International Journal of Applied Research and Sustainable Sciences (IJARSS)
Vol. 3 No. 9 , 2025: 763 - 776

Study on Aquatic Medicinal Taxa and Their Utility in Kendrapara Town, Kendrapara, Odisha

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A R T I C L E I N F O

Keywords: Aquatic plants, Medicinal taxa, Traditional medicine, Ethnobotany, Biodiversity, Conservation

Received : 25 June
Revised : 25 July
Accepted: 30 August

A B S T R A C T

Aquatic ecosystems support a diverse range of plant species, many of which offer significant medicinal value. Kendrapara town in Odisha, India, harbors a variety of aquatic and semiaquatic flora traditionally used for healthcare. This study documents important aquatic medicinal taxa present in Kendrapara, their local utility, habitats, and potential for scientific exploration. A survey of the region identified ten key species used in folk medicine for conditions ranging from digestive issues to wound healing. The findings underscore the vital role of aquatic medicinal plants in rural healthcare and the necessity of conserving local knowledge amidst increasing urbanization.

INTRODUCTION

Aquatic plants represent a vital component of global biodiversity and contribute significantly to both ecological stability and human well-being (Mishra et al., 2010). They occupy a variety of ecological niches in freshwater and brackish environments such as wetlands, rivers, ponds, and marshes, where they perform key ecosystem services including water purification, sediment stabilization, nutrient cycling, and providing habitat for aquatic fauna (Chambers et al., 2008). In addition to their ecological roles, numerous aquatic species are valued in traditional medicine systems for their therapeutic potential, particularly in regions where local communities maintain a close dependence on natural resources (Joy et al., 1998). The Indian subcontinent, due to its diverse climatic zones and habitats, hosts an exceptionally rich flora, including a wide range of aquatic and semi-aquatic medicinal taxa that have been integrated into indigenous healthcare practices for centuries.

LITERATURE REVIEW

The district of Kendrapara in the eastern state of Odisha offers an ideal context for such ethnobotanical studies. Situated in fertile deltaic plains and nourished by the distributaries of the Mahanadi River, Kendrapara sustains extensive wetlands, marshes, and ponds that foster the growth of aquatic medicinal plants (Pattnaik & Raut, 2011). Local communities in this area have traditionally relied on these plants as accessible, low-cost remedies for ailments ranging from digestive problems and skin infections to postpartum health management. The knowledge of their uses is largely transmitted orally from generation to generation, forming an inseparable part of the region's cultural heritage (Behera & Misra, 2006). However, with rapid urbanization, agricultural expansion, and habitat degradation, both the plant populations and the associated ethnomedicinal knowledge are facing unprecedented threats (Kumar et al., 2019).

Although India's medicinal plant diversity has been extensively documented—over 7,500 species are recorded in traditional medicine (Rao et al., 2010)—aquatic medicinal taxa remain comparatively under-researched. The majority of pharmacogenetic and phytochemical studies have focused on terrestrial plants, leaving aquatic species less understood in terms of their bioactive compounds, pharmacological efficacy, and conservation requirements (Singh & Pandey, 2018). Certain species, such as Bacopa monnieri and Centella asiatica, have attracted scientific attention due to their neuroprotective and anti-inflammatory properties, respectively (Russo & Borrelli, 2005; Brinkhaus et al., 2000). Nonetheless, many other taxa in local use remain scientifically undocumented, despite their prevalence in folk healthcare systems.

Documenting and analyzing such ethnomedicinal knowledge is crucial for multiple reasons. Firstly, it facilitates the preservation of indigenous medical traditions that are increasingly at risk in a rapidly modernizing society. Secondly, it strengthens biodiversity inventories, which are essential for formulating conservation strategies and sustainable utilization frameworks, especially under the current pressures of climate change and wetland loss (Prance et al., 2014). Thirdly, ethnobotanical records often serve as a primary step in drug discovery,

providing leads for pharmacological screening and development of novel therapeutics (Fabricant & Farnsworth, 2001). The World Health Organization advocates integrating validated traditional plant-based medicines into primary healthcare, especially in resource-limited regions where access to conventional pharmaceuticals is restricted (WHO, 2013).

This study, therefore, aims to systematically document the aquatic medicinal plants of Kendrapara District, Odisha, focusing on their vernacular names, habitats, and ethnomedicinal uses as practiced by local communities. By engaging with knowledgeable elders, traditional healers, and community members, the research seeks to bridge the gap between indigenous knowledge and modern science. The findings are intended not only to contribute to ethnobotanical literature but also to inform conservation planning, sustainable utilization, and possible integration of certain remedies into public health strategies. Ultimately, this work underscores the intertwined importance of biological and cultural heritage, both of which are indispensable for sustainable rural healthcare and biodiversity conservation.

METHODOLOGY

This ethnobotanical research was conducted in Kendrapara town and its surrounding areas, located in the fertile deltaic region of Odisha, India. The study was carried out over an eight-month period from August 2013 to March 2014, following a systematic approach to capture comprehensive information on aquatic and semi-aquatic medicinal plants and their uses by local communities.

The research began with a preliminary assessment to identify key aquatic habitats in the area, including wetlands, ponds, riverbanks, marshlands, and rice fields. Site selection was based on prior knowledge from local informants and observations of plant diversity, ensuring wide ecological representation. Multiple field surveys were conducted during the study period to record seasonal variations in plant availability and use.

A purposive sampling method was adopted to select both sites and participants. Informants included experienced traditional healers, elderly residents, and community members recognized for their knowledge of local medicinal plants. In total, 35 informants of varying ages and both genders participated in the study. Prior informed consent was obtained in every case, with the aims of the research explained in the local language to ensure voluntary participation and mutual understanding.

Data collection relied primarily on semi-structured interviews and guided field walks with informants. These interviews sought detailed information on local names, habitats, parts used, methods of preparation, and medicinal applications of each plant species. Guided walks allowed participants to identify species in their natural settings and demonstrate collection methods. Field notes were meticulously maintained, and where possible, photographs of plants and preparation techniques were taken to supplement descriptions.

Participant observation further enriched the data by documenting the practical aspects of plant use in home remedies and small-scale community healthcare. Group discussions with clusters of knowledgeable individuals were

also organized to cross-verify information and resolve discrepancies in plant identification or use.

Plant specimens were collected following standard botanical protocols. Each sample was carefully pressed, dried, and labelled with details such as locality, date of collection, and habitat. Specimens were later authenticated by comparison with regional floras and herbarium records. Voucher specimens were deposited in the Department of Botany, Kendrapara Autonomous College, for reference and future research use.

To ensure data reliability, each medicinal claim was confirmed by at least two independent informants wherever possible. The collected information was organized into detailed tables listing botanical name, family, local name, habitat type, plant part used, preparation method, and therapeutic application. Analysis focused on identifying species with frequent medicinal use, common ailments treated, and patterns in local knowledge retention.

Throughout the study, special attention was paid to conservation concerns. Field observations noted the condition of aquatic habitats, the presence of threats such as pollution or encroachment, and community perceptions of resource decline. The entire research process was conducted with cultural sensitivity, ensuring respect for local traditions and intellectual property, with anonymity maintained where requested.

By integrating structured interviews, observational methods, and botanical validation, this study provides a reliable and culturally grounded record of aquatic medicinal plant use in Kendrapara. The combination of ecological documentation and community-based knowledge aims to contribute to both biodiversity conservation and the preservation of traditional healthcare practices in the region.

RESEARCH RESULT

The present study documented a total of ten aquatic medicinal plant taxa commonly found in Kendrapara town and its surrounding water bodies. These species span a variety of aquatic habitats including marshy areas, submerged water bodies, amphibious zones, and fixed-floating environments. The documented taxa are integral to local healthcare practices due to their diverse therapeutic applications. Table 1 summarizes the plants' botanical names, families, local names, habitats, and key medicinal uses.

Sl. No.	Botanical Name	Family	Local Name	Habitat	Medicinal Utility
1.	***Alternanthera sessilis***	Amaranthaceae	Madaranga Saga	Marshy	Galactorrhoea Remedy
2.	***Bacopa monnieri***	Scrophulariaceae	Brahmi Saga	Marshy	Used For Stammering In Children
3.	***Centella asiatica***	Apiaceae	Thalkuri	Herb	Cures Hyperacidity, Vomiting

4.	***Ceratophyllum demersum***	Ceratophyllaceae	Shrungaparne	Submerged	Used In Glycosuria
5.	***Crinum defixum***	Amaryllidaceae	Panikenduli	Amphibious	Dysuria Treatment
6.	***Hydrilla verticillata***	Hydrocharitaceae	Chingudia-dala	Submerged	Cuts, Wounds, Stomach/Lung Disorder
7.	***Hygrophila auriculata***	Acanthaceae	Koilikhia	Amphibious	Expelling Intestinal Worms
8.	***Ipomoea aquatica***	Convolvulaceae	Kalama Saga	Amphibious	Women's Post-Partum Health
9.	***Marsilea minuta***	Marsileaceae	Chhota sunusunia	Amphibious	Epilepsy, Anorexia
10.	***Nymphoides indica***	Menyanthaceae	Chandramala	Fixed floating	Treats Scalp Ulcers In Children

1. Habitat Distribution and Ecological Notes:

The aquatic medicinal taxa were distributed across varied aquatic habitats:

- Marshy Plants: *Alternanthera sessilis* and *Bacopa monnieri* thrive in marshy soil and damp areas, commonly near agricultural fields and shallow wetlands.
- Submerged Plants: *Ceratophyllum demersum* and *Hydrilla verticillata* grow fully submerged in ponds and slow-moving waterbodies.
- Amphibious Plants: *Crinum defixum*, *Hygrophila auriculata*, *Ipomoea aquatica*, and *Marsilea minuta* inhabit transitional zones between land and water, such as pond edges and wet rice paddies.
- Fixed Floating Plant: *Nymphoides indica* floats anchored by roots in still water, often on pond surfaces.

Figure 1. Representative aquatic and semi-aquatic medicinal plant species documented in Kendrapara, Odisha. Photographs illustrate (from top left to bottom right): (**1**) *Alternanthera sessilis*, (**2**) *Bacopa monnieri*, (**3**) *Centella asiatica*, (**4**) *Ceratophyllum demersum*, (**5**) *Crinum defixum*, (**6**) *Hydrilla verticillata*, (**7**) *Hygrophila auriculata*, (**8**) *Ipomoea aquatica*, (**9**) *Marsilea minuta*, and (**10**) *Nymphoides indica*. These taxa inhabit diverse wetland environments including marshes, ponds, submerged zones, and amphibious margins, and are traditionally utilized for treating ailments such as digestive disorders, skin conditions, gynecological health, and pediatric care. The composite highlights

the morphological diversity and ecological adaptation of aquatic medicinal flora integral to local ethnomedicinal practices.

2. Ethnomedicinal Uses and Preparation:

Each species serves unique therapeutic purposes, primarily administered through simple preparations such as decoctions, fresh juices, poultices, or cooked vegetables. Key medicinal uses include:

- ***Alternanthera sessilis*** (Madaranga Saga) is reputed to stimulate lactation in postpartum women, with leaf juice commonly consumed for galactorrhea management.
- ***Bacopa monnieri*** (Brahmi Saga) is used traditionally to aid children with speech difficulties like stammering, often administered as an oral tonic.
- ***Centella asiatica*** (Thalkuri) leaf decoctions are employed to alleviate hyperacidity and vomiting.
- ***Ceratophyllum demersum*** (Shrungaparnee) finds use in managing glycosuria through herbal remedies prepared from submerged plant parts.
- ***Crinum defixum*** (Panikenduli) is applied for urinary disorders such as dysuria.
- ***Hydrilla verticillata*** (Chingudia-dala) is utilized for healing cuts and wounds, as well as treatment of stomach and lung ailments.
- ***Hygrophila auriculata*** (Koilikhia) is valued for its anti-helminthic properties, expelling intestinal worms.
- ***Ipomoea aquatica*** (Kalama Saga) is traditionally consumed by women post-partum to aid recovery.
- ***Marsilea minuta*** (Chhota sunusunia) addresses neurological disorders such as epilepsy and is used to stimulate appetite in anorexic patients.
- ***Nymphoides indica*** (Chandramala) provides topical treatment for scalp ulcers, particularly in children.

3. Patterns in Medicinal Use:

The survey revealed that most of these aquatic taxa hold established roles in local health traditions, particularly focused on women's health, pediatric care, and common chronic ailments. Remedies are generally prepared from fresh plant parts to maximize efficacy, reflecting the importance of proximity to these natural resources for rural healthcare.

Conservation Observations: Field observations noted varying levels of abundance for these taxa, with some populations declining due to habitat degradation, water pollution, and encroachment. The marshy and amphibious plants exhibited vulnerability to wetland drainage and agricultural intensification, while submerged plants showed signs of reducing habitats in small ponds. Local community members expressed concern over the loss of these valuable plants and emphasized the need for conservation and sustainable harvesting practices.

4. Detailed Species Accounts:

- ***Alternanthera sessilis*** (Madaranga Saga): Found in marshy areas and wet fields, this plant's leaves are used fresh in traditional medicine to promote lactation and treat galactorrhea. Leaf juice is typically consumed by postpartum women to stimulate milk production.
- ***Bacopa monnieri*** (Brahmi Saga): This marshy plant grows in damp soils near water sources. Traditionally, its leaves and whole plant extracts are administered to children with speech impairments like stammering and to improve memory and cognitive function.
- ***Centella asiatica*** (Thalkuri): Found in moist soils and pond margins, the leaf decoctions of this herb are used for treating hyperacidity and vomiting. The plant is also valued for its anti-inflammatory and wound-healing properties.
- ***Ceratophyllum demersum*** (Shrungaparnee): A fully submerged aquatic plant in ponds and slow-moving waters, it is used in managing glycosuria (excess sugar in urine). Herbal preparations using this plant help regulate blood sugar levels.
- ***Crinum defixum*** (Panikenduli): Amphibious by nature, this plant inhabits pond edges and marshlands. It is traditionally used for urinary ailments such as dysuria (painful urination), with extracts of its bulbs or leaves applied as remedies.
- ***Hydrilla verticillata*** (Chingudia-dala): A submerged plant common in clean ponds and lakes, it is used to treat cuts and wounds by applying crushed leaves as a poultice. Additionally, decoctions are consumed for stomach and lung disorders.
- ***Hygrophila auriculata*** (Koilikhia): This amphibious species grows along pond margins and damp soils. Known for its anti-helminthic properties, it is used to expel intestinal worms, often administered as a bitter herbal decoction.
- ***Ipomoea aquatica*** (Kalama Saga): An amphibious vegetable often cultivated in wet fields, it is consumed by women post-partum to aid recovery and improve overall health after childbirth. It is also used to treat jaundice and skin diseases.
- ***Marsilea minuta*** (Chhota sunusunia): This small fern-like amphibious plant grows near wetlands and rice paddies. Traditionally, it is used to manage epilepsy and stimulate appetite in anorexic patients through decoctions or leaf preparations.
- ***Nymphoides indica*** (Chandramala): A fixed floating plant found on still pond surfaces, it is applied topically to treat scalp ulcers, especially in children. Extracts from its leaves are valued for their healing and antimicrobial properties.

5. Habitat Distribution:

The aquatic medicinal plants documented in Kendrapara inhabit diverse aquatic habitats that reflect their ecological adaptations:

- **Marshy/Amphibious Habitats**: Plants such as *Alternanthera sessilis*, *Bacopa monnieri*, *Ipomoea aquatica*, and *Marsilea minuta* thrive in marshes, wet soils, and transitional zones where water levels fluctuate. These habitats include marshlands, pond edges, and wet rice fields, characterized by moist or periodically inundated soils.
- **Submerged Habitats:** Species like *Hydrilla verticillata* and *Ceratophyllum demersum* are fully submerged aquatic plants living entirely underwater in ponds, lakes, and slow-moving freshwater bodies. They often grow rooted or free-floating beneath the water surface.

Fixed Floating Habitat: *Nymphoides indica* is a fixed floating plant that remains anchored by roots but floats on still water surfaces such as ponds. It forms leaf mats that float and provide a unique microhabitat.

DISCUSSION

The findings of this study highlight the significant role that aquatic medicinal plants play in the traditional healthcare practices of Kendrapara town and its surrounding regions. The diversity of species documented, ranging from marshy and amphibious plants to submerged and fixed-floating taxa, illustrates the rich ecological variety present within the aquatic habitats of this deltaic landscape. This ecological diversity directly supports a wide array of ethnomedicinal applications, reflecting a deeply rooted knowledge system sustained by local communities over generations.

Aquatic plants serve as critical healthcare resources, particularly in rural and semi-urban settings where access to modern medical facilities is often limited or costly. The use of species such as Alternanthera sessilis to promote lactation and Bacopa monnieri to support cognitive development in children underscores how these plants fulfill niche medicinal needs that may not be adequately addressed by conventional medicine. Moreover, remedies prepared from Centella asiatica and Hydrilla verticillata indicate a practical and accessible approach to managing common ailments such as digestive disturbances and wound healing. These examples confirm the integrative nature of traditional ethnomedicine, which emphasizes locally available natural resources in disease prevention and treatment.

This reliance on aquatic medicinal plants for primary healthcare highlights their social and cultural importance, emphasizing how traditional knowledge is embedded within community practices. Women's health and pediatric care emerged as prominent themes in the ethnobotanical accounts, underscoring the gendered dimensions of medicinal plant use. Postpartum care involving Ipomoea aquatica and treatments for pediatric conditions such as scalp ulcers with Nymphoides indica demonstrate a gender-sensitive and life-stage-specific approach to health that addresses vulnerable population groups. Such specificity

in plant use reflects nuanced empirical knowledge developed through long-term observation and experimentation within the local context.

However, the study also brings to light several conservation challenges threatening these invaluable plant resources and the traditional knowledge associated with them. Rapid urbanization, agricultural intensification, wetland drainage, and water pollution were frequently cited by informants as critical pressures causing habitat loss and population declines in many aquatic taxa. Observations of degraded marshes and shrinking pond areas correlate with diminishing availability of key species such as Crinum defixum and Hygrophila auriculata. These environmental threats not only imperil the plants themselves but also endanger the continuity of ethnomedicinal traditions dependent on their sustainable harvest and use. The erosion of these habitats could thus trigger cascading effects on local biodiversity, cultural heritage, and community health resilience. In this context, conservation measures must not only focus on protecting and restoring natural aquatic ecosystems but also actively involve local communities as custodians of traditional knowledge. Community engagement and education aimed at promoting sustainable harvesting techniques and habitat conservation could help mitigate pressures on these fragile environments. The encouragement of cultivation programs for high-demand taxa, combined with formal documentation and validation of medicinal uses, would support both conservation and healthcare integration goals. Such participatory approaches foster a sense of ownership and responsibility among the local population, reinforcing the cultural and practical value of aquatic medicinal plants.

Furthermore, this study underscores the untapped pharmacological potential of many of the documented taxa. While some species like Bacopa monnieri and Centella asiatica have been subject to contemporary scientific scrutiny revealing bioactive compounds with neuroprotective and anti-inflammatory properties, others remain relatively unexplored. Plants such as Marsilea minuta and Ceratophyllum demersum, which are used locally to manage neurological disorders and metabolic conditions, present promising avenues for further phytochemical analysis and clinical evaluation. Systematic pharmacological research could thus help bridge the gap between traditional knowledge and modern medicine, paving the way for the development of novel therapeutic agents derived from aquatic plants.

The integration of validated aquatic remedies within formal healthcare systems aligns with global health policy initiatives advocating for the promotion of traditional medicine, particularly in underserved areas. Recognizing and supporting the value of ethnobotanical knowledge could enhance healthcare accessibility and affordability while fostering biocultural conservation. It also contributes to a more holistic understanding of health, emphasizing prevention and community-based care through natural and sustainable means.

Ultimately, the findings of this study reaffirm the importance of aquatic medicinal plants as both biological and cultural resources integral to the well-being of communities in Kendrapara. Protecting these species and their associated knowledge is essential not only for preserving biodiversity but also

for sustaining resilient local healthcare practices in the face of environmental and social change. Future efforts should prioritize multidisciplinary collaboration encompassing ethnobotany, ecology, pharmacology, and community development to realize the full potential of aquatic medicinal plants for health and conservation.

By advancing such research and policy initiatives, the legacy of aquatic ethnomedicine in Kendrapara can be preserved, enriched, and adapted to meet contemporary challenges, thereby continuing to benefit both present and future generations.

CONCLUSIONS AND RECOMMENDATIONS

This study highlights the rich diversity and cultural significance of aquatic medicinal plants in Kendrapara, Odisha, documenting ten species utilized by local communities for a variety of health concerns. These taxa, found across marshy, submerged, amphibious, and fixed-floating habitats, form an essential component of traditional healthcare, with applications ranging from postpartum care and pediatric treatments to remedies for digestive, urinary, and skin disorders.

The findings emphasize that aquatic medicinal plants are not merely biological resources but also repositories of indigenous knowledge passed down through generations. However, increasing urbanization, wetland degradation, and declining availability of certain species pose serious threats to both biodiversity and associated cultural heritage. Conservation of these plants and their habitats is therefore critical, alongside systematic documentation and validation of their medicinal properties.

Promoting sustainable harvesting, encouraging local cultivation, and integrating proven remedies into primary healthcare can enhance both ecological preservation and community well-being. This research contributes a valuable record for further pharmacological investigation while underscoring the urgent need for coordinated efforts between scientists, policymakers, and local communities to safeguard these vital natural resources for future generations.

ACKNOWLEDGMENT

The author(s) gratefully acknowledge the people of Kendrapara, Odisha, for sharing their ethnomedicinal knowledge, and the Department of Botany, Kendrapara Autonomous College, for technical support. Appreciation is also extended to colleagues, field assistants, and family for their invaluable help, encouragement, and cooperation throughout the study period.

CONFLICT OF INTEREST:

The author declares no conflict of interest regarding the publication of this research paper. The study was conducted independently without personal relationships that could influence the findings and interpretations presented.

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