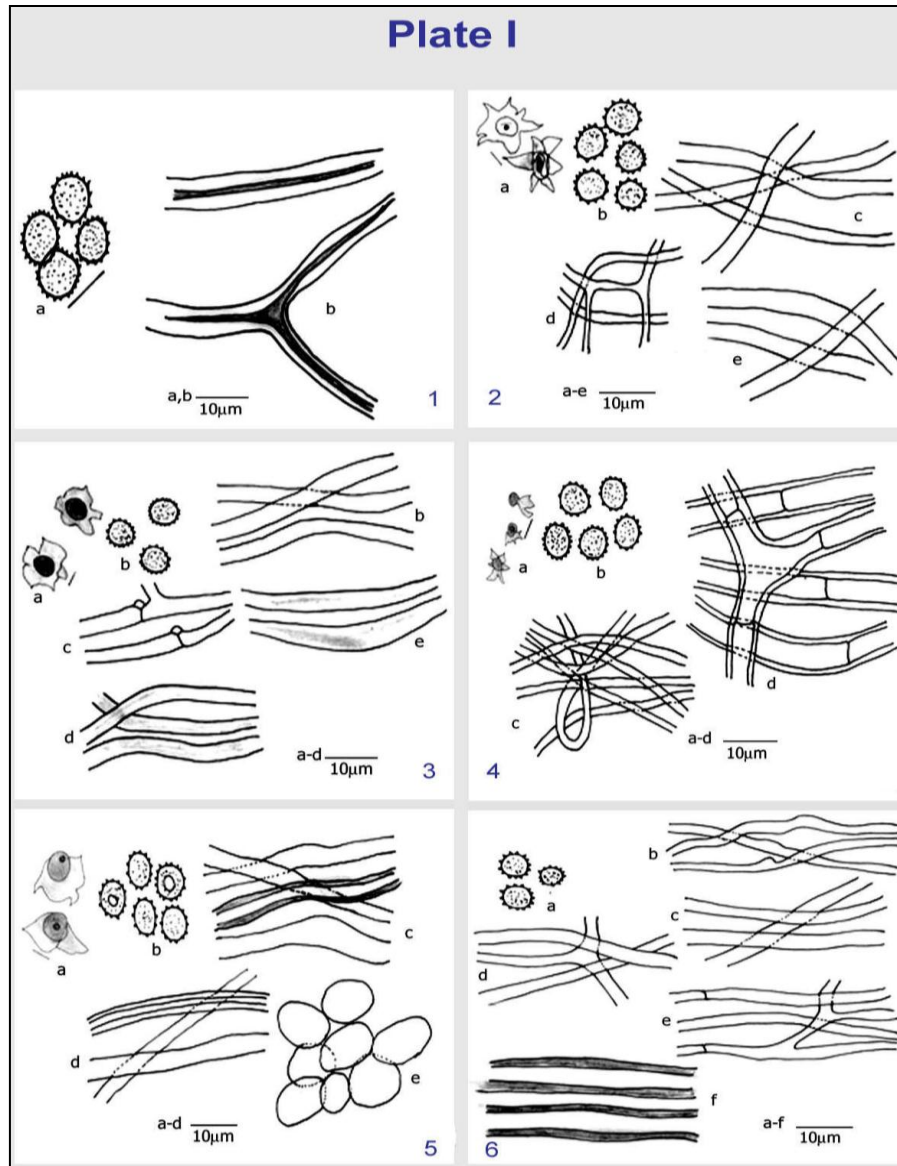
**6. *Geastrum velutinum*** Morgan [as 'Geaster'], *J. Cincinnati. Soc. Nat. Hist.* 18: 38 (1895)

**Collection examined:** Jammu and Kashmir, Bhadarwah, Kishtwar, humicolous, solitary to scattered, coniferous forests of *Pinus wallichiana* and *Cedrus deodara*, BHJU 070, Sanjeev Kumar and Y.P. Sharma, November, 2009, September 2009 (Plate I-6 a-f).

**Exoperidium:** small, 0.7-1.0 x 0.3-0.5 cm at the base, splitted into 5-7 rays; **Mycelial layer:** smooth, encrusted with debris, papery and composed of interwoven, unbranched hyphae and 2.4-3.0  $\mu\text{m}$  wide; **Fibrillose layer:** pale yellow, thick, leathery and composed of hyaline, aseptate, unbranched hyphae of 2.4-3.2  $\mu\text{m}$  width; **Fleshy layer:** cracked and ornamented to exoperidium hence exposing fibrous layer and composed of septate, yellowish, hyaline hyphae measuring 2.5-4.0  $\mu\text{m}$  wide; **Endoperidium:** forming spore sac, globose and composed of septate, branched, hyaline hyphae of 3.2-5.6  $\mu\text{m}$  width; **Peristome:** apical, broadly oval, concolorous with rest of endoperidium; **Gleba:** dark brown; **Columella:** present; **Basidiospores:** globose, 3.2-4.8  $\mu\text{m}$  in diameter, smooth to minutely verrucose; **Capillitium threads:** thick walled, 5.6-7.2  $\mu\text{m}$  wide, encrusted with debris.

**Distribution:** On humicolous soil from Shimla (Thind and Thind, 1982).

**Remarks:** A new report from Jammu Province.



## LEGENDS

### PLATE I:

- 1) *Geastrum campestre*: a) basidiospores b) capillitium threads
- 2) *Geastrum drummondii*: a) habit b) basidiospores c) endoperidial hyphae d) mycelial layer e) fibrillose layer
- 3) *Geastrum fimbriatum*: a) habit b) basidiospores c) endoperidial hyphae d) mycelial layer e) capillitium threads f) fibrillose layer
- 4) *Geastrum pectinatum*: a) habit b) basidiospores c) mycelial layer **d) fibrillose layer**
- 5) *Geastrum triplex*: a) habit b) basidiospores c) fibrillose layer d) mycelial layer e) fleshy layer

- 6) *Geastrum velutinum*: a) basidiospores b) mycelial layer c) fibrillose layer d) endoperidial hyphae e) fleshy layer f) capillitium threads.

## ACKNOWLEDGEMENTS

Authors wish to thank Dr. T.N. Kaul (Former Director, R.R.L. Jammu, J&K) and Prof. T.N. Lakhanpal (Department of Biosciences, H.P. University, Shimla) for their priceless suggestions regarding these natural resources.

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