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Review Article

BIO-PROSPECTING OF NATURAL RESOURCES: ROLE OF MEDICINAL PLANTS IN ASSAM

Bonani Saikia [1*]
[1] Assistant Professor, Department of Zoology, Joya Gogoi College (Government of Assam), Khumtai 785619, India

ABSTRACT

Bio prospecting in Assam, celebrated for its abundant biodiversity, entails the exploration and sustainable use of natural resources for both economic and scientific progress. This involves identifying and extracting valuable compounds from diverse sources such as plants, microbes, and insects. Non-timber forest products (NTFPs) in Assam, including medicinal plants, edible forest products, spices, and herbal dyes, are vital for the healthcare and livelihoods of local communities. Furthermore, the region's mineral resources, like coal, petroleum, and natural gas, play a significant role in its economy. However, it is crucial to exploit these resources sustainably and scientifically to avoid ecological imbalance and ensure long-term benefits.

Significantly, Assam boasts a rich diversity of medicinal plants, extensively utilized in traditional medicine by local indigenous communities. These plants play a vital role in bio-prospecting initiatives, given their potential to produce new pharmaceuticals and therapeutic substances. We shall delve deeper to look into understanding the ecology and different other aspects of such traditional methods paving new paths for bio-prospecting.

This paper underscores the potential of Assam's natural resources in fostering the role of medicinal plants in Assam, highlighting their importance in traditional medicine, the ongoing bio-prospecting efforts, and the economic and social impacts of these activities.

Keywords: Bio prospecting, Medicinal plants, Healthcare, etc.

INTRODUCTION

Assam, located in India's northeastern region, is celebrated for its rich biodiversity and plentiful natural resources. Its medicinal plants, in particular, offer significant potential for bio-prospecting—the search for commercially valuable genetic and biochemical properties in natural resources. Sharma (n.d.). The indigenous communities in Assam possess traditional knowledge, combined with the area's diverse plant life; there lies a unique opportunity to uncover new compounds that could transform modern medicine. For centuries, medicinal plants have been central to Assam's culture and healing traditions, serving roles in both traditional remedies and modern pharmaceuticals. Assam's lush forests are filled with a wide variety of plant species, many of which remain unexplored for their medicinal benefits. Indigenous Insights (n.d.). Bio-prospecting these plants entails identifying, gathering, and analyzing their compounds to potentially develop new drugs and treatments for various illnesses. "Bio-prospecting thus implicates a methodical investigation into the diverse array of natural biological resources, encompassing flora, fauna, microorganisms, and their genetic constituents, to uncover novel and valuable compounds, genetic material, or biological elements. These discoveries often hold immense potential for applications in industries such as pharmaceuticals, agriculture, cosmetics, and biotechnology. The process

*Corresponding Author:
Email address: Bonani Saikia (saikiabonani@gmail.com)

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Transparency: The authors affirm that this manuscript presents an honest, accurate, and transparent account of the study. All essential aspects have been included, and any deviations from the original study plan have been clearly explained. The writing process strictly adhered to established ethical standards.
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frequently draws upon the rich repository of indigenous knowledge, which offers crucial insights into the traditional uses and significance of these biological assets." Laird and Wynberg (2008).

Medicinal plants play a vital role in Assam's bio-prospecting initiatives, aligning with the worldwide pursuit of sustainable, eco-friendly health solutions. Utilizing this natural resource, Assam has the potential to aid in discovering new medicines, bolster conservation efforts, and encourage the sustainable use of its biodiversity. In this regard, recognizing the importance of medicinal plants in Assam's bio-prospecting efforts is essential not only for scientific and commercial progress but also for safeguarding the traditional knowledge and practices of local communities.

The bio-prospecting of natural resources, with a focus on medicinal plants in Assam, is a captivating and crucial area of study. Located in northeastern India, Assam is known for its rich biodiversity and unique flora and is home to over 500 species of medicinal plants, which are used by indigenous communities in their traditional healthcare systems. Indigenous Insights (n.d.). For hundreds of years, these plants have been used to treat various ailments, ranging from the common cold to more serious diseases. The process of bio-prospecting therefore receives examining these natural resources to identify new compounds that could be harnessed for contemporary medicine. This endeavor not only aids in the creation of new pharmaceuticals but also fosters the preservation of biodiversity and the responsible use of natural resources. The traditional wisdom of the local tribes is vital in this process, as they possess extensive knowledge about the medicinal qualities of these plants. A major challenge in bio-prospecting is recording and safeguarding this traditional knowledge before it vanishes due to modernization and deforestation. Systematic efforts are underway to research and catalog the medicinal plants of Assam, their applications, and the tribes that utilize them. This data is essential for future scientific research and the creation of new medical treatments. For instance, an insightful study featured in the American Journal of Ethno medicine delved into the rich traditional knowledge of the Garo community in Meghalaya. The research meticulously cataloged the ethno medicinal plants utilized by this indigenous group, shedding light on their profound understanding of natural remedies. This exploration not only underscores the community's deep connection with their environment but also enriches the broader discourse on indigenous healthcare systems and their relevance to contemporary medical practices. Bain and Biswas (2021). Similarly, in a recent publication in the International Journal of Herbal Medicine, an insightful study explored the rich tapestry of ethno medicinal plants utilized by the tribes of Dhemaji district, Assam. The research eloquently emphasized the critical need to preserve and document traditional knowledge, highlighting its invaluable potential in advancing contemporary healthcare practices. Gogoi et al. (2019)

Traditional medicinal knowledge is connected to communities' histories, environments, and everyday healthcare practices. A review of 12 earlier studies from Dima Hasao and Karbi Anglong documented 273 ethnomedicinal species, used for a range of ailments. Begum et al. (2024). Such documentation can help identify plants for further study, while also showing why local knowledge and the people who hold it must be treated respectfully.

Further, Assam boasts an impressive spectrum of ecosystems, encompassing tropical rainforests, grasslands, wetlands, and riverine landscapes. These varied habitats nurture an exceptional diversity of species, establishing the state as a veritable treasure trove of biodiversity. Among its many natural wonders, the Kaziranga National Park—a distinguished UNESCO World Heritage Site—stands as a testament to this ecological wealth. It serves as a sanctuary for the iconic one-horned rhinoceros (Rhinoceros unicornis), alongside a myriad of other remarkable species. The state's climatic diversity, spanning tropical to subtropical zones, combined with generous rainfall, creates favorable conditions for the proliferation of over 4,000 species of flowering plants, 183 species of orchids, and an array of medicinal plants. Assam's wetlands, intricately linked to the Brahmaputra and Barak river systems, play a pivotal role in sustaining the interdependent web of aquatic and terrestrial life. Assam State Biodiversity Board (n.d.)

For generations, medicinal plants have been central to the traditional healthcare practices of Assam's indigenous tribes. These communities hold a profound understanding of the healing properties inherent in the local flora, using them to address a wide array of ailments. For example, the Deori tribe makes use of a diverse range of herbal plants, not only for medicinal purposes but also for dietary and cultural functions, underscoring the profound and enduring relationship between the people and their natural surroundings. Phukon (2024)

A number of medicinal plants indigenous to Assam are remarkable for their healing qualities. A few noteworthy among them could be, Azadirachta indica (Neem), renowned for its antimicrobial and anti-inflammatory properties, neem is widely used to treat infections, dental issues, and various skin conditions. Malick et al. (2022). Glycyrrhiza glabra (Licorice), with its long-standing use for anti-inflammatory and antimicrobial effects, licorice is traditionally employed in the treatment of respiratory and gastrointestinal ailments. Malick et al. (2022). Carica papaya (Papaya), the bioactive compounds found in papaya peels possess potent antimicrobial properties, making them effective in combating various infections. Malick et al. (2022) Curcuma longa (Turmeric), a cornerstone in both Assamese cuisine and traditional medicine, turmeric is celebrated for its anti-inflammatory and antioxidant properties, offering therapeutic benefits for a broad spectrum of health conditions. Protech Group (2023). Bacopa monnieri (Brahmi), valued for its ability to enhance memory and cognitive function, brahmi is also prized for its adaptogenic qualities, assisting in the management of stress. Protech Group (2023)

This paper therefore reviews the role of medicinal plants in bioprospecting and considers their reported contributions to healthcare, economic activity, and conservation in Assam. It is based on secondary sources and does not present new field interviews, botanical surveys, or laboratory experiments.

OBJECTIVES & METHOD OF THE STUDY

1) Role of medicinal plant in Bio-prospecting.
2) Assessing their contribution to healthcare, economy, and conservation.

METHOD/ METHODOLOGY

This paper adopts a descriptive narrative literature-review method based on secondary sources. Relevant material was drawn from peer-reviewed journal articles, review papers, books, and official government or biodiversity documents concerning medicinal plants in Assam and Northeast India. Searches focused on terms includes: 'medicinal plants of Assam,' 'ethnomedicinal plants Assam,' 'bioprospecting medicinal plants,' 'medicinal plant trade Northeast India,' and 'medicinal plant conservation.' Sources were selected for their relevance to the two objectives and for discussing traditional uses, research potential, trade, or conservation. The selected information was organized under four themes: bioprospecting, healthcare, economy, and conservation. Findings are presented as a synthesis of previously published and official information, not as new empirical results. Review-method guidance emphasizes making the sources and selection approach clear to readers.

MEDICINAL PLANTS AND BIOPROSPECTING

Medicinal plants offer an important basis for bioprospecting, as their chemical constituents may provide avenues for further scientific investigation. Traditional knowledge can guide the identification of promising species, plant parts, and preparations, thereby linking community practices with systematic research. This process may proceed from the documentation of traditional uses to botanical identification, phytochemical analysis, and laboratory testing. However, the identification of potential bioactive compounds must be followed by rigorous safety and efficacy studies before any plant-derived product can be considered for therapeutic application.

As mentioned earlier, we may note that a 2024 review of ethnomedicinal literature from Dima Hasao and Karbi Anglong documented 273 species belonging to 208 genera and 83 families. Begum et al. (2024). The findings underscore the significance of traditional knowledge as a basis for investigating bioactive compounds and identifying priorities for biodiversity conservation. Such documentation provides a foundation for future bioprospecting research, while the therapeutic claims associated with recorded remedies require independent scientific validation. The significance of medicinal plants in bioprospecting extends beyond their chemical properties to issues of botanical identification, scientific validation, sustainable resource use, and the recognition of community knowledge and rights. A systematic approach must distinguish between traditional medicinal claims, laboratory-based findings, and clinically established effects, as each represents a distinct level of scientific evidence.

CONTRIBUTION TO HEALTHCARE

Medicinal plants have long constituted an integral component of healthcare traditions in Assam, reflecting the intimate relationship between local communities and the region's rich ecological resources. The state's biodiversity records underscore the continued relevance of these plants in both indigenous healing systems and contemporary medical practices. Ethnobotanical research conducted across different parts of Assam further reveals the persistence of plant-based therapeutic knowledge among diverse communities. Studies focusing on districts such as Dima Hasao and Karbi Anglong, for instance, document an extensive repertoire of medicinal flora employed in the treatment of a wide range of ailments, highlighting the enduring significance of traditional knowledge in local healthcare practices. Assam State Biodiversity Board (n.d.)

Medicinal plants must be understood within the context of local knowledge systems and healthcare practices, without equating reported traditional uses with scientifically established therapeutic efficacy. Their documentation in ethnobotanical studies provides a basis for further investigation while underscoring the need for scientific validation. Such documentation may also contribute to preserving knowledge at risk of decline. However, the academic and commercial use of community knowledge necessitates due consideration of consent, attribution, access, and equitable benefit-sharing, making these concerns integral to responsible research.

ECONOMIC IMPORTANCE

Medicinal plants hold considerable economic significance through their collection, cultivation, processing, and commercial utilization. A 2023 review identified 37 medicinal plant species in Northeast India with national and international trade importance. However, the continued dependence on wild harvesting, coupled with inadequate quality-control infrastructure and limited sustainable cultivation, raises concerns about the long-term viability of these resources and the livelihoods dependent upon them. Borah et al. (2023)

These regional findings point towards the potential economic significance of medicinal plants for Assam, although it would be inappropriate to assume that every species documented in the literature currently generates income within the state. The available

sources support a more measured assessment: medicinal plants may create opportunities for livelihoods and enterprise, but the realisation of these benefits depends on cultivation, sustainable supply, processing capacity, market access, and product quality.

Economic value must also be examined in relation to the questions of control over biological resources and the distribution of benefits. Where commercial products are developed using biological resources or associated traditional knowledge, fair and transparent benefit-sharing assumes particular ethical significance. The Convention on Biological Diversity's Nagoya Protocol addresses access to genetic resources and the fair and equitable sharing of benefits arising from their utilisation, including relevant associated traditional knowledge. Laird and Wynberg (2008)

CONSERVATION

The sustainability of bioprospecting is closely linked to the continued availability of biological resources. Unregulated extraction of commercially valuable medicinal plants may place increasing pressure on wild populations and their habitats. The Northeast India trade review, which highlights the dependence on wild harvesting and the need for sustainable collection and cultivation, underscores the importance of integrating conservation with the commercial utilization of medicinal plants. Dutta et al. (2023) Conservation measures discussed in the literature include sustainable harvesting, cultivation of commercially demanded species, protection of habitats, and maintaining accurate records of plant identity and use. Such measures can help reduce pressure on wild populations and support a more dependable supply. The Assam government's documentation of medicinal-plant diversity provides a useful state-level context, though further species-specific evidence would be needed to assess the conservation status of each plant. Assam State Biodiversity Board (n.d.)

Conservation extends beyond the protection of biological resources to include the preservation of traditional knowledge and recognition of the communities that sustain it. Bioprospecting must therefore be understood within the interrelationship between plants, local knowledge systems, community rights, and the ecosystems in which these resources are embedded. Sikarwar (2026)

RESULTS AND DISCUSSION

The literature reviewed establishes the interconnected scientific, social, economic, and ecological significance of medicinal plants in Assam. Their reported traditional uses provide a basis for formulating research questions and identifying species for further scientific investigation. The documented diversity of ethnomedicinal plants in Assam, alongside the wider commercial significance of medicinal plants in Northeast India, reinforces the need for systematic research and careful documentation. Sikarwar (2025)

At the same time, the available literature calls for a cautious interpretation of the evidence. Traditional medicinal use cannot, by itself, establish clinical efficacy; regional trade findings do not necessarily demonstrate species-specific economic benefits in Assam; and the number of medicinal plant species documented does not determine the conservation status of each species. Bioprospecting must therefore be approached through a balanced assessment in which research potential is explored while claims concerning efficacy, profitability, and sustainability remain grounded in evidence specific to the species and context.

For Assam, a responsible framework for bioprospecting would bring documented traditional knowledge into dialogue with botanical and pharmacological research, while incorporating sustainable cultivation, biodiversity conservation, and equitable benefit-sharing. Such an approach situates medicinal plants not merely as potential commercial commodities, but as biological resources embedded in local healthcare practices, community livelihoods, and ecological systems.

CONCLUSION

Medicinal plants constitute an important resource for bioprospecting, offering avenues for investigating plant-derived compounds and products. In Assam, official records and published reviews highlight considerable medicinal-plant diversity and a rich body of ethnomedicinal knowledge. Their significance extends to traditional healthcare and potential economic activity, although dependence on wild harvesting and inadequate cultivation and quality-control systems present important challenges.

Bioprospecting in Assam must therefore be understood as a potential pathway to scientific and economic development rather than a guaranteed outcome. Its long-term significance depends on scientific validation, the conservation of species and habitats, sustainable resource management, and the recognition of community knowledge and rights. An integrated approach is essential to ensure that the utilisation of medicinal plants advances research and livelihoods without undermining the biological resources and traditional knowledge on which it depends.

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