



Specific Features and Ecological Significance of Mosses

Nagmetullaev Marat*

Karakalpak State University

DOI:

<https://doi.org/10.47134/jees.v2i2.635>

*Correspondence: Nagmetullaev Marat

Email: marat@gmail.com

Received: 11-12-2024

Accepted: 18-01-2025

Published: 25-02-2025



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Abstract: This article examines the role of mosses (Bryophyta) in the ecological system, their chemical composition, and potential uses. The main goal of the research is to determine the role of mosses in ensuring environmental sustainability and to assess the possibilities of their use as bioindicators. Methodologically, methods of literature analysis, empirical research, laboratory experiments, and statistical analysis were used. The research results showed the influence of mosses on soil formation, moisture retention properties, and the possibility of their use in industry. The practical significance lies in the fact that mosses can be used as bioindicators in environmental monitoring systems, as well as in the fields of pharmaceuticals and biotechnology.

Keywords: Mosses, Bryophyta, Lower Plants, Ecology, Bioindicator, Biopolymers

Introduction

Environmental pollution and climate change are among the global problems, and the issue of sustainable preservation of natural ecosystems is relevant. In this process, mosses play an important role, actively participating in soil formation and environmental monitoring (Smith, 2004). Also, mosses are an integral part of the ecosystem, which participates in moisture retention, regulation of biogeochemical cycles, and the creation of a habitat for organisms. Therefore, it is necessary to deeply study their ecological significance and conduct a scientifically based analysis.

A number of scientific studies have been conducted on mosses and their ecological significance. The studies of Gignac (2001) provide information on the sensitivity of mosses to climate change and their significance as a bioindicator. Glime (2007) studied the role of mosses in hydrological systems and the processes of moisture regulation. Research conducted by Rydin and Jeglum (2013) highlighted the importance of mosses in peat areas. These studies show that mosses play an important role in ensuring environmental sustainability.

Although there are various studies on the role of mosses in the ecological system, there are still insufficient studies on their chemical composition and potential uses. In particular, the issues of its use as a bioindicator and its significance in environmental monitoring need deeper study.

The main goal of this research is to determine the place of mosses in the ecological system and to analyze the possibilities of their potential use. To achieve this goal, the following tasks have been defined:

- Analysis of the morphological and physiological characteristics of mosses;
- Studying their role in the ecosystem;
- Determination of chemical composition and potential use possibilities;
- Study of the significance of mosses as a bioindicator.

The object of this research is the role and ecological functions of mosses in various ecosystems. The subject of the research is the determination of the chemical composition, bioindicator properties, and significance of mosses in ecological systems.

Research Method

The following approaches were used as the research methodology:

Literature Analysis

Existing scientific articles, books, and electronic sources were studied, and data on the biological and ecological characteristics of mosses were collected.

Empirical Research

Geobotanical studies were conducted to determine the role of mosses in ecological systems and their significance as bioindicators. Data on the composition and distribution of mosses in various media were collected and analyzed.

Experimental methods

The chemical composition of mosses was analyzed in laboratory conditions. In this process, spectrophotometric and chromatographic methods were used.

Data Analysis

The obtained results were processed using statistical methods, and scientific conclusions were drawn on the ecological significance of mosses.

Result and Discussion

As a result of experimental studies, the following properties of mosses were revealed:

- Moisture retention capacity - it was found that mosses have the ability to retain water up to 20-30 times their mass.
- Influence on soil formation - an acceleration of the decomposition of organic matter was observed as a result of the appearance of mosses on the soil surface.
- Sensitivity to air pollution - high levels of heavy metals (Pb, Cd) were detected in mosses growing near industrial areas.

The ability of mosses as bioindicators was assessed based on laboratory analyses. According to the results, an increase in the concentration of harmful substances in the leaf tissues of mosses was observed in areas with a high level of air pollution. This confirms that

they will be an effective tool in the environmental monitoring system.

It has been established that polysaccharides and phenolic compounds isolated from mosses are promising for use in the pharmaceutical and cosmetic industries. As a result of special tests, it was noted that moss extracts have antibacterial and anti-inflammatory effects.

Discussions

The research results show that mosses play an important role in ensuring the stability of the ecosystem. Their properties, such as soil formation, moisture retention, and accumulation of heavy metals, prove that they can be an effective tool for environmental monitoring.

The importance of mosses as a bioindicator is very high. During the study, the chemical composition of samples taken from contaminated and relatively clean areas was analyzed. The results showed that the content of fluorescent substances, lead, and cadmium in mosses growing in areas with increased accumulation of industrial waste and heavy metals in the atmosphere increased. This proves that they can be used in environmental monitoring systems.

Also, the chemical composition of mosses and their richness in biologically active substances, such as biopolymers and polysaccharides, make it possible to widely use them in the fields of pharmaceuticals, cosmetics, and biotechnology. The research results confirmed the antibacterial and anti-inflammatory properties of moss extracts. This indicates their potential application in medicine and pharmaceuticals.

The moisture-retaining and hygroscopic properties of mosses can also be applied in agroecological processes. In arid regions, there are prospects for their use as a natural moisture-retaining material to support plant development and reduce soil erosion.

Future research should be aimed at a deeper study of the stability of mosses in various ecological conditions, their biological and biochemical properties. In particular, their further study in the pharmaceutical industry and use as a new indicator for environmental monitoring is of scientific and practical importance.

Conclusion

Mosses are an important component of the ecosystem, and their ecological functions, bioindicator properties, and chemical composition are of great scientific importance. According to the research results, mosses play an important role as a biological indicator of soil formation, moisture retention, and air pollution. The polysaccharides and phenolic compounds contained in them can be promising raw materials in the pharmaceutical and cosmetic industries.

Practically, mosses serve as an effective tool for assessing air and soil pollution in environmental monitoring. Also, their hygroscopic properties help support plant growth in arid regions. In the future, the widespread study of mosses within the framework of ecological and biotechnological research is of great importance.

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