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A study of Bryophytes Flora of Ramgarh Impact Crater Kishanganj, Baran, Rajasthan, India

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Abstract
Ramgarh Impact Crater is a circular shape structure with ~ 3.4 km diameter. It is home of many flora and fauna. Bryophytes, including mosses, liverworts, and hornworts, are non-vascular cryptogamic plants known for their ecological importance in moisture retention, soil formation, and as pioneer species. Field observations and microscopic analyses were conducted to identify morphological and anatomical characteristics and determine their ecological significance. Bryophytes like *Riccia cavernosa* Mitt. (Liverwort)), *Cyathodium* sp. (Liverwort), *Notothylas orbicularis* (Schwein.) Sull. (Hornwort), *Fissidens flaccidus* Mitt. (Moss) are found. Pteridophytes -*Actiniopteris radiata* (Sw.) Link, also present with *Cyathodium* sp. *Fissidens flaccidus* Mitt. *Adiantum caudatum* L. (Pteridophytes) also observed on the Bhand-devra temple (Mini Khajuraho) in Ramgarh Impact Crater.

Keywords- Impact Crater, Bryophytes, cryptogamic, Liverwort,

INTRODUCTION

Ramgarh Impact Crater is made of extra-terrestrial material Asteroid Impact Crater. Its have their cultural and historical value for its temple, origin of this site etc. Ramgarh Impact Crater is located in Hadoti plateau of south-eastern region of Rajasthan. The Ramgarh Impact Crater is now declared as Geo-heritage site of India (Govt of Rajasthan). In Ramgarh Impact Crater 197 vascular plants species are documented by Sharma *et. al*, (2025). In present study seasonal survey of the site provide the clear picture of flora and fauna. Flora includes broad biodiversity spectrum, including algae to angiosperm. Mostly *Anogeissus pendula* Edgew. forest present in this circular shape region. Bryophytes are among the earliest land plants and play a crucial role in Ramgarh Impact Crater ecosystem. They lack true roots, vascular tissues, and seeds but have developed unique adaptations to terrestrial life. This paper presents morphological and anatomical observations of Bryophytes species collected from moist, shaded habitats of Ramgarh crater. Bryophytes are known as the "amphibians of the plant kingdom" because they are primitive plants that are adapted to live on land but still require water for sexual reproduction. They have evolved some land adaptations, such as anchoring to soil with root-like structures, but they lack specialized vascular tissues and depend on a film of water for their motile sperm to swim to the egg for fertilization to occur. In Ranthambhore Tiger Reserve, Rajasthan 27 species of bryophytes belonging to 13 genera distributed to 8 families recorded by Alam *et. al,* (2011). After it In Rajasthan and Panjab plains 51 taxa of bryophytes are identified by Rawat *et. al,* 2015.

MATERIALS AND METHODS

The Ramgarh Impact Crater falls between geographic co-ordinates $25^0$20'16.0008" N $76^0$37'28.9992" E with diameter ~3.2 km is situated in Village Ramgarh, Tehsil Kishanganj, District Baran, Rajasthan, India (RAJASTHAN GAZZETTE March 19, 2024: Department of Environment and Climate Change, Notification Jaipur, 16 March, 2024). Bryophytes diversity observed and identified during January 2024 to August 2025. Samples were collected from temple walls, rocky surfaces and tree bases in a shaded Ramgarh Impact Crater. Devices like- hand Lens, knife, Mobile phone Camera, Plastic bags used for Bryophytes collection and other plant survey essentials are used during the study and field work. Both macroscopic and microscopic examinations were performed. During Field Observation external features such as colour, growth pattern, and habitat and microscopic studies of thalli and leaf structure, cell arrangement was examined. Identification is based on related literature https://www.britishbryologicalsociety.org.uk/ and floras and by help of expert.

RESULT AND DISCUSSION

Riccia cavernosa Mitt. ((common name – Crystal-wort) family- Ricciaceae) observed in Pushkar Talab Complex moist area in Ramgarh Impact Crater. *Cyathodium* Kunze sp. (Liverwort), *Fissidens flaccidus* Mitt. (Moss) are found with Pteridophytes - *Actiniopteris radiata* (Sw.) Link, *Adiantum caudatum* L. *Cyathodium* Kunze sp. represents a simple liverwort, commonly found in tropical and subtropical regions. Its thalloid form aids in moisture absorption and gas exchange. *Fissidens flaccidus* Mitt. shows the characteristic moss features such as leafy shoots and leaf arrangement patterns. The unique leaf structure helps identify the genus *Fissidens.* Before it five moss species was recorded in Rajasthan desert namely *Gymnostomiella veronicosa* (Hook.) Fleisch., *Tortula muralis* Hedw., *Hyophila involuta* (Hook.) Jaeger., *Semibarbula orientalis* (Web.) Wijk. & Marg. and *Fissidens flaccidus*

Mitt. (Deora & Deora, 2017). In mount Abu, Rajasthan 113 bryophytes taxa were listed, in these 24 taxa as new to the Mount Abu area. Out of these, 14 are new records to Rajasthan, while 07 taxa are new to Central Indian bryo-geographical region (Ojha, 2022). These species exhibit adaptations to moist, shaded environments, indicating their preference for high-humidity microclimates. Table 1. showing the bryophytes with their location.

Table: 1. Distribution range of Bryo-flora in Ramgarh Impact Crater-

S. No.	Name of Bryophytes	Family	Locality
1.	*Riccia cavernosa* Mitt.	Ricciaceae	Mudy area of Phuskar Talab Complex (Lake in Ramgarh Impact Crater)
2.	*Fissidens flaccidus* Mitt.	Fissidentaceae	Wall of temple, rocky area in Ramgarh Impact Crater
3.	*Cyathodium* Kunze	Cyathodiaceae	Wall of temple and rocky region of south-west opening area in Ramgarh Impact Crater
4.	*Notothylas orbicularis* (Schwein.) Sull.	Notothyladaceae	Wall of temple in Ramgarh Impact Crater

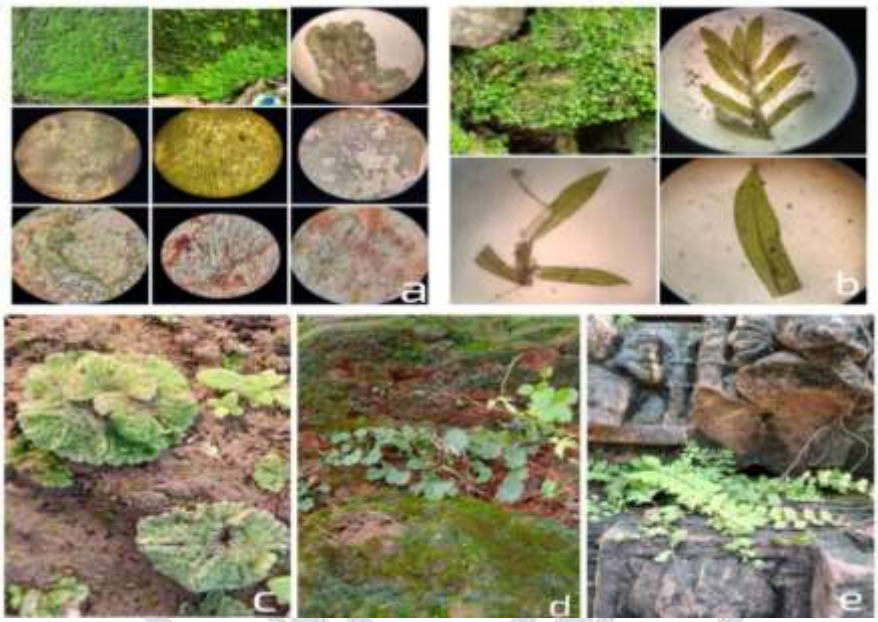

Fig. 1. Identified Bryophytes and pteridophytes present in Ramgarh Impact Crater, a. *Cyathodium* sp., b. *Fissidens flaccidus* Mitt., c. *Riccia cavernosa* Mitt., d. *Actiniopteris radiata* (Sw.) Link, e. *Adiantum caudatum* L.

CONCLUSION

During the study 4 species of Bryophytes were identify which belongs to 4 families (Table 1.). When *Cyathodium* Kunze present on rocky area it's found with *Fissidens flaccidus* Mitt and *Actiniopteris radiata* (Sw.) Link (Pteridophytes), *Adiantum caudatum* L. (Pteridophytes). *Cyathodium* Kunze also present on the temple wall's lower part in a population. *Riccia cavernosa* Mitt. present in Pushkar Talab Complex after the residue water in mudy region. *Notothylas orbicularis* (Schwein.) Sull. present on the temple steps, its found in single circular patches and rarely found. The study confirms the identification of the collected bryophytes, their morphological and anatomical traits contribute to understanding the diversity and ecological function of bryophytes in Ramgarh Impact Crater ecosystems.

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