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BRIEF REPORT

Unusual occurrence of rare Geastrum species with an abnormal stoma development found in Madurai, Tamil Nadu, India [version 1; peer review: 1 approved with reservations, 1 not approved]

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Abstract

Unusual occurrence of Geastrum species fungi, belonging to the class Basidiomycetes, found in riverbank regions of Madurai, Tamil Nadu, India. Its detailed illustrations and morphological characterization analysis are reported in this study.

Keywords

Basidiomycetes, Geastrum and Characterization

Open Peer Review

Approval Status

	1	2
version 1
05 Nov 2020	view	view
1. Julieth Sousa , Universidade Federal do Rio Grande do Norte, Rio Grande do Norte, Brazil		
2. Shwet Kamal , ICAR-Directorate of Mushroom Research, Solan, India		
Babita Kumari , ICAR-Directorate of Mushroom Research, Solan, India		
Any reports and responses or comments on the article can be found at the end of the article.		

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Introduction

The species of the genus *Geastrum*, classified under order Geastrales, is rare and the species are red listed (Piętka & Kujawa in 2012; Wojewoda *et al.*, 2006). Although in the distant past they were recorded in several locations worldwide, sightings of this attractive earthstar in plains are now highly limited due to anthropogenic activity. Kirk *et al.* (2008) and Perez (2009) described 50 species of *Geastrum* in a dictionary of fungi. Zamora *et al.* (2014) described 100 to 120 species of *Geastrum* based on field and herbarium studies.

There have been many reports about the pluralistic distribution of *Geastrum* species in Western Ghats by Karun & Sridhar, 2014, in Central India by Verma *et al.* (2018) and in Tamil Nadu by Meenakshi & Selvam (2020). *Geastrum* species share morphology with *Myriostoma* species, as reported by Alexov *et al.* (2012); Esqueda (2009); Outcounit *et al.* (2009) and Pawłowski & Adamska (2008).

Many mycologists classify *Myriostoma* in between Geastraceae and Astraeaceae. However, currently it is classified under Geastraceae (Dring, 1973; Sunhede, 1989). Using rDNA and other genetic markers, its molecular taxonomic position within Geastraceae was confirmed, and it is closely associated with the genus of *Geastrum* (Hosaka *et al.*, 2006; Krüger *et al.*, 2001).

These inedible fungi are widely distributed in Africa, Asia, North and South America, and Europe, where they grow in humus-rich forests. *Geastrum* are rather rare fungi; they have been characterized as critically endangered, red listed and threatened in many European countries like Poland, Montenegro, Bulgaria, Slovakia, Sweden, Switzerland and Czech Republic (Wojewoda *et al.*, 2006 and Piętka & Kujawa, 2012). Consistent and periodical surveys of macrofungi result in identification of new fungi. The present objective of this work is to report the *Geastrum* species found in the riverbank canal of Madurai, Tamil Nadu, India with an abnormal stoma development.

Methods

Specimen collection

The specimens were collected from our college campus: Thiagarajar college, Teppakulam, Madurai, Tamil Nadu, India. The soil texture of the collection site is highly humus and moist, with shady regions provided by large trees in the nearby area. The collected specimens were photographed, subcultured in potato dextrose medium (pH 6.5) and preserved in formalin bottles (10%).

Specimen storage and analysis

Collected specimens were dried using a glass desiccator and analysed morphologically and anatomically. Morphological characters were observed using a stereomicroscope (Labline, model number 3923061230; 20X & 40X with flat field) and measurements were taken with a ruler. Microscopic features (e.g., basidiospores, capillitium, hyphae of peridium) were studied under light microscopy at high magnification (40X). Lacto-phenol (0.1%) mixed with trypan blue was used to study the gleba. Microscopic images were taken using Camera Lucida (HLP-3 Model). Standard specimen identification described by Smith (1963)

was followed for the anatomical and morphological features based microscopic examination.

Results and discussion

The specimen (TMC 1001) has been deposited in the collection of Gasteroid fungi at the Department of Botany, Thiagarajar college, Teppakulam, Madurai, Tamil Nadu, India.

The fruiting body size measures 40 mm in width by 20 mm in height, is solitary, and consists of an upper stalked spore case and radiating rays below (Figure 1 and Figure 2). The exoperidium has 10–12 rays, which are revolute, thin, united in the base and free at the tips, and triple layered, with a blackish brown mycelial layer (Figure 3). The tips curve towards the basal position. The peridium is bilayered. The endoperidium body

Figure 1. *Geastrum* dorsal view.

Figure 2. *Geastrum* ventral view.

Figure 3. A) Geastrum in field. B and C) Geastrum size measurement.

spore case is greyish brown, up to 19 mm in diameter, with many stalks attached. The spore case opens by many pores through which spores escape.

The fungus has brown basidiospores with a globose and verrucose structure. Brown eucapillitium threads are thin walled, straight, aseptate and up to 3µm in diameter. The exoperidium is composed of hyaline, aseptate to rarely septate, unbranched, thick walled, tightly packed hyphae, up to 4µm in diameter, wall thickness up to 1.7 µm. The endoperidium is unbranched, aseptate, brown in colour, with tightly packed hyphae measuring up to 3µm in diameter.

Although these fungi are cosmopolitan in distribution, due to the periodical environmental disruption nowadays, occurrence

of these fungi is highly limited. According to [Signalarter \(2000\)](#) and [Benkert \(2003\)](#), the *Geastrum* species serve as indicators of specific habitats in need of conservation.

Data availability

All data underlying the results are available as part of the article and no additional source data are required.

Acknowledgements

I grateful to our beloved management of Thiagarajar College for the permission to carry out this study. I deeply acknowledge to all my students of I-M.Sc., Botany for their valuable help during collection of this rare fungi.

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Version 1

Reviewer Report 27 April 2022

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Shwet Kamal

ICAR-Directorate of Mushroom Research, Solan, Himachal Pradesh, India

Babita Kumari

ICAR-Directorate of Mushroom Research, Solan, Himachal Pradesh, India

1. *Geastrum* species are commonly found in India so this is not a rare genus in India.
2. There is no mention about the species. Also there is no information about the sequences. The species may be sequenced to get the correct identification of species.
3. No mention about the abnormal stoma development as mentioned in the title of the manuscript. Also, 'Stoma' is not a term in *Geastrum* glossary.
4. Only photographs of the specimen are given in the manuscript. Nothing has been given on microscopic images or camera lucida drawings.
5. The techniques of preservation as a herbarium specimen is not detailed.

Overall the manuscript is poorly written as no detailed data and methods are provided.

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

Partly

If applicable, is the statistical analysis and its interpretation appropriate?

Not applicable

Are all the source data underlying the results available to ensure full reproducibility?

No source data required

Are the conclusions drawn adequately supported by the results?

Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Mushroom biology, Genetics and breeding, Production technology, etc.

We confirm that we have read this submission and believe that we have an appropriate level of expertise to state that we do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Reviewer Report 04 May 2021

<https://doi.org/10.5256/f1000research.28281.r83859>

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Julieth Sousa

Programa de Pós-Graduação em Sistemática e Evolução, Universidade Federal do Rio Grande do Norte, Rio Grande do Norte, Brazil

The presence of more than one peristome and more than one stalk are reported by Sunhede, S. 1989. Geastraceae (Basidiomycotina). Morphology, ecology and systematics with special emphasis on the North European species. Synopsis Fungorum 1: 1-534.

The description need improvements:

1. Add details about Peristome.
2. Add spores measurements.
3. Add photos of microstructures.

Please add some discussions/conclusions.

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

Partly

If applicable, is the statistical analysis and its interpretation appropriate?

Not applicable

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Taxonomy, Sistematics, Mycology.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 04 May 2021

veluswamy karthikeyan, Thiagarajar college, Madurai, India

As per the reviewer, we accept the revision required. We here describe the:

1. Peristome size and structure peristome are up to 3µm in diameter.
2. The spore print was not taken at that time we are unable to determine the spore size.

Competing Interests: No competing interests were disclosed.

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