



Full Length Article

Gasteroid Mycota of District Mansehra, Khyber Pakhtunkhwa, Pakistan

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Abstract

During the exploration of basidiomycetes of Pakistan, twenty gasteroid fungi were collected and identified from district Mansehra, Pakistan. Out of these, nine specimens represented different taxa; two belong to genera *Gaeastrum* and *Lycoperdon*, one each species belonged to genera *Astraeus*, *Bovista*, *Phallus*, *Pisolithus*, and *Scleroderma*. These gasteroid taxa have been identified, described and discussed. Among these, *Phallus hadriani* is a second report for Pakistan, and four gasteroid taxa are new records for District Mansehra. © 2014 Friends Science Publishers

Keywords: Basidiomycota; Diversity; Gasteromycetes; Taxonomy

Introduction

District Mansehra is located in Hazara civil division of the Khyber Pakhtunkhwa Province, Pakistan. It is situated between 34°-14' and 35°-11' north latitudes and 72°-49' and 74°-08' east longitude. It consists of Mansehra, Balakot and Oghi tehsils. The district spread over an area of 5959 km² (Shah and Khan, 2006) and has been blessed with high mountains, lakes, beautiful valleys, plains and more especially the rich and harmonious combination of tall and stately fine trees. The mountains of the northern side are also the extension of the same mountain system. From the north east, Musa-ka-Musala a peak (4080 meters), which lies along the north eastern side of Konsh and Bhogarmang valleys (Mustafa, 2003). On the western side of Agror valley (Oghi) there is a famous black mountain range which runs northwards (Mustafa, 2003). The climate of the district is moist temperate with seasonal periods of rainfall, snow, and drought (Mustafa, 2003). Forests of the district are rich in trees as Deodar, Blue pine, Chir, Walnut, Cherry, Poplar and Kao (SMEDA, 2009) and supports a rich diversity of macro fungi during monsoon. Gasteroid fungi represent a major group belonging to macro fungi. Most of the members of this group viz., *Astraeus*, *Pisolithus*, *Scleroderma* are involved in ectomycorrhizal associations with some coniferous trees (Martin, 2001; Turjaman *et al.*, 2005; Pyasi *et al.*, 2011; Kaewgrajang *et al.*, 2013). Some members belonging to genus *Bovista*, *Lycoperdon* are edible and have medicinal value (Lans *et al.*, 2007, Ramesh and Pattar, 2010).

So far only 17 gasteroid fungi have been reported from different areas of district Mansehra (Ahmad, 1939, 1952a, b, 1956, 1969, Khan 1968, Ahmad *et al.*, 1997). In present

investigation, nine gasteroid taxa have been reported, out of which one is new record for the country, four are new record for district Mansehra and 5 taxa are being described from different localities of district Mansehra for the first time.

Materials and Methods

Basidiomata were collected with the help of a sharp digger avoiding the loss of rhizomorphs. Specimens were dried manually and brought to laboratory for further investigation. Morphological characters (e.g., basidiospores, capillitium, endoperidium, and exoperidium) were observed macroscopically using a stereomicroscope (Meiji Techno EMZ-5TR) and studied under light microscope (Nikon YS 100) at high magnification (1600x). Glebal material was examined when mounted in lacto-phenol and 5% KOH medium. Illustrations of microscopic features were prepared with the help of a camera Lucida (Ernst Leitz Wetzlar Germany) fitted to a light microscope.

Specimens were identified with the help of literature (Coker and Couch 1928; Bottomly, 1948; Miller and Miller, 1988; Ellis and Ellis, 1990; Pegler and Spooner 1995). All of the specimens have been deposited in the collection of gasteroid fungi at the LAH Herbarium, Department of Botany, University of the Punjab, Lahore, Pakistan.

Results

Taxonomy

Astraeus hygrometricus (Pers.) Morgan, J. Cincinnati Soc. Nat. Hist. 12: 20 (1889) (Fig. 1A-B, 4).



Fig. 1: A-D: A. *Astraeus hygrometricus*, young basidiomata. B. *A. hygrometricus*, a mature basidioma. C. *Bovista plumbea*, a mature basidioma with exposed endoperidium. D. *Geastrum saccatum*. Scale Bar: A = 1.5 cm, B = 0.7 cm, C = 0.5 cm, D = 0.8 cm.



Fig. 2: A-C: A. *Geastrum triplex*. B. *Lycoperdon perlatum* (Gem stud Puff ball). C. *Lycoperdon excipuliforme*. Scale Bar: A = 1.2 cm, B = 1.8 cm, C = 1 cm.



Fig. 3: A-C: A. *Pisolithus tinctorius*. B. *Phallus hadriani*. C. *Scleroderma Bovista*. Scale Bar: A and B = 1.5 cm, C = 1 cm

Mature gasterocarps globose to depressed globose, sessile, 25–50 mm in diam. when mature, splitting in a stellate pattern, encrusted with soil particles and other debris material, odour not recorded. *Peridium* double. *Exoperidium* up to 1.5 mm thick, splitting in to 5-9 acute rays; rays expanded when fresh, recurved inward upon drying; composed of three layers; mycelial layer, thin, brown, not persistent; middle layer off-white to grey, thicker than mycelial layer; inner layer off-white to grey to brown with age, as thick as middle layer, extensively cracked in mature specimens. *Endoperidium* sessile, off-white to grey, opens by a pore; pore small to medium, up to 3 mm in diam. *Gleba* light brown to brown, cottony. *Basidiospores* dark brown, ornamented, densely verrucose, up to 7–11 μm in diam. including ornaments, (6–11 μm in diam. ornamentation excluded), verrucae up to 1–1.7 μm long. *Capillitium* hyaline, thick walled, with narrow lumen, branched, rarely septate, up to 5.0–12.8 μm in diam., (walls up to 1.9–4.5 μm), clamp connections present.

Material Examined

Pakistan: Khyber Pakhtunkhwa, District Mansehra, Khabbal Paien, at 1910 m a.s.l., in groups, among grass, 1st Aug. 2010, M. Fiaz, 62 (LAH100100); Dadar, at 1235 m a.s.l., solitary, 1st Aug. 2010, M. Fiaz, FM226, (HUP Herbarium No. MFG–321), (LAH100101).

Comments

Astraeus hygrometricus was reported first time by Ahmad in 1956 as *Geastrum hygrometricum*, from different regions of Pakistan viz., Patriata (Murree) of Punjab, Kalam (Swat), Kaghan Valley of KPK. It is reported first time from Khabbal Paien, and Dadar of district Mansehra.

Bovista plumbea Pers., Ann. Bot. (Usteri) 15: 4 (1795) (Fig. 1C and Fig. 5).

Basidioma 30 mm broad x 25 mm high, globose to subglobose, off-white when young, solitary, sometimes gregarious; attached to the substratum via thick tuft of mycelium; rhizomorphs black, sometimes white, heavily encrusted with soil particles, dehiscence by an apical pore; pore small to medium, up to 4 mm in diameter, develops as exoperidium sloughs off. *Exoperidium* white when young, grayish off white when mature, thick, persistent when young, peeling off upon maturity, in the form of sheets, firstly from apical portion then below, sometimes patches can be found all over the gasterocarp, can be seen attached to the basal part in mature specimens in the form of weathered, thin membranous layer. *Endoperidium* mouse gray when exposed, smooth to rough, papery, sometimes covered with dust, encrusted with sand particles. *Gleba* grayish black, cottony to powdery, pulverulent. *Sterile base* absent. *Basidiospores* sub-globose to oval, dark brown, 3.5–6 \times 4.5–7.5 μm , with central oil droplet, pedicellate, pedicel

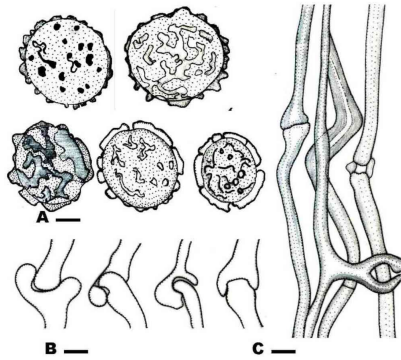


Fig. 4: A–C: *Astraeus hygrometricus*. A. Verrucose basidiospores. B. Eucapillitial threads. C. Joint like septa in capillitial threads. Scale Bar: A = 3.5 μ m, B = 13 μ m, C = 8.5 μ m.

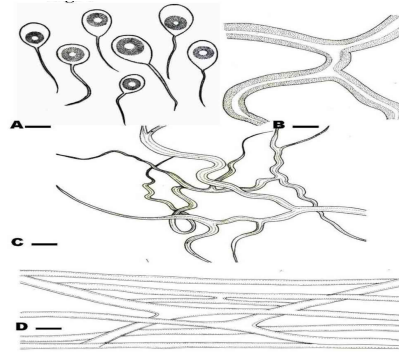


Fig. 5: A–D: *Bovista plumbea*. A. Pedicellate basidiospores. B. Eucapillitial thread, thick walled main axis. C. Eucapillitium, an isolated unit. D. Endoperidial hyphae. Scale Bar: A = 6 μ m, B = 19.5 μ m, C = 48 μ m, D = 21 μ m.

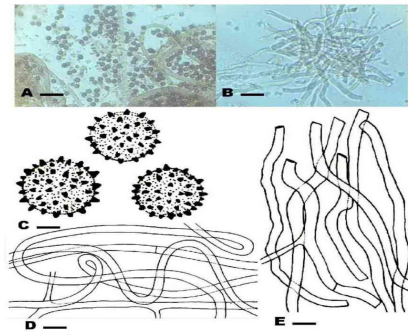


Fig. 6: A–E: *Geastrum saccatum* A. LM image of capillitial threads. B. LM image of endoperidial hyphae. C. Verrucose basidiospores. D. Capillitial threads. E. Endoperidial hyphae. Scale Bar: A = 21 μ m, B = 26 μ m, C = 1.8 μ m, D = 16 μ m, E = 13 μ m.

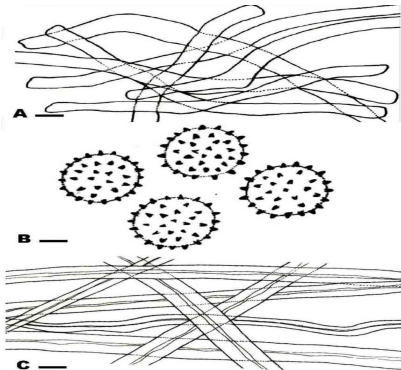


Fig. 7: A–C: *Geastrum triplex*. A. Endoperidial hyphae. B. Verrucose basidiospores. C. Eucapillitial threads; thick walled hyphae. Scale Bar: A = 7 μ m, B = 5 μ m, C = 7.5 μ m

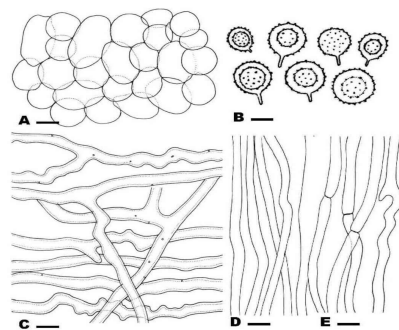


Fig. 8: A–E: *Lycoperdon perlatum*. A. Exoperidial elements. B. Verrucose basidiospores. C. Eucapillitium; aseptate hyphae. D. Endoperidial hyphae. E. Paracapillitial hyphae. Scale Bar: A = 13 μ m, B = 3 μ m, C = 18 μ m, D and E = 4 μ m.

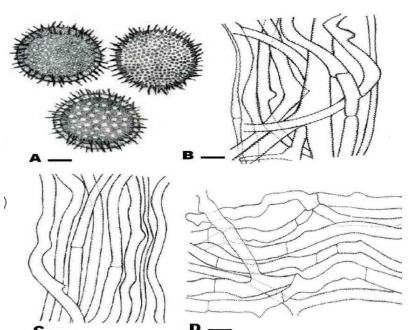


Fig. 9: A–D: *Pisolithus tinctorius*. A. Verruculose basidiospores. B. Exoperidial hyphae. C. Endoperidial hyphae. D. Pseudo-peridiole hyphae. Scale Bar: A = 3 μ m, B and C = 13 μ m, D = 7 μ m.

up to 12 μ m long, brown to hyaline, tapering, straight to slightly curved. *Capillitium* brown, prominent, well developed, in the form of isolated units, not much interwoven, thick main axis, with branches originating from the axis, branches tapers at the ends, aseptate, pores absent, main axis up to 17 μ m thick, branches up to 1.8–4.7 μ m thick, wall thickness from 1.8–5.7 μ m.

Material Examined

Pakistan: Khyber Pakhtunkhwa, District Mansehra, Musaka-Musala, at 4062 m a.s.l., solitary, among grass, Aug. 2011, M. Fiaz, M3, (HUP Herbarium No. MFG–323.), (LAH100102).

Comments

Bovista plumbea is the type species of genus *Bovista*. It is characterized by globose fruiting bodies with white exoperidium and lead grey endoperidium, oval, long pedicellate basidiospores. It is usually found growing on grounds and among grasses. It is commonly occurring gasteroid taxon, reported from different localities of Pakistan. It has previously been reported from Changla gali, Bata Kundi (Kaghan Valley), and Kalam (Swat) of KPK by Ahmad (1952b and 1956). It is being reported from Musa ka Masala of district Mansehra for first time. It occurs solitary, sometimes gregarious on ground, among grasses in Himalayan Moist Temperate Forests of Punjab, Khyber

Pakhtunkhwa and in alpine vegetation of Gilgit-Batistan. However, this is first report of its occurrence in drier parts of the country.

Geastrum saccatum Fr., Syst. mycol. (Lundae) 3(1): 16 (1829) (Fig. 1D and Fig. 6).

Basidioma scattered on soil, at first hypogeous and ovate, attached with a basal mycelium to the substratum, expanded on maturity and superficial, up to 4 cm across, *Exoperidium* splitting from middle to the tip into 10 non hygroscopic rays, with acute apices, up to 2 cm in length, bending downward, upper surface pinkish tan to pale yellowish to camel brown, occasionally cracking. *Endoperidial body* sessile, 2 cm across, globose to subglobose or slightly depressed, onion shaped when not depressed, smooth, seated in saccate, slightly depressed basal area of exoperidium, grayish brown with occasional darker tints; *Peristome* fibrillose and conical, dark brown, surrounded by circular shallow groove. *Gleba* dull brown, pulverulent. *Basidiospores* globose, 3.3–5.2 µm in dia, dark brown, finely verrucose. *Capillitial threads* 2–7 µm thick, coiled, mostly smooth walled, slightly covered by debris, yellowish to pale brown to brown in KOH. *Endoperidial hyphae* densely interwoven, 2–6 µm wide, thick walled, smooth, sometime undulating and yellowish brown.

Material Examined

Pakistan: Khyber Pakhtunkhwa, District Mansehra, Balakot, Nadibunglaw, solitary on sandy soil among mix forest of *Abies pindrow* Royle, *Picea smithiana* (Wall.) Boiss and *Pinus wallichiana* A. B. Jackson, at 2512 m. a. s. l., 1st Aug. 2010. MF # FM–243. (HUP Herbarium No. MFG–326).

Comments

Previously, *Geastrum saccatum* has only been reported from Kaghan valley by Ahmad in 1952 and 1956. This is the second report of this species from Pakistan. It is a new record for Balakot and Nadibunglaw of district Mansehra.

Geastrum triplex Jungh. [as 'Geaster'], Tijdschr. Nat. Gesch. Physiol. 7: 287 (1840) (Fig. 2A and Fig. 7).

Basidiomata in groups on soil, expanded fruit body epigeous, 3–7 cm in dia, attached by a basal mycelial tuft with substrata. *Exoperidium* splitting from middle into 5–7 non-hygroscopic, thick and more or less triangular arms, with cracks and fissures on the upper surface in mature specimen, often splitting to form collar or saucer shaped platform having the spore sac seated in it, often the rays turn downward, uplifting and exposing the spore sac. *Endoperidium* sessile, 1.5–3 cm across, globose to onion shaped, depressed in aged specimen, dull brown or snuff brown, smooth. *Peristome* fibrillose, conical, surrounded by a paler, occasionally depressed circular area. *Gleba* dull brown, powdery, collumella distinct. *Basidiospores* globose to subglobose, 3.8–5.8 µm in dia, pale brown to dark brown, finely verrucose. *Capillitial threads* 2.8–8.5 µm thick,

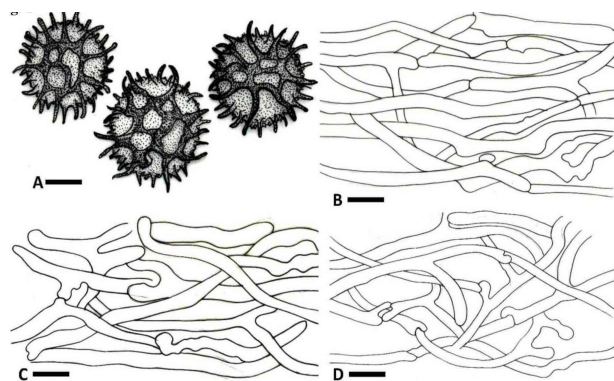


Fig. 10: A–D. *Scleroderma bovista*. A. Verrucose basidiospores. B. Exoperidial hyphae. C. Endoperidial hyphae. D. Tramal hyphae. Scale Bar: A = 5.5 µm, B and C = 9.7 µm, D = 18.5 µm

hyaline to pale yellowish to pale reddish brown, with gradually tapering or obtuse tips, encrusted. *Endoperidial hyphae* compactly arranged, 3–6.6 µm thick, thick walled, smooth, yellowish.

Material Examined

Pakistan: Khyber Pakhtunkhwa, District Mansehra, Balakot, Nadibunglaw, Gregarious on soil among mix forest of *Abies pindrow* Royle, *Picea smithiana* (Wall.) Boiss and *Pinus wallichiana* A. B. Jackson, at 2512 m. a. s. l., 1st Aug. 2010. MF # FM–222. (HUP Herbarium No. MFG–327a.); Solitary on ground, Balakot, Nadibunglaw, at 2518 m. a. s. l., August 2010. MF # FM–245. (HUP Herbarium No. MFG–327b).

Comments

It has previously been reported from Kalam (Swat), Shogran (Kaghan valley), Nathia Gali, Patriata (Murree hills) by Ahmad in 1952 and 1956, also by Khan in 1968. It is first time reported from Balakot and Nadibunglaw of district Mansehra.

Lycoperdon excipuliforme (Scop.) Pers., Syn. meth. fung. (Göttingen) 1: 143 (1801) (Fig. 2C).

Detailed descriptions and illustrations of *Lycoperdon excipuliforme* are available by Yousaf et al. (2012).

Material Examined

Pakistan: Khyber Pakhtunkhwa, District Mansehra, Musa Ka Musala, at 3894 m a.s.l., in groups, 1st Aug. 2010, M. Fiaz, 245, FM222, (HUP Herbarium No. MFG–328) (LAH100103).

Comments

It has been reported by Yousaf et al. in 2012 from Nathia Gali, Khyber Pakhtunkhwa, Pakistan. It is a new record from district Mansehra.

***Lycoperdon perlatum* Pers., *Observ. mycol. (Lipsiae)* 1: 145 (1796)** (Fig. 2B and Fig. 8).

Basidiomata gregarious, pyriforme, 30–50 mm high × 15–35 mm broad, off-white when young, brown when mature; rhizomorphs white encrusted with particles of soil and other debris material. Dehiscence by an apical pore, up to 5 mm in diam. *Exoperidium* consisting of 1 mm long warts; warts off white, more prominent over spore case, less evident below, rubbed off when mature, sometimes adherent in mature specimens. *Endoperidium* papery, yellowish brown. *Gleba* cottony, white when young, brown later on, up to 1 mm high, comprising 1/3rd of gasterocarps. *Pseudocolumella* present, well developed. *Sterile base* comprising of 2/3rd of gasterocarps, chambered, showing two zones of different colors, upper zone yellowish brown just below the gleba, lower zone brown to olive. *Basidiospores* brown, globose to subglobose, nearly smooth, 3–5 µm in diam., pedicellate; pedicel up to 1.2 µm, hyaline. *Eucapillitium* brown, *Lycoperdon* type, well developed, aseptate, frequently branched, pores absent, up to 2–7 µm in diam., wall thickness up to 1.6 µm, branches with tapering ends, straight to sub undulate, often bulging at some points. *Paracapillitium* present, hyaline, septate, branched, joint like septa also present, up to 5 µm in diam. *Exoperidium* composed of hyaline, globose to subglobose to elongated hyphal elements, up to 30 µm high, 9.5 µm broad. *Endoperidium* composed of thin walled, aseptate, tightly packed hyphal elements, up to 5 µm in diam.

Material Examined

PAKISTAN: KHYBER PAKHTUN KHW, District Mansehra, Khabbal Paen, Ucharhi, at 1825 m a.s.l., in groups, 1st Aug. 2010, M. Fiaz, F-04, (HUP Herbarium No. MFG–329). (LAH100104).

Comments

It is the most commonly occurring *Lycoperdon* sp. in moist temperate region of Pakistan. It has been reported from Patriata (Murree), Changla gali, Bahrain (Swat), Shogran, Sharan (Kaghan Valley) by Ahmad in 1952 and 1956. It is first report of this taxon from Khabbal Paen and Ucharhi of district Mansehra.

***Phallus hadriani* Vent., *Mém. Inst. nat. Sci. Arts* 1: 517 (1798)** (Fig. 3B).

Mature basidioma gray with violet tone, up to 125 mm high, attached to the substratum by well-developed mycelial base; Rhizomorphs off white. *Receptaculum* with off white reticulate pileus head and stipe; *Pileus* up to 30 mm in height × 25 mm in diam., campanulate, hollow. *Gleba* olivaceous green wet, sticky, deliquescent. *Stipe* hollow, off white, spongy, up to 80 mm in height × 17–20 mm in diam., cylindrical. *Volva* globose, thick, soft, cup shaped, covering 1/3rd of the stipe, grayish to violet,

lined with grayish to violet gelatinous and sticky material inside, up to 37 mm in height × 35 mm in diam.

Material Examined

Pakistan, Khyber Pakhtunkhwa, District Mansehra, Chattar Plain near PTDC hotel, at 1320 m a. s. l., September 2011. MF # FM–P1. (HUP Herbarium No. MFG–330). Bt-8, (LAH100105).

Comments

Phallus hadriani is a new record for District Mansehra. It is the second report of this species from Pakistan.

***Psolitus tinctorius* (Mont.) E. Fisch., (1900)** (Fig. 3A and Fig. 9).

Detailed descriptions are available by Razzaq and Shazad (2004).

Material Examined

Pakistan: Khyber Pakhtunkhwa, District Mansehra, Khabbal Paen, at 1825 m a.s.l., in groups, Aug. 2010, M. Fiaz, 21 (LAH100106); Dadar hills, at 1337 m a.s.l., solitary, Aug. 2010, M. Fiaz, FM31, (HUP Herbarium No. MFR–273), (LAH100107).

Comments

Only report of this species belongs to Karachi by Razzaq and Shahzad in 2004. It is new record for district Mansehra.

***Scleroderma bovista* Fr., *Syst. Mycol. (Lundae)* 3: 48 (1829)** (Figs. 3C and Fig. 10).

Basidiomata epigeous, 30 mm broad × 30 mm high, globose to slightly subglobose, yellowish to dull brown, with well-developed mycelial base. *Peridium* <1 mm thick, tough, relatively rough, elastic, scales present; scales black, thin, more dense on top, spot-like; dehiscence by an irregular rupturing of an apical part. *Gleba* firm, compact, powdery with age, grayish black. *Basidiospores* dark brown, partially to completely reticulate, ornamented, verrucose, 13–19 µm (av. 16 µm) in diam. including ornamentation, 11–14.5 µm in diam. excluding ornamentation, verrucae up to 4.7 µm high. *Exoperidium* composed of hyaline, septate, branched hyphae, up to 6 µm in diam. *Mesoperidium* composed of hyaline, branched, septate hyphae with clamp connections, up to 9.5 µm in diam. *Endoperidium* composed of hyaline, thin walled, branched, septate hyphae with clamp connections, up to 6 µm in diam.

Material Examined

PAKISTAN: Khyber PakhtunKhw, Mansehra, 5 July. 2011, in groups, among grass, at a.s.l., M. Fiaz. 32, (LAH100108).

A checklist of gasteroid mycota of District Mansehra, Pakistan

Genus	Species	Habitat	Distribution	Literature
<i>Astraeus</i> Morgan	<i>Astraeus hygrometricus</i> (Pers.) Morgan, J. Cincinnati Soc. Nat. Hist. 12: 20 (1889)	Growing under <i>Pinus wallichiana</i>	Kaghan Valley; Dadar, Khabbal Paen (Mansehra)	Ahmad (1956)
<i>Bovista</i> Pers.	<i>Bovista plumbea</i> Pers., Ann. Bot. (Usteri) 15: 4 (1795)	Solitary to gregarious, among grass, on ground	Batakundi (Kaghan Valley); Musa-ka-Musala (District Mansehra)	Ahmad (1952, 1956)
	<i>Bovista polymorpha</i> (Vittad.) Kreisel, Reprium nov. Spec. Regni veg. 69: 201 (1964)	On the ground, on soil	Kaghan Valley	Ahmad (1952, 1956)
<i>Crucibulum</i> Tul. & C. Tul.	<i>Crucibulum laeve</i> (Huds.) Kambly, Iowa: 167 (1936)	Gast. On the ground	Shogran (Kaghan Valley)	Ahmad (1952, 1956)
<i>Gaeastrum</i> Pers.	<i>Gaeastrum clelandii</i> Lloyd, Mycol. Writ. 5(Letter 53): 749 (1918)	On the ground	Naran (Kaghan Valley)	Ahmad (1952, 1956)
	<i>Gaeastrum rufescens</i> Pers. [as 'Geaster'], meth. fung. (Göttingen) 1: 134 (1801) = <i>Gaeastrum vulgatum</i> Vittad.	On the ground	Shogran (Kaghan Valley)	Ahmad (1969)
	<i>Gaeastrum saccatum</i> Fr., Syst. mycol. (Lundae) 3(1): 16 (1829)	On the ground, solitary on sandy soil among mix forest of <i>Abies pindrow</i> Royle, Balakot	Shogran (Kaghan Valley), Ahmad (1956)	
	<i>Picea smithiana</i> (Wall.) Boiss and <i>Pinus wallichiana</i> A. B. Jackson			
	<i>Gaeastrum schmidlii</i> Vittad. [as 'Geaster'], Monograph Lyc.: 12 (1842)	On the ground	Shogran (Kaghan Valley)	Ahmad (1956b)
	<i>Gaeastrum triplex</i> Jungh. [as 'Geaster'], Tijdschr. Nat. Gesch. Physiol. 7: 287 (1840)	On the ground, solitary to gregarious on soil among mix forest of <i>Abies pindrow</i> Royle, Balakot	Shogran (Kaghan Valley), Ahmad (1956)	
	<i>Picea smithiana</i> (Wall.) Boiss and <i>Pinus wallichiana</i> A. B. Jackson			Khan (1962)
<i>Lycoperdon</i> Tourn. ex	<i>Lycoperdon excipuliforme</i> (Scop.) Pers., meth. fung. (Göttingen) 1: 143 (1801)	On the ground, solitary to gregarious	Nathia gali, Musa Ka Musala (district Mansehra)	Yousaf et al., 2012
	<i>Lycoperdon oblongisporum</i> Berk. & M. A. Curtis, in Berkeley, J. Linn. Soc., Bot. 10(no. 46): 345 (1868) [1869]	On the ground	Shogran (Kaghan Valley)	Ahmad (1952)
	<i>Lycoperdon perlatum</i> Pers., Observ. mycol. (Lipsiae) 1: 145 (1796)	On the ground, on soil, in groups, solitary sometimes	Shogran, Sharan (Kaghan valley), Khabbal Paen, Ucharhi (District Mansehra)	Ahmad (1952, 1956)
	<i>Lycoperdon pratense</i> Pers., Tent. disp. fung. (Lipsiae): 7 (1797)	On the ground	Kaghan Valley	Ahmad (1952, 1956)
<i>Pisolithus</i> Alb. & Schwein.	<i>Pisolithus tinctorius</i> (Mont.) E. Fisch., (1900)	On ground, among grass, solitary to gregarious	Karachi; Khabbal Paen, Dadar hills (District Mansehra)	Razzaq & Shahzad (2004)
<i>Phallus</i> L. ex Pers	<i>Phallus hadriani</i> Vent., Mém. Inst. nat. Sci. Arts 1: 517 (1798)	On ground, among grass	Mansehra	
	<i>Phallus impudicus</i> L., Sp. pl. 2: 1178 (1753)	On soil	Batakundi, Shogran (Kaghan Valley)	Ahmad (1952, 1956)
	<i>Phallus rubicundus</i> (Bosc) Fr., Syst. mycol. (Lundae) 2(2): 284 (1823)	On the ground, among grass	Balakot, Mahandri (Kaghan Valley)	Ahmad (1939)
<i>Rhizopogon</i> Fr.	<i>Rhizopogon flavus</i> Petch, Ann. R. bot. Gdns Peradeniya 6(3): 207 (1917)		Shogran, Sharan, Kaghan	Ahmad (1956)
<i>Scleroderma</i> Pers.	<i>Scleroderma bovista</i> Fr., Syst. mycol. (Lundae) 3(1): 48 (1829)	On the ground, among grass	District Mansehra	Ahmad (1956), Khan (1962)
	<i>Scleroderma flavidum</i> Ellis & Everh., J. Mycol. 1(7): 88 (1885)	On the ground	Shogran (Kaghan Valley)	Ahmad (1956)
	<i>Scleroderma verrucosum</i> (Bull.) Pers., meth. fung. (Göttingen) 1: 154 (1801)	On the ground	Kaghan Valley	Ahmad (1952, 1956)
<i>Secotium</i> Kze.	<i>Secotium acuminatum</i> Mont., in Durieu, Sci. Alg. 1(livr. 10): 371 (1848) [1846-49]	On the ground	Shogran (Kaghan Valley)	Ahmad (1956)

Comments

It has been reported from Patriata (Murree hills) in 1956b by Ahmad. It is a new record for District Mansehra.

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References

- Ahmad, S., 1939. Higher Fungi of Punjab plains. II. The Gasteromycetes. *J. Ind. Bot. Soc.*, 18: 169–177
- Ahmad, S., 1952a. *Gasteromycetes of Pakistan*. Publ. Dept. Bot. University of the Punjab, 11: 1–92
- Ahmad, S., 1952b. *Gasteromycetes of West Pakistan*. Punjab University Press. Lahore
- Ahmad, S., 1956. Fungi of Pakistan. *Biol. Soc. Pak. Lahore, Monogr. 1*: 1–126
- Ahmad, S., 1969. Fungi of Pakistan. *Biol. Soc. Pak. Lahore, Monogr. 5*: 1–110

- Ahmad, S., S. H., Iqbal and A.N. Khalid, 1997. *Fungi of Pakistan*. Sultan Ahmad Mycological Society of Pakistan, Lahore
- Bottomley, A.M., 1948. Gasteromycetes of South Africa. *Bothalia*, 4: 474–810
- Coker, W.C. and J.N. Couch, 1928. *Gasteromycetes of the Eastern United States and Canada*. University of North Carolina Press, USA
- Ellis, J.B. and M.B. Ellis, 1990. *Fungi without gills: (Hymenomycetes and Gasteromycetes): An identification Handbook*, Chapman and Hal, London
- Kaewgrajang, T., U. Sangwanit, K. Iwase, M. Kodama and M. Yamato, 2013. Effects of Ectomycorrhizal Fungus *Astraeus Odoratus* on *Dipterocarpus Alatus* Seedlings. *J. Trop. Forest Sci.*, 25: 200–205
- Khan, S.A. and M. Kamal, 1968. The fungi of South West Pakistan. Part I. *Pak. J. Sci. Ind. Res.*, 2: 61–80
- Lans, C., N. Turner, T. Khan, G. Brauer and W. Boepple, 2007. Ethnoveterinary medicines used for ruminants in British Columbia, Canada. *J. Ethnobiol. Ethnomed.*, 3: 11
- Martin, T.P., 2001. Observations of mycorrhizal inoculation of pin and scarlet oak production in containers, *M.Sc. thesis*. Blacksburg, Virginia.
- Miller, H.R. and O.K. Miller, 1988. *Gasteromycetes: Morphological and Developmental Features, with Keys to the Orders, Families, and Genera*, Eureka, Calif: Mad River Press
- Mustafa, G., 2003. Mansehra, an introduction, gazetteer of the Hazara District. Sang-e-Meel Publications, Lahore, Pakistan
- Pegler, D.N., T. Laessoe and B. Spooner, 1995. *British puffballs, earthstars and stinkhorns*, Royal Botanic Gardens, Kew
- Pyasi, A., K.K. Soni and R.K. Verma, 2011. Dominant Occurrence of Ectomycorrhizal Colonizer *Astraeus hygrometricus* of Sal (*Shorea robusta*) in Forest of Jharsuguda, Orissa. *J. Mycol. Plant Pathol.*, 41: 222–225
- Ramesh, C. and M.G. Pattar, 2010. Antimicrobial properties, antioxidant activity and bioactive compounds from six wild edible mushrooms of Western Ghats of Karnataka, India. *Pharmacognosy Res*; 2: 107–112
- Razzaq, A. and S. Shahzad, 2004. *Pisolithus tinctorius*, a new record from Pakistan. *Pak. J. Bot.*, 36: 449–451
- Shah, G.M. and M.A Khan, 2006. Check list of medicinal plants of Siran Valley Mansehra–Pakistan. *Ethnobot. Leaflets*, 10: 63–71
- SMEDA, NWFP. 2009. *District profile Mansehra*. Small and Medium Enterprises Development Authority, Ministry of Industries and Production. Government of Pakistan.
- Turjaman, M., Y. Tamai, H. Segah, S.H. Limin, J.Y. Cha, M. Osaki and K. Tawaraya, 2005. Inoculation with the ectomycorrhizal fungi *Pisolithus arhizus* and *Scleroderma* sp. improves early growth of *Shorea pinanga* nursery seedlings. *New For.*, 30: 67–73
- Yousaf, N., A.R. Niazi and A.N. Khalid, 2012. New records of noteworthy gasteroid fungi from Pakistan. *Mycotaxon*, 119: 261–267

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