IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

"Identification And External Morphological Variation Of Moss Flora From Four Selected Sites Of Ranchi District, Jharkhand"

Anish Maiti [1], Agatha Sylvia Khalkho[2]

[1] University Department of Botany, Ranchi University, Ranchi.

[2] Department of Botany, Marwari College, Ranchi.

Abstract

Mosses (Bryophytes) are sensitive indicators of environmental variation due to their dependence on moisture, shade, substrate, and microclimatic conditions. Ranchi district of Jharkhand represents a mosaic of ecological habitats; however, bryophyte diversity in the region remains insufficiently explored. This study investigates the identification and external morphological variation of mosses collected from four distinct habitats: two from urban road side area and two from forest area. Moss samples were collected to identify and are examined for key morphological characters such as growth form, leaf architecture, colour, seta/capsule features, and substrate specificity. To study the external morphological response of moss during three seasons (summer, rainy, and winter) at four different locations for a period of one year. A total of four moss species belonging to three families were recorded. Species richness was highest in the moist riparian habitat and lowest in the urban habitat. Significant morphological plasticity was observed in species such as *Entosthodon buseanus* and *Funaria hygrometrica*, reflecting environmental stress gradients. The study highlights strong habitat influence on external morphology and underscores the importance of microhabitat conservation for maintaining regional bryophyte diversity.

Keywords: Mosses, Bryophytes, Morphology, Habitat variation, Species identification

INTRODUCTION

Mosses are classified under bryophytes, are among the most ancient land plants and are renowned for their simplicity and lack of vascular tissues. Found across diverse habitats, mosses have persisted for millions of years, pioneering the colonization of terrestrial environments and shaping the foundation for plant ecosystem[1]. Mosses act as ecosystem engineers, establishing soil on bare rocks and other inhospitable surfaces by promoting weathering and decomposition of organic matter. Their dense mats regulate soil moisture, prevent erosion, and buffer temperature extremes, enhancing biodiversity and soil health. Mosses influence nutrient cycling, sequester carbon dioxide on a global scale, and help control pathogens, supporting the health and resilience of surrounding plant communities.

Due to their structural simplicity and lack of true roots or vessels, mosses absorb water and nutrients directly from their environment and therefore respond rapidly to fluctuations in moisture, light, temperature, and atmospheric pollutants. Their sensitivity makes them vital bio-indicators for monitoring ecological health and the effects of environmental change[2].

Despite the ecological importance of mosses, Ranchi district of Jharkhand remains poorly studied with respect to bryoflora, although the region hosts diverse microhabitats ranging from forest patches to rocky uplands and moist valleys. Understanding species composition and morphological responses across different habitats is crucial for biodiversity documentation and conservation planning.

This study aims to provide a comparative analysis of mosses from four different habitats of Ranchi district and evaluate variations in their external morphological characters in response to environmental differences.

MATERIAL & METHODS

Study Sites

Ranchi district has been chosen as study area. Ranchi district, is an important administrative and industrial centre in the state. It is connected through NH-33 and NH-23 and adjoining districts are Ramgarh & Hazaribagh in the North, Gumla and Latehar in the West, Purulia (West Bengal) in the East and Saraikela Kharsawan in the South. The average altitude of Ranchi is 600 meters above the sea level with undulating land features. The district experiences pleasant climatic conditions as relative humidity remains low, so the summer season is also not uncongenial. December is the coldest month with minimum temperature of 10.3°C and May is the hottest month with maximum temperature of 37.2°C. Average annual rainfall of the district is 1,375 mm and more than 80 percent precipitation is received during monsoon months. The district is surrounded by a large & green forest area, which provides many basic raw materials to a large number of industries. Due to the presence of natural and mineral resources the district has been seen as a good place for setting up medium and large-scale industries.

Four ecologically distinct habitats in Ranchi district were selected from where moss samples were collected to identify and external morphological changes were recorded. Two are from urban roadside area and two are from forest area. Moss samples were collected and subsequently examined from four locations:

- **Dhurwa (Urban roadside)** – 23.317919°N, 85.279703°E
- **Bajra, Itki Road (Urban roadside)** – 23.371476°N, 85.260686°E
- **Horhap Forest Area** – 23.333849°N, 85.464409°E
- **Churni Waterfall Forest Area** – 23.363005°N, 85.491264°E

Sampling Procedure

Two moss samples collected and externally examined from urban roadside areas and two samples collected from forest areas one from a waterfall site and another from a riverbank were studied. To enable comparison of data from the present survey with previous surveys, mosses were sampled from the same locations used in earlier studies. For identification, the moss samples were collected from the surfaces of rocks and tree trunk by scraping with a hand hoe and stored in tightly sealed boxes. The locality information, including GPS coordinates of each sampling site, was also recorded.

External morphological analysis

External morphological changes in the moss of the selected areas were examined seasonally over a one-year period, with observations conducted in each of the three seasons (summer, rainy and winter).

RESULTS & DISCUSSION

Identification of Moss samples

Four different moss specie were identified in the collected samples from four different areas of Ranchi district:

Entosthodon buseanus- These are small, delicate moss species in the family Funariaceae**.** It typically grows on bare or disturbed soil, such as banks, paths, or open ground where competition from larger plants is low.

It is characterized by short, light brown to greenish stems. Numerous rhizoids that help anchor it to soil. The sporophyte of the moss *Entosthodon buseanus* is characterized by its long seta and a distinct capsule. Seta is longer, straight, and typically smooth, supporting the capsule above the plant body. Shape of the capsule is Obovoid or broadly pyriform (pear-shaped to inversed egg-shaped).

Plagiothecium nemorale- It is a moderately robust plant with flattened shoots and more or less symmetrical leaves that have a short double nerve, and it is generally dull green in colour. The leaves are 2 - 3.2 mm long, egg shaped to narrowly egg shaped. Capsules are occasionally produced.

It is also known as Woodsy Silk-moss. Found mostly on tree bases, able to grow in a wide range of condition[3].

Fissidens crenulatus- These are small also known as pocket moss in the family Fissidentaceae, known for its distinctive two ranked leaves that look like tiny, paired wings, growing typically on rocks. green to yellowish-green plants, often 2-4 mm tall. Leaves are lanceolate to oblong- lanceolate, 1.0- 1.8mm long[4].

Funaria hygrometrica- Also known as bonfire moss. These are a type of water moss which grows on shady, moist soil.

The plant body is green, soft and upright, about half an inch tall. They have oblique septa. The main axis of the plant, which is upright, bears a set of spirally arranged, sessile leaves having a clearly distinguishable midrib. The leaves are usually medium green, semi-transparent and hair less. The leafy stem terminates in a long slender stalk (seta) with a spore bearing capsule. The stalk is 20-50mm long, light green (immature) to red (mature). The stalk has a tendency to nod and bend from the weight of the spore bearing capsule. Immature capsules are 2- 3.5mm long, light green, oblanceoloid- obovoid in shape, slightly curved[5].

Table 1: Identification of Mosses.

Scientific Name	**Family**
Entosthodon buseanus Dozy & Molk.	Funariaceae
Plagiothecium nemorale (Mitt.) A.Jaeger	Plagiotheciaceae
Fissidens crenulatus Mitt.	Fissidentaceae
Funaria hygrometrica Hedw.	Funariaceae

Source: Botanical Survey of India, Central National Herbarium

CNH/Tech.11/2025/59

Plagiothecium nemorale and *Fissidens crenulatus* were identified from the Horhap (23.333849° N and 85.464409° E) and Churni waterfall (23.363005° N and 85.491264° E) forest areas, whereas *Entosthodon buseanus* and *Funaria hygrometrica* were recorded from the urban roadside areas of Dhurwa (23.317919° N and 85.279703° E) and Bajra, Itki road (23.371476° N and 85.260686° E).

External Morphological Change of Exposed Moss towards environmental condition.

External Morphological observations were conducted to assess external morphological variations resulting from environmental changes across the study locations. These observations were carried out over three seasons within a one-year period.

The conditions of the moss in each study location across the different seasons are summarized as follows:

Horhap forest area (23.333849° N and 85.464409° E)

- Summer Season: The mosses appeared greenish in colour but showed a weak and droopy (flaccid) condition.
- Rainy Season: The mosses appeared healthy and vibrant, with a bright green colour and a flourishing growth pattern. Looked like a carpet form.
- Winter Season: The mosses remained greenish but exhibited a flaccid and less vigorous dull appearance.

Churni waterfall forest area (23.363005° N and 85.491264° E)

- Summer Season: The mosses were lively green but sparsely distributed.
- Rainy Season: The mosses displayed a healthy, vigorous condition, characterised by a bright green colouration and robust, flourishing growth. Looked like a cushion form.
- Winter Season: The mosses retained their greenish colouration but showed a flaccid and reduced-vigour condition.

Dhurwa road side urban area (23.317919° N and 85.279703° E)

- Summer Season: The mosses dry out. The moss colour changed from greenish to brownish green.
- Rainy Season: With the return of favourable moisture conditions, mosses rapidly rehydrate and resume active growth and reproduction. The dried gametophyte tissue quickly absorbs water and becomes green and turgid. The resulting diploid zygote develops into the sporophyte (stalk and capsule), which grows attached to the gametophyte.

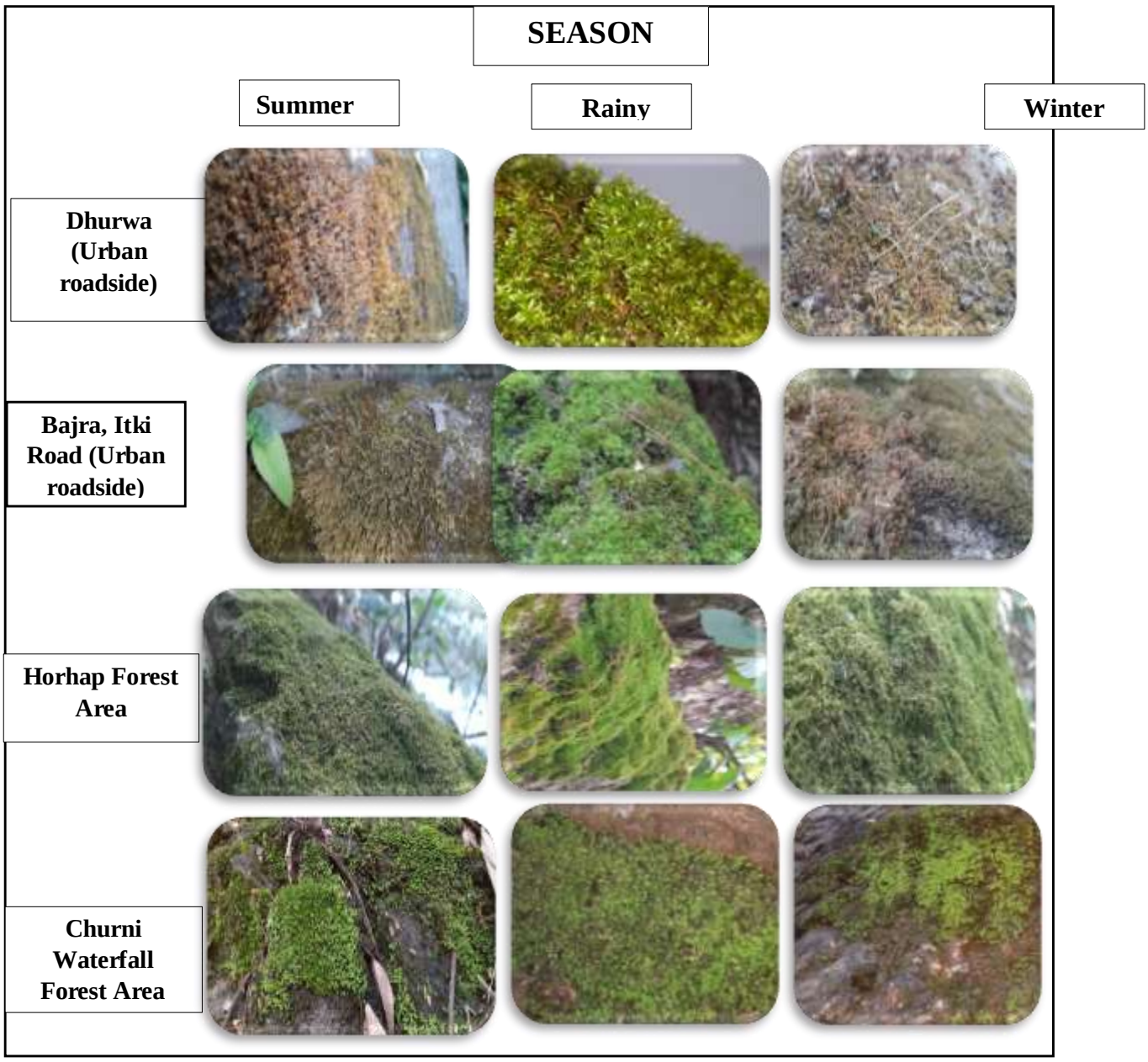
- Winter Season: Mosses undergo noticeable external morphological changes due to environmental stress, particularly cold and reduced water availability. The most apparent changes involve colour loss (greener tissues turning brownish and dull), reduced leaf turgidity (leaves becoming less plump), and shrinkage and curling of leaves.

Bajra, Itki road. Road side urban area (23.371476° N and 85.260686° E)

- Summer Season: The green colour fades to brownish green. Leaves gets curl upward.
- Rainy Season: Curled leaves absorbed water, swell, and spread away wide open to maximize surface area for light interception and photosynthesis. The vibrant green colour returns and plans looks like rehydrated and metabolic activity (like photosynthesis) resumes. Sporophyte (stalk and capsule), which grows attached to the gametophyte during the rainy season also looks green in colour.

- Winter Season: Under environmental stress especially low temperatures and limited water mosses undergo marked external morphological alterations. These typically manifest as diminished pigmentation, with formerly green tissues turning brown and dull, alongside reduced leaf turgor and pronounced leaf shrinkage and curling. Sporophytes also become brownish in colour.

Table 2: Seasonal External Morphological Changes in Mosses across study locations.



Discussion

The study demonstrates strong microhabitat-driven morphological variation in mosses. Moisture availability emerged as the most influential factor governing both species richness and morphological plasticity.

Urban habitats, characterized by pollution, heat, and low moisture, showed reduced moss diversity and stressed morphology, especially in *Entosthodon buseanus* and *Funaria hygrometrica*. Rocky hill slopes exhibited adaptations to xeric conditions, including reduced leaf size and cushion-like growth.

Forest habitats maintained moderate diversity but showed adaptations to lower light and higher humidity, such as broader leaves in *Plagiothecium nemorale* and *Fissidens crenulatus* species. Riparian habitats, due to constant moisture, promoted larger leaf sizes, bright coloration, and prolific sporophyte production.

These findings align with global patterns where moss morphology correlates with humidity, substrate stability, and light availability. The study reinforces the ecological sensitivity of bryophytes and their potential as microhabitat indicators in tropical regions like Ranchi.

CONCLUSION

This study documents the diversity and morphological variation of mosses across four distinct habitats of Ranchi district. Results show:

- Riparian zone supports highest moss diversity.
- Urban environment is least favorable for moss growth.
- Moss morphology varies significantly with moisture, light, and substrate.
- Species like *Entosthodon buseanus* and *Funaria hygrometrica* show high morphological plasticity.

The findings contribute new baseline data for bryophyte diversity in Ranchi and highlight the importance of conserving microhabitats that support moss communities.

ACKNOWLEDGEMENT

The authors like to thanks the Head of the Department, University of Botany, Ranchi University, Ranchi for support and guidance.

REFERENCES

1. K*enrick, P., Wellman, C.H., Schneider, H. and Edgecombe, G.D. (2012)* "A timeline for terrestrialization: consequences for the carbon cycle in the Palaeozoic" Philosophical transactions of the Royal Society of London. Series B, Biological sciences, 367: 519-536.

2. *Tremper, A.H., Agnet a, M., Burton, S. Higgs, D. E. (2004)* "Field and laboratory exposures of two moss species to low level metal pollution" Journal of Atmospheric Chemistry 49 : 111-120.

3. www.britishbryologicalsociety.org.uk/content/uploads/2020/12/Plagiothecium-succulentum-nemorale.pdf

4. *N.Wallich*; holo: NY Mitt., J. Proc. Linn. Soc., Suppl. 1: 140 (1859).

5. https://www.illinoiswildflowers.info/mosses/plants/bonfire_moss.html

6. *Radziemska et al., (2019)* "Using mosses as bioindicators of potentially toxic element contamination in ecologically valuable areas located in the vicinity of a road: a case study" Int. J. Environ. Res. Public Health.

7. *Md Yatim, N., & Azman, N. I. A. (2021*) "Moss as bio-indicator for air quality monitoring at different air quality environment" Int. J. Eng. Adv. Technol., pp. 43-47.

8. *Świsłowski, P.; Vergel, K.; Zinicovscaia, I.; Rajfur, M.; Wacławek, M. (2022)* "Mosses as a Biomonitor to Identify Elements Released into the Air as a Result of Car Workshop Activities". Ecol. Indic. 138, 108849.