



***Myriostoma coliforme*, first record of a rare and endangered gasteroid basidiomycetes from Pakistan**

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Abstract

A rare gasteroid basidiomycetes has been collected for the first time from himalayan moist temperate forest of Pakistan. Its detailed morphological characterization, illustration and a review have been given.

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Introduction

Myriostoma Desv. is a monotypic genus that belongs to order Geastrales. It was first established by Desv. (1809) when he published *Myriostoma anglicum* Desv. [= *Myriostoma coliforme* (Dicks.) Corda] as type species.

Myriostoma coliforme has cosmopolitan and worldwide distribution (Spegazzini, 1908; Lange, 1953; Kotlaba, 1961, Reid *et al.*, 1980, Lazo, 1982, Binyamini, 1984, Sunhede, 1989, Minter *et al.*, 1990, Beltrán-Tejera, 1998, Monti *et al.*, 2001, Asan *et al.*, 2002, Baseia, 2002, Zhou & Yan, 2002, Benkert, 2003, Jordan, 2004, Guinberteau, 2005, Rees *et al.*, 2005, Hernández-Crespo, 2007, Remijn, 2007, Pawłowski and Adamska, 2008, Esqueda, 2009, Outcoumit *et al.*, 2009, Alexov *et al.*, 2012). It is found growing either solitary or in groups on humus rich soil (Courtecuisse and Duhem, 1995).

Most of the studies carried out so far on *M. coliforme* were related to taxonomy and an attempt for its placement in an appropriate taxonomic family. Initial studies on *M. coliforme* was done by John Ray in 1696, although it was first scientifically described as new species in 1776 by James Dickson (Doody, 1696, Dickson, 1785). Phylogeny of genus *Myriostoma* faced many shifts between Geastraceae and Astraeaceae by many mycologists however it is currently being treated under the former (Dring, 1973, Sunhede, 1989). Molecular and phylogenetic studies using rDNA and other genes as genetic markers have also confirmed its position within Geastraceae. It is a sister genus to *Geastrum* (Kruger *et al.*, 2001, Hosaka *et al.*, 2006).

There are currently no studies showing the presence or extraction of useful compounds in *Myriostoma*. However, many of such compounds which have anti-inflammatory, antioxidants effects have been found to be extracted from the species of its sister genus *Geastrum* (Ying and Xiao-Lan, 1987, Guerra Dore *et al.*, 2007). Future

works to check for the presence and extraction of such compounds from genus *Myriostoma* are also needed.

During the exploration of macro fungi from different areas of Pakistan, find of a rare fungal specimen has been remained a successful venture. Because this species has been included in list of 33 fungal species facing the threats of extinction (Dahlberg & Croneborg H. 2003). It also poses a need to explore more areas for looking for more flora in the view of conversation of macro fungal biodiversity. *M. coliforme* is first time reported as a new record from Pakistan.

Materials and Methods

Morpho-anatomical Analysis

Basidiocarps of specimens were collected and photographed in the field. Collected specimens were dried and analyzed morphologically and anatomically. Morphological characters were observed using a stereomicroscope (Meiji Techno EMZ-5TR). Microscopic features (e.g., basidiospores, capillitium, hyphae of peridium) were studied under light microscopy (Optika, B350) at high magnification (1000x). For glebal study, small amount of glebal material was mounted in 5% KOH medium, lacto-phenol and trypan blue. Illustrations of microscopic characters were prepared with the help of a camera lucida (Ernst LeitzWetzlar Germany) fitted to a light microscope.

The specimen (LAH1007) has been deposited in the collection of gasteroid fungi at the LAH Herbarium, Department of Botany, University of the Punjab, Lahore, Pakistan.

Results

Taxonomy

Myriostoma coliforme (Dicks.) Corda, Anleit. Stud. Mykol.,Prag: 131 (1842)

Dried basidioma up to 55 mm in width × 60 mm in height, solitary, consists of upper stalked

spore case and radiating rays below. Peridium bilayered. Exoperidium splitting from the middle by forming 10 or more rays, rays revolute, united from the base near the endoperidium body, free at the tips, up to 30 mm long, tips curving towards the central basal portion, often touching the mycelial layer, rays rarely splitting at tips; Exoperidium three layered; mycelial layer blackish brown, thin, patchy throughout, persistent, encrusted heavily with the debris material; Fibrous layer brown; pseudo-parenchymatous layer yellowish brown with some dark brown, dotted powdery mass attached, thick; endoperidium body (including multiple stalks and spore case), spore case greyish brown, up to 15 mm in height and 30 mm in diameter; endoperidium grayish brown, stalks, many attached, up to 5 mm in height; spore case opens by many pores through which spore escapes, up to 2 mm in diam. Gleba brown, cottony, later becoming pulverulent.



Fig. 1. A-C. *Myriostoma coliforme*. A & B. Two mature basidiomata B. Illustration of a basidioma. Scale bar. 1cm for A-C

Basidiospores brown, globose, heavily ornamented, verrucose, up to 7 μm in diam. including verrucae, up to 5 μm in diam. (ornamentation excluded), verrucae up to 2 μm long. Eucapillitium threads brown, aseptate, straight, thin walled, up to 5 μm in diam. in diam.

Exoperidium composed of hyaline, aseptate to rarely septate, unbranched, thick walled, tightly packed hyphae, up to 6 μm in diam., wall thickness up to 2.5 μm . Endoperidium composed of brown, unbranched, aseptate, tightly packed hyphae, up to 5 μm in diam.

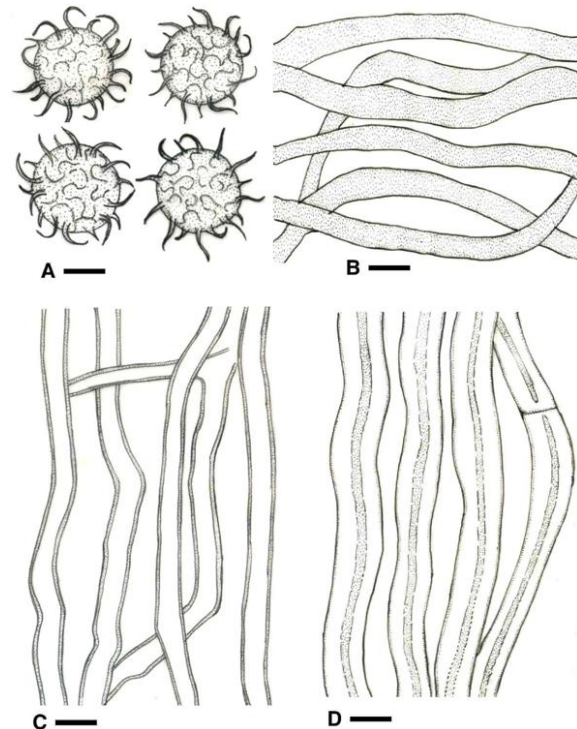


Fig. 2. A-D. *Myriostoma coliforme*. A. Verrucose basidiospores B. Endoperidial hyphae C. Eucapillitial hyphae D. Exoperidial hyphae. Scale bar. 2 μm for A, 5 μm for B-D.

Material Examined: PAKISTAN, Khyber Pakhtunkhwa, Khanspur, Halipad, solitary, Himalayan Moist Temperate Forests, 2250 m. (7500 ft.). a.s.l., A. R. Niazi, 8 Aug. 2008. (LAH1007)

Additional Material Examined: Pakistan, Khyber Pakhtunkhwa (KPK), Swat, Kalam, solitary, Sultan Ahmad, 23 Aug. 1952. (LAH15651) (Unpublished)

Comments

Myriostoma coliforme is commonly called as pepper pot earth star or salt shaker because of the shape of its fruiting body which splits open from the middle forming many rays revealing endoperidium body (Long, 1942, Pegler and

Spooner, 1992). Corda (1842) replaced the name *M. anglicum*, given by Desvaux with *Myriostoma coliforme* which is currently accepted name of this species. Many species have been considered as a synonymy, which include *Lycoperdon coliforme* Dicks., *Geastrum coliformis* (Dicks.) Pers., *Polystoma coliforme* (Dicks.) Gray, and *Myriostoma coliforme* var. *capillisporum* V.J. Staněk. European Council for Conservation of Fungi enlisted *M. coliforme* as a threatened species that is facing the danger of habitat extinction. Authors have been surveying different parts of the country since last 10 years for exploring diversity of the fungi. Explored areas range from plains and deserts of Punjab to higher altitude of Himalayas, pastures of fairy meadows, Gilgit, Baltistan to Deosai plains, second highest plateau of the world. Among all the fungi collected, *M. coliforme* is thought to be very rare as its distribution in this region is concerned, when compared with other gasteroid fungi.

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