



From Wetlands to Wellness: Medicinal Potential of Aquatic Plants in Dimoria, Assam

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Abstract

Aquatic plants constitute an essential component of wetland ecosystems and have long been associated with traditional healthcare systems across the world, particularly in biodiversity-rich regions such as Northeast India. These plants play a dual role by contributing to ecological stability while also serving as valuable resources for medicinal applications. The Dimoria region of Sonapur in Assam is characterized by a complex network of wetlands, seasonal water bodies, floodplains, and marshy landscapes that provide suitable ecological niches for a wide range of aquatic and semi-aquatic plant species. These ecosystems support not only plant diversity but also sustain the livelihoods and healthcare practices of local communities who depend heavily on natural resources. The utilization of aquatic plants for medicinal purposes is deeply rooted in indigenous knowledge systems that have evolved through centuries of interaction between humans and their environment.

The present study aims to systematically document the diversity of aquatic plants in Dimoria and to analyse their medicinal uses through a combination of field surveys, ethnobotanical investigations, and extensive literature review. The study recorded a total of 30 aquatic and semi-aquatic plant species belonging to multiple botanical families, indicating a rich diversity within a relatively localized geographical area. These plants are traditionally used for the treatment of a wide range of ailments, including skin diseases, digestive disorders, liver problems, fever, infections, and inflammatory conditions. The findings reveal that the highest proportion of plant usage is associated with dermatological and gastrointestinal conditions, suggesting a strong reliance on plant-based remedies for common health issues in rural settings.

Furthermore, scientific validation from existing literature supports many of these traditional uses, confirming that these plants contain bioactive compounds such as flavonoids, alkaloids, tannins, and phenolic substances that contribute to their pharmacological properties. These compounds are known to exhibit antimicrobial, antioxidant, anti-inflammatory, and hepatoprotective activities, thereby enhancing the therapeutic potential of aquatic flora.



However, despite their ecological and medicinal significance, aquatic plant populations in the region are increasingly threatened by environmental degradation, pollution, habitat loss, and rapid urban expansion. Such pressures not only endanger biodiversity but also risk the erosion of valuable traditional knowledge systems. Therefore, this study emphasizes the urgent need for conservation and sustainable utilization of aquatic plant resources, while also highlighting the importance of integrating traditional ethnobotanical knowledge with modern scientific research for future healthcare development.

Introduction

Aquatic plants, commonly referred to as macrophytes, are plant species that grow in or near water bodies and are specially adapted to aquatic environments such as ponds, lakes, rivers, wetlands, and marshes. These plants can be broadly classified into submerged, floating, and emergent categories based on their growth habit and interaction with water. Submerged plants grow entirely under water, floating plants remain on the water surface, and emergent plants are rooted in waterlogged soil but extend above the water surface. This classification reflects their ecological adaptations and functional roles within aquatic ecosystems. Aquatic plants play a critical role in maintaining ecological balance by regulating nutrient cycles, improving water quality through filtration and absorption of pollutants, stabilizing sediments, and providing habitat and food for a wide range of aquatic organisms including fish, insects, and microorganisms. Their presence contributes significantly to ecosystem productivity and resilience.

Beyond their ecological functions, aquatic plants have gained recognition for their medicinal value and are widely used in traditional healthcare systems across different cultures. Many aquatic plants possess bioactive compounds that exhibit therapeutic properties, making them valuable resources for ethnomedicine as well as modern pharmacological research. Studies have shown that aquatic plants contain compounds such as flavonoids, alkaloids, glycosides, and essential oils that contribute to their antimicrobial, antioxidant, anti-inflammatory, and hepatoprotective activities (Chambers et al., 2008). These properties have made them an important component of traditional medicine systems such as Ayurveda, Unani, and folk medicine.

India, particularly the northeastern region, is recognized as one of the global biodiversity hotspots due to its unique geographical location, varied topography, and favorable climatic conditions. Assam, with its extensive network of rivers, floodplains, wetlands, and beels, provides an ideal environment for the growth of aquatic vegetation. The wetlands of Assam are rich in plant diversity and support numerous species of aquatic macrophytes that are utilized by local communities for food, fodder, and medicine. Ethnobotanical studies conducted in different parts of Assam have documented the use of aquatic plants in treating a wide range of diseases including jaundice, skin infections, digestive disorders, respiratory ailments, and fever (Saikia et al., 2006). These studies highlight the importance of aquatic plants in traditional healthcare systems and emphasize the need for their conservation.

Dimoria, located in the Kamrup (Metro) district of Assam, represents a unique ecological landscape characterized by wetlands, low-lying areas, and seasonal water bodies. The region is inhabited by diverse communities, including tribal populations, who maintain a close relationship with their natural environment. These communities rely on locally available plant resources for their daily needs, including healthcare. Traditional knowledge related to medicinal plants is still prevalent in the region, although it is gradually declining due to factors such as modernization, urbanization, and changing lifestyles. Plants such as *Bacopa monnieri*, *Centella asiatica*, and *Hydrocotyle sibthorpioides* are commonly used in Dimoria and have been scientifically validated for their pharmacological properties, including antioxidant, anti-inflammatory, and antimicrobial activities (Gohil et al., 2010)

Despite the ecological and medicinal importance of aquatic plants, there is limited systematic documentation of their diversity and uses in the Dimoria region. Most existing studies focus on broader regional assessments, leaving a gap in localized ethnobotanical documentation. This study aims to address this gap by providing a detailed account of aquatic plant diversity and their medicinal applications in Dimoria. Such documentation is crucial not only for preserving traditional knowledge but also for promoting sustainable use and conservation of biodiversity. Additionally, it provides a foundation for future research in pharmacology, ecology, and conservation biology.

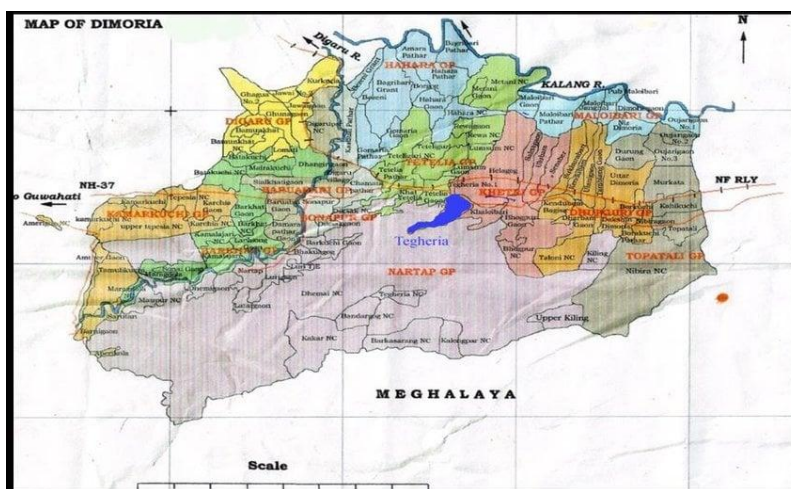


Fig 1 : Map of Dimoria, Sonapur, Assam

Study Area

Dimoria, commonly referred to as Sonapur, is located on the southeastern fringe of Guwahati city in the Kamrup (Metro) district of Assam, India, and forms an important transitional landscape between the urban expansion zone of Guwahati and the rural floodplains of the Brahmaputra valley. Geographically, the region lies approximately between 26.10°N to 26.15°N latitude and 91.90°E to 92.05°E longitude and is characterized by a mosaic of lowland plains, wetlands, hillocks, and seasonal water bodies. The climatic conditions of the region are humid subtropical,



with high annual rainfall averaging between 1800–2200 mm, warm summers, and mild winters. The monsoon season plays a crucial role in shaping the hydrology of the area, leading to the formation and seasonal expansion of numerous wetlands, beels, ponds, and marshy depressions that serve as ideal habitats for aquatic and semi-aquatic vegetation.

The Dimoria region hosts several ecologically significant wetlands that contribute to its rich biodiversity and support aquatic plant diversity. Among these, **Sonai Beel**, located near Sonapur town, is one of the prominent wetlands in the region, covering an approximate area of 20–30 hectares depending on seasonal water levels. This wetland supports a wide range of aquatic macrophytes and serves as an important site for local fishing activities. Another important wetland is **Borsola Beel**, situated in the outskirts of Dimoria, which is relatively smaller in size (approximately 10–15 hectares) but plays a crucial role in maintaining local hydrological balance and supporting aquatic vegetation. Additionally, **Ghoramara Beel**, located closer to the floodplain areas, is a seasonal wetland that expands significantly during the monsoon and provides habitat for numerous aquatic plant species, birds, and fish. Smaller unnamed wetlands, village ponds, and low-lying marshy areas scattered throughout Dimoria collectively contribute to the overall wetland ecosystem and act as microhabitats for diverse plant communities.

These wetlands are ecologically significant as they support a wide range of biodiversity, including aquatic plants, fish, amphibians, birds, and microorganisms. Aquatic macrophytes found in these wetlands play an important role in nutrient cycling, sediment stabilization, and water purification by absorbing excess nutrients and pollutants. The wetlands also function as natural buffers that regulate water flow and reduce the impact of floods during the monsoon season. The soil in the region is predominantly alluvial and fertile, enriched by periodic flooding and sediment deposition, which further enhances plant growth and supports both natural vegetation and agricultural activities in surrounding areas.

The socio-economic importance of wetlands in Dimoria is equally significant, as local communities depend heavily on these ecosystems for their livelihood and daily needs. Wetlands provide resources for fishing, irrigation, livestock grazing, and the collection of edible and medicinal plants. Aquatic plants form an important component of local diets as well as traditional medicine, particularly in rural areas where access to modern healthcare facilities may be limited. Traditional practices involving the use of aquatic plants for medicinal purposes are still prevalent and are deeply embedded in the cultural fabric of the region. Knowledge regarding plant identification, preparation methods, and therapeutic applications is often transmitted orally across generations, highlighting the importance of preserving this indigenous knowledge system.

However, despite their ecological and socio-economic importance, the wetlands of Dimoria are increasingly under threat due to anthropogenic pressures. Rapid urban expansion from nearby Guwahati city has led to encroachment and conversion of wetland areas into residential and commercial land. Land-use changes, including agricultural



intensification and infrastructure development, are causing habitat fragmentation and loss of biodiversity. Pollution from domestic waste disposal, agricultural runoff containing fertilizers and pesticides, and small-scale industrial activities is degrading water quality and negatively affecting aquatic plant growth. Overexploitation of wetland resources, including unsustainable harvesting of medicinal plants, further contributes to ecological imbalance. These challenges highlight the urgent need for effective conservation and management strategies that integrate ecological protection with sustainable livelihood practices.

In this context, the conservation of wetlands such as Sonai Beel, Borsola Beel, and Ghoramara Beel becomes critically important for maintaining biodiversity, preserving traditional knowledge, and ensuring long-term ecological sustainability. The application of modern tools such as Geographic Information Systems (GIS) and remote sensing can aid in mapping wetland distribution, monitoring changes in land use, and developing informed conservation plans. Community participation, awareness programs, and policy interventions are also essential to protect these fragile ecosystems and promote their sustainable utilization for future generations.

Methodology:

The present study was conducted using a multidisciplinary approach that combines field-based observations, ethnobotanical surveys, and comprehensive literature review. This integrated methodology ensures the accuracy, reliability, and scientific validity of the data collected while also capturing the traditional knowledge associated with aquatic plant use.

Field surveys were carried out in various wetland areas of Dimoria, including ponds, marshes, seasonal water bodies, and low-lying floodplain regions. These surveys were conducted during different seasons to capture the variation in plant diversity and availability. Plant specimens were collected, photographed, and identified using standard taxonomic keys and botanical references. Identification was further verified by consulting herbarium records and existing literature to ensure accuracy.

Ethnobotanical data were collected through informal and semi-structured interviews with local residents, traditional healers, and elderly individuals who possess extensive knowledge of medicinal plants. These interviews focused on gathering information about plant uses, parts used, methods of preparation, dosage, and the ailments treated. The use of local language and culturally sensitive communication helped in obtaining reliable and detailed information. Ethnobotanical methods emphasize the importance of direct interaction with knowledge holders and the documentation of traditional practices in their original context.

In addition to field and ethnobotanical data, a comprehensive literature review was conducted using scientific databases. This review aimed to validate the medicinal uses of the documented plant species and to identify existing scientific studies related to their pharmacological properties. The integration of traditional knowledge with scientific



evidence enhances the credibility of the study and provides a broader understanding of the medicinal potential of aquatic plants. Ethnobotanical research frameworks highlight the importance of combining local knowledge with scientific validation to ensure accurate documentation and promote sustainable use of plant resources (Martin, 2010). The collected data were analysed qualitatively to identify patterns in plant usage, frequency of use for specific ailments, and distribution of plant families. Graphical representations such as bar graphs and pie charts were used to illustrate these patterns and provide a clear visual understanding of the findings. Ethnobotanical research methods emphasize the importance of integrating local knowledge with scientific validation (Martin, 2010).

Diversity of Aquatic Plants and Medicinal Uses

Sl No.	Scientific Name	Common Name	Medicinal Uses	Reference
1	<i>Bacopa monnieri</i>	Brahmi	Memory, anxiety	Fazlul et al., 2019
2	<i>Centella asiatica</i>	Gotu kola	Brain tonic	
3	<i>Ipomoea aquatica</i>	Water spinach	BP, piles	Li et al., 2007
4	<i>Hydrocotyle sibthorpioides</i>	Pennywort	Liver	Hazarika et al., 2021
5	<i>Alternanthera sessilis</i>	Joyweed	Skin diseases	Nath et.al., 2014
6	<i>Eichhornia crassipes</i>	Water hyacinth	Wound healing	Ayanda,Opeyemi et.al.,2020
7	<i>Nelumbo nucifera</i>	Lotus	Diarrhea	Bylka, Wiesława, et al.2013
8	<i>Nymphaea nouchali</i>	Water lily	Cooling	Kiranmai, Basani et.al.,2023
9	<i>Lemna minor</i>	Duckweed	Skin	Steinberg et.al.,1946
10	<i>Azolla pinnata</i>	Azolla	Antioxidant	Basak, Biplob, et al.2002
11	<i>Marsilea quadrifolia</i>	Water clover	Fever	Gopalakrishnan, Karikalan et.al.,2014
12	<i>Pistia stratiotes</i>	Water lettuce	Skin	Tripathi, P., et al. 2010
13	<i>Sagittaria sagittifolia</i>	Arrowhead	Digestive	Kumar, HK Sundeep, et al.2010
14	<i>Cyperus rotundus</i>	Nut grass	Digestive	Al-Snafi, Ali Esmail et.al.,2016
15	<i>Colocasia esculenta</i>	Taro	Nutrition	Kaushal, Pragati et.al.,2015
16	<i>Hygrophila auriculata</i>	Marsh barbel	Kidney	Sethiya, Neeraj K., et al.2018



17	<i>Monochoria vaginalis</i>	Pickereel weed	Anti-inflammatory	Ahmad, Nadeem, et al.2010
18	<i>Polygonum hydropiper</i>	Water pepper	Pain relief	Kong, Yi-Dan, et al.2023
19	<i>Ludwigia adscendens</i>	Water primrose	Skin	Shilpi, Jamil A et.al.,2010
20	<i>Utricularia aurea</i>	Bladderwort	Antibacterial	Rutishauser, Rolf. et.al.,1993
21	<i>Salvinia molesta</i>	Floating fern	Skin	McFarland, Dwilette G., et al.2004
22	<i>Vallisneria spiralis</i>	Tape grass	Cooling	Yuan, Lin et.al.,2006
23	<i>Ottelia alismoides</i>	Duck lettuce	Digestive	Wang, Liyuan, et al.2022
24	<i>Trapa natans</i>	Water chestnut	Nutrition	Shalabh, Bhatiwal et.al.,2012
25	<i>Typha angustifolia</i>	Cattail	Wounds	Bonanno, Giuseppe et.al.,2017
26	<i>Acorus calamus</i>	Sweet flag	Digestive	Balakumbahan, Ramachandran et.al.,2010
27	<i>Enhydra fluctuans</i>	Water cress	Liver	Ali, Md Ramjan, et al.2013
28	<i>Houttuynia cordata</i>	Fish mint	Infection	Wu, Zhao, et al.2021
29	<i>Najas minor</i>	Water nymph	Cooling	Topuzovic, Marina D., et al.2015
30	<i>Potamogeton crispus</i>	Pondweed	Digestive	Bolduan, Brad R., et al.1994

Table 1: Diversity of Aquatic Plants and Medicinal Uses

The present study documented a total of 30 aquatic and semi-aquatic plant species belonging to a wide range of botanical families, reflecting the rich ecological diversity of the Dimoria region of Sonapur, Assam. This diversity is strongly influenced by the presence of wetlands, ponds, seasonal water bodies, and marshy landscapes that provide suitable habitats for different categories of aquatic macrophytes, including submerged, floating, and emergent species. The recorded plant diversity not only highlights the ecological richness of the area but also demonstrates the close relationship between local communities and their surrounding natural environment. The dependence of rural populations on aquatic plants for medicinal purposes indicates a well-established ethnobotanical tradition, where knowledge has been passed down through generations and continues to play a vital role in primary healthcare.

The medicinal importance of these aquatic plants is extensive and multifaceted, as they are used to treat a wide variety of ailments affecting different physiological systems. The plants documented in this study exhibit a broad spectrum of pharmacological properties, including antimicrobial, anti-inflammatory, antioxidant, hepatoprotective, analgesic, and digestive functions. These properties are largely attributed to the presence of bioactive compounds such as flavonoids, alkaloids, tannins, saponins, and phenolic compounds. These phytochemicals are known to interact with biological systems and contribute to disease prevention and treatment. For instance, *Bacopa monnieri*, commonly known as Brahmi, is widely recognized for its cognitive-enhancing and neuroprotective properties and is extensively used in Ayurvedic medicine for improving memory and reducing anxiety. Similarly, *Centella asiatica* is valued for its ability to promote wound healing, improve brain function, and act as an anti-inflammatory agent, making it an important medicinal plant in both traditional and modern therapeutic systems. Another commonly used species, *Ipomoea aquatica*, is utilized for treating digestive disorders, regulating blood pressure, and improving overall health due to its rich nutritional and medicinal composition.



Fig 2: Showing some beautiful aquatic plants

In addition to these widely known species, several lesser-known aquatic plants also contribute significantly to traditional healthcare practices. Plants such as *Enhydra fluctuans* and *Houttuynia cordata* are frequently used for liver-related ailments and infections, while species like *Pistia stratiotes* and *Lemna minor* are applied in the treatment of skin diseases and wounds. The diversity of medicinal applications observed in this study reflects the versatility of aquatic plants and their ability to address multiple health concerns. Scientific studies have further validated many of these traditional uses, providing evidence for their pharmacological efficacy. For example, *Azolla pinnata* has been reported to possess strong antioxidant properties and is also used in phytoremediation due to its ability to absorb heavy metals and pollutants from water bodies (Sood et al., 2012). Such findings highlight the dual ecological and medicinal importance of aquatic plants, making them valuable resources for both environmental management and healthcare.

Observation and Analysis:

The analysis of medicinal uses of aquatic plants in Dimoria reveals a clear pattern in the types of ailments most commonly treated using plant-based remedies. A significant proportion of the documented species are used for treating skin diseases, digestive disorders, and liver-related problems. This distribution reflects both the prevalence of these health conditions in rural communities and the effectiveness of traditional plant-based treatments. Skin diseases, in particular, account for the highest proportion of plant usage, which may be attributed to environmental factors such as humidity, water exposure, and sanitation conditions that increase the risk of skin infections. The antimicrobial and anti-inflammatory properties of many aquatic plants make them especially suitable for treating such conditions.

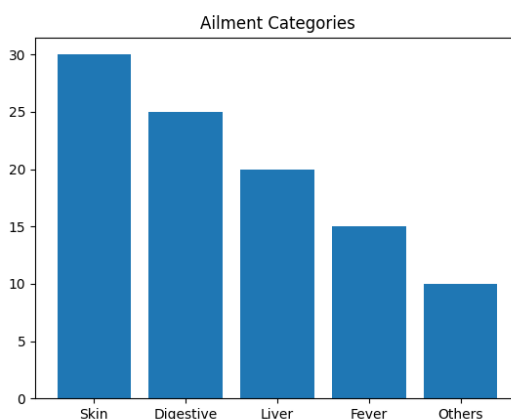


Fig 3: Showing different ailment categories cured by the aquatic plants

The graphical representation of ailment categories further supports this observation, showing that approximately one-third of the plants are used for dermatological purposes, followed by digestive and liver-related uses. The high usage of plants for digestive disorders can be linked to dietary habits and the availability of medicinal plants that aid in digestion and detoxification. Similarly, the use of plants for liver disorders indicates the presence of hepatoprotective compounds that help in maintaining liver health and treating conditions such as jaundice.

The family-wise distribution of aquatic plants provides additional insights into the ecological structure of the region. The dominance of families such as Cyperaceae, Araceae, and Nymphaeaceae indicates their adaptability to wetland environments and their ecological significance. These families are known to thrive in waterlogged conditions and play important roles in nutrient cycling and habitat formation. The distribution pattern is influenced by factors such as water availability, soil composition, climate, and seasonal variations.

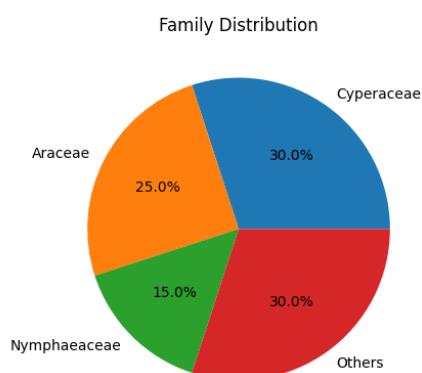


Fig 4: Showing diversity of different families among the Aquatic plants

Discussion:

The findings of this study highlight the critical role of aquatic plants in supporting traditional healthcare systems in Dimoria. The widespread use of these plants demonstrates their accessibility, affordability, and effectiveness as natural remedies. In regions where access to modern healthcare facilities may be limited, aquatic plants serve as a reliable source of treatment for common ailments. The knowledge of plant use is deeply rooted in cultural practices and is often preserved by traditional healers and elderly members of the community. This indigenous knowledge system represents an important intangible heritage that contributes to both healthcare and biodiversity conservation.

The scientific validation of medicinal properties further strengthens the significance of these plants. Studies have shown that *Bacopa monnieri* exhibits neuroprotective, antioxidant, and anti-inflammatory activities, making it a



valuable plant for neurological disorders. Similarly, *Centella asiatica* has been widely studied for its wound healing, anti-inflammatory, and cognitive-enhancing properties (Orhan, 2012) These findings provide a scientific basis for traditional practices and open new avenues for the development of plant-based medicines.

Despite their importance, aquatic ecosystems in Dimoria are facing increasing threats from human activities. Pollution from agricultural runoff, domestic waste, and industrial discharge is degrading water quality and affecting plant growth. Habitat destruction due to urban expansion and land-use changes is leading to the loss of wetlands, which are essential for maintaining aquatic plant diversity. Overharvesting of medicinal plants without proper management is also contributing to the decline of certain species. These challenges highlight the urgent need for conservation strategies that focus on sustainable use and protection of aquatic resources.

Efforts should be made to integrate traditional knowledge with modern scientific approaches to promote sustainable healthcare and biodiversity conservation. Community participation is essential in this process, as local people are the primary custodians of these resources. Awareness programs, documentation of ethnobotanical knowledge, and promotion of sustainable harvesting practices can help in preserving both plant diversity and traditional wisdom. Additionally, the use of modern tools such as GIS and remote sensing can aid in monitoring wetland ecosystems and developing effective conservation plans.

Conclusion

The present study clearly demonstrates that the wetlands of Dimoria (Sonapur), Assam, represent a highly significant reservoir of aquatic and semi-aquatic plant diversity with strong ethnomedicinal relevance. The documentation of 30 plant species used by local communities highlights not only the ecological richness of the region but also the deep-rooted traditional knowledge systems that continue to support primary healthcare in rural and semi-urban settings. The dominance of plant usage for treating skin diseases, digestive disorders, and liver-related ailments reflects both the prevalence of such health conditions in the region and the effectiveness of plant-based remedies developed through generations of empirical knowledge. Similar ethnobotanical studies conducted in Assam wetlands such as Deepor Beel and Chandubi Beel have also reported that a significant proportion of aquatic plants are used for dermatological and hepatic disorders, confirming the broader regional pattern of medicinal plant use.

The findings further emphasize that aquatic macrophytes are not merely ecological components but also functional bioresources that contribute to human health and livelihood security. These plants are rich in bioactive compounds such as alkaloids, flavonoids, tannins, and phenolic substances, which are responsible for their antimicrobial, antioxidant, anti-inflammatory, and hepatoprotective properties. Scientific studies have increasingly validated these pharmacological activities, thereby bridging the gap between traditional knowledge and modern medicine. Reviews on aquatic medicinal plants confirm that these species possess significant biological and pharmaceutical potential and



are increasingly being explored for drug development and nutraceutical applications. This indicates that the traditional practices observed in Dimoria are not only culturally important but also scientifically relevant.

Another important aspect highlighted by this study is the accessibility and affordability of aquatic medicinal plants. In many rural areas where access to modern healthcare facilities is limited, these plants serve as primary sources of treatment. Their easy availability in wetlands and surrounding landscapes makes them an essential component of community-based healthcare systems. This aligns with global perspectives that recognize traditional medicine as a key element in achieving sustainable healthcare, especially in developing regions. Aquatic macrophytes have also been recognized globally as cost-effective and low-risk alternatives to synthetic drugs, further increasing their importance in modern pharmacological research.

However, despite their importance, aquatic plant diversity in Dimoria is facing serious threats due to anthropogenic pressures. Rapid urbanization, wetland encroachment, pollution, agricultural expansion, and overharvesting are leading to habitat degradation and loss of biodiversity. Studies have shown that medicinal plant populations are declining due to unsustainable harvesting practices and environmental changes, which can ultimately result in the loss of valuable genetic resources and traditional knowledge. This situation is particularly concerning because once traditional knowledge is lost, it is extremely difficult to recover, and valuable medicinal resources may disappear before their full potential is scientifically explored.

The study also highlights the urgent need for conservation and sustainable management of wetland ecosystems in Dimoria. Conservation strategies should include both in-situ and ex-situ approaches, along with community participation. Local communities should be actively involved in conservation programs, as they are the primary custodians of traditional knowledge. Awareness programs, documentation of ethnobotanical knowledge, and integration of traditional practices into formal healthcare systems can help in preserving this valuable heritage. Additionally, scientific research should focus on phytochemical analysis, clinical validation, and sustainable cultivation of medicinal aquatic plants to ensure their long-term availability.

Furthermore, the integration of modern technologies such as Geographic Information Systems (GIS) and remote sensing can play a crucial role in mapping, monitoring, and managing wetland ecosystems. GIS-based studies can help identify biodiversity hotspots, assess habitat changes, and develop conservation strategies. Given that Dimoria is undergoing rapid developmental changes, the use of such tools becomes even more important for sustainable planning and biodiversity conservation.

In conclusion, the aquatic plants of Dimoria (Sonapur) represent a valuable intersection of biodiversity, traditional knowledge, and medicinal potential. The study reinforces the idea that traditional ethnomedicinal practices are not outdated but rather form a scientifically relevant and sustainable healthcare system. Protecting these resources requires a multidisciplinary approach involving ecology, ethnobotany, pharmacology, and community participation.



Future research should aim at validating traditional uses through clinical studies, exploring new drug leads, and developing conservation strategies that balance ecological preservation with human needs. The preservation of aquatic plant diversity is not only essential for ecological stability but also for maintaining cultural identity and ensuring sustainable healthcare for future generations.

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