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A Study on the Ethnomedicinal Uses and Diversity of Aquatic Plants in Selected Water Bodies of Churu District, Rajasthan

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ABSTRACT: The present study explores the ethnomedicinal uses and diversity of aquatic plants in selected water bodies of Churu district, Rajasthan, a region characterized by its arid climate and limited aquatic resources. Despite the ecological constraints, these water bodies support a range of aquatic plant species that hold significant traditional medicinal value. Field surveys were conducted across different sites to document species diversity and their ethnomedicinal applications, with data collected through direct observation, plant identification, and interviews with local communities and traditional healers.

KEYWORDS: Ethnomedicinal; Aquatic Plants; Diversity; Water Bodies; Churu.

I. INTRODUCTION

Traditional herbal medicine is practiced worldwide as indigenous medicine. The use of medicinal plant resources for curing human illnesses coincides with the emergence of human civilization and constitutes the foundation of contemporary medicine's origins. The increasing prevalence of herbal medicines and other complementary therapies prompted the establishment of the Office of Alternative Medicine by the National Institutes of Health, USA, in 1992. Herbal medicine gained global prominence when the World Health Organization advocated for poor nations to use traditional plant-based remedies to address demands inadequately fulfilled by contemporary medical systems. Herbal medicine is used by 75–80% of the global population, mostly in underdeveloped nations for basic healthcare. Furthermore, herbal medications are considered to be devoid of adverse effects, economical and readily accessible. The use of plants for the treatment of human illnesses dates back to the inception of human civilization. The Indian medical systems, including Ayurveda, Unani and Sidha, use a diverse array of plants in their therapeutic and prophylactic formulations. The resurgence of interest in herbals as sources of cosmetics, medicines, toners, rejuvenators, detoxifiers and anti-aging agents has unveiled new avenues for study in their botany, cultivation, chemistry and clinical standards. These plants are also being investigated for the development of pharmaceuticals to treat disorders for which allopathic medicine has found no adequate control. Examples of such illnesses include neurological problems, cardiovascular diseases, cancer, AIDS, arthritis, bronchial asthma and diabetes. The escalating utilization of herbs is mirrored in their burgeoning trade: the current worldwide herbal industry, valued at around US\$62 billion, is expanding at an annual rate of 5% and may reach \$5 trillion by 2050. India's part in total commerce is about 2%, in stark contrast to our neighbouring country, China, which commands a substantial 33% stake. We export around Rs. 300 crores worth of herbal products from our yearly output, while local trade amounts to Rs. 4000 crores. The precise proportion of dry zones in India is unknown; however, it is thought to be between 20% and 25%. The arid region of Rajasthan is endowed with 628 species over 352 genera and 87 families. Among them, 116 species from 99 genera and 52 families are significant for their medicinal properties and are used as home remedies in traditional systems. Seventeen species are economically exploited, while twenty-eight species are components of Ayurvedic and Unani formulations. The majority of these species are gathered from natural ecosystems, fallow fields, field boundaries and wastelands. Further research indicates that among the 19 species most often used in pharmaceutical formulations, these also dominate the export market. Thirteen originate from arid and semiarid regions. Furthermore, several medicinal plants are optimally derived from the dry and semi-arid regions of Rajasthan, owing to the unique agro-climatic conditions there. The knowledge on these plants, including their occurrence, biology, applications and both raw and processed commercial



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products, is either fragmented, limited, or often unavailable. Furthermore, aquatic ecosystems host a remarkable diversity of life forms that play essential roles in maintaining ecological balance and supporting human needs. Among these, aquatic plants form a crucial component of freshwater biodiversity, contributing significantly to nutrient cycling, oxygen production, habitat formation, and food web dynamics. Therefore, the paper made an attempt to study aquatic plant diversity and their medicinal uses in selected water bodies of Churu District, Rajasthan.

II. METHODOLOGY

Study Area: Churu district is situated in close proximity to the northern extension of the Aravalli hills, which slope in a northeast-southwest direction and reach a maximum elevation of around 500 meters above mean sea level at the district line. Nonetheless, a significant portion of the territory is enveloped by a vast expanse of sand, interspersed with isolated low-lying outcrops of hard rock. The sand dunes, mostly of a settled type, together with interdunal hollows, provide an undulating landscape. The geographical orientation of these sand dunes is mostly NE-SW or NNESSW. The district has a gradual incline towards the north or northwest, with the maximum and minimum elevations exceeding 500 m and falling below 230 m, respectively, above mean sea level. For the purpose of this study, four significant water bodies of Churu district were selected: Sethani ka Johara, Kalera Johara, Gajsar Genani, and Pithrano ka Johara.

1. Sethani ka Johara: Sethani ka Johara is a historical site Located about 5 km. towards north-west of the road to Ratangarh. It is spread over an area of about 950 square meters. Sethani ka Johara was built by wife of Bhagwandas Bagla. Some village elders in Churu say that the water in the Johara has never dried up till date.
2. Kalera Johara: Kalera Johara is situated 7 km from Churu at the state highway from Churu to Taranagar. It is manmade water body covering a circular area of 740 meters.
3. Gajsar Genani: Gajsar Genani is a site Located about 5 km. towards of the road of Ghantel. It is spread over an area of about 3 km square, built by the Churu administration in 1990 for the drainage of urban water.
4. Pithrano ka Johara: Pithrano ka Johara is Located 5 km from Churu and near the Ramsara village. It is manmade water body covering a circular area of 650 meters.

Fig 1: Images showing study sites – (a) Sethani ka Johara (b) Kalera Johara (c) Gajsar Genani (d) Pithrano ka Johara



(a)

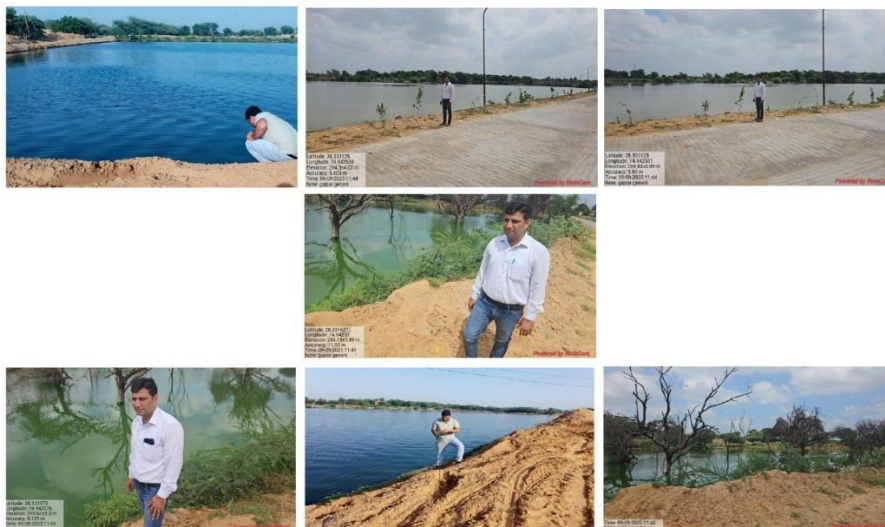


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(b)



(c)



(d)



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Diversity of Aquatic Plants: Aquatic plants were gathered directly, completely cleaned, excess water absorbed with filter paper, placed in polythene bags with filter paper, and promptly transported to the laboratory where they were stored in 10% formalin for observation. An ethnobotanical study was conducted. The study included distant communities situated next to local ponds, lakes, and wetland regions. Prior informed permission was secured from the village leaders and healers of the study's aims and the planned applications of the recorded information. Field trips were undertaken with local people and traditional healers to gather aquatic plant specimens used for therapeutic applications. Observations were recorded on-site. Voucher specimens were collected, pressed, desiccated, and affixed to herbarium sheets according to established botanical protocols (Jain and Rao 1977). The Society of Ethnobotanists' ethical guidelines for ethnobotanical research were adhered to, encompassing prior informed consent, safeguarding indigenous intellectual property rights, appropriate attribution and acknowledgment of contributors, and disseminating research findings to the local community. Specimen collection was limited to the minimum necessary for identification, and well dried voucher specimens were sent to the institutional herbarium for future reference. Accurate botanical identification of the gathered aquatic plant specimens was crucial for dependable recordkeeping. This was accomplished via the use of regional floras and taxonomic keys, by comparing morphological characteristics with herbarium specimens, and by consultation with professional taxonomists. The verified specimens were archived in the institute's herbarium along with collecting information. The taxonomic classification and nomenclature were revised to conform to the newest standards using the Plants of the World internet database and other internet resources. The familial classifications were corroborated using the Angiosperm Phylogeny Website. Specimens were further correlated with digital herbarium data on the JSTOR Global Plants website. All ambiguities or inconsistencies in identification were rectified prior to the completion of the data compilation.

Medicinal Properties of Aquatic Plants: Comprehensive interviews and group discussions were carried out with traditional healers and older household members, both male and female, who were suggested by the healers and village leaders for their expertise in the folk medicinal applications of local flora. The information was verified via many sources to attain agreement and prevent false assertions. Group talks were held to acquire more insights by collective engagement, memory sharing, and agreement on traditional medical knowledge.

III. RESULT AND DISCUSSION

Aquatic Angiosperm Diversity:

The aquatic vegetation of Churu district reveals a rich assemblage of both submerged, floating, and emergent plant species spanning across Magnoliopsida, Liliopsida/Equisetopsida, and Polypodiopsida classes. These plants represent a range of adaptations suited for aquatic environments, such as specialized vegetative reproduction, flexible stems, floating leaves, and submerged growth forms. Magnoliopsida species dominate in variety, featuring plants like *Alternanthera philoxeroides*, *Bacopa monnieri*, *Centella asiatica*, and *Ipomoea aquatica* that mainly thrive through vegetative growth, indicating resilience and rapid colonization potential. *Nelumbo nucifera* and *Trapa natans* are prominent floating-leaf plants, while *Polygonum spp.* and *Typha spp.* represent emergent vegetation rooted in sediments but extending above the water surface. In Liliopsida/Equisetopsida, species like *Hydrilla verticillata*, *Vallisneria americana*, and *Potamogeton crispus* dominate as submerged plants, critical for underwater habitat structure and oxygenation. Floating species like *Lemna polyrrhiza*, *Spirodela polyrrhiza*, *Pistia stratiotes*, and *Eichhornia crassipes* are common in stagnant and nutrient-rich waters, often forming dense mats that can affect water flow and light penetration. Polypodiopsida plants like *Azolla pinnata* and *Marsilea quadrifolia* represent aquatic ferns capable of floating or spreading across water surfaces, aiding in nitrogen fixation (*Azolla*) and contributing to the biodiversity of ephemeral and permanent wetlands. The wide variety of reproductive strategies (vegetative fragmentation, tubers, turions, seeds, and sporocarps) among these species suggests a stable yet dynamic aquatic ecosystem capable of recovering from disturbances. The occurrence of invasive species like *Eichhornia crassipes* and *Alternanthera philoxeroides* also points to potential ecological pressures due to nutrient enrichment or anthropogenic activities. Overall, the aquatic plant diversity of Churu district indicates a heterogeneous and ecologically important system, supporting both biodiversity and ecosystem services like habitat provision and stabilization of sediment.



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Table 1: Aquatic plant diversity in different water bodies of Churu district

Class	Family	Plant Species	Characteristics
Magnoliopsida	Amaranthaceae	<i>Alternanthera philoxeroides</i>	This plant exhibits vegetative growth at the apical and axillary buds. Its stems are fleshy and succulent, while the leaves, measuring 5–10 cm, grow in opposite pairs with a prominent midrib. White flowers bloom between December and April. Reproduction occurs mainly through vegetative fragmentation, with seed production being rare or seeds often non-viable.
	Scrophulariaceae	<i>Bacopa monnieri</i>	A creeping, perennial herb with smooth, succulent stems that root at the nodes, featuring many prostrate branches 10–30 cm long. Leaves are fleshy, sessile, opposite, entire, and have a punctuated texture. Blue or white flowers appear from May to October, usually solitary and axillary. The seeds are ellipsoid, ribbed longitudinally with transverse markings.
	Apiaceae	<i>Centella asiatica</i>	A perennial, evergreen herb that creeps along the ground. Its stems are slender and trailing, bearing kidney-shaped leaves arranged alternately in clusters at the nodes. Pink and white flowers are produced during August and September.
	Convolvulaceae	<i>Ipomoea aquatica</i>	A fast-growing, trailing vine that can be annual or perennial. Its hollow, branched stems are succulent. Leaves are alternate, smooth, and arrow-shaped. Flowers, either solitary or clustered at leaf axils, range from white to pink.
	Nelumbonaceae	<i>Nelumbo nucifera</i>	Recognized as India's national flower, this perennial aquatic herb has submerged, horizontal stems. Its leaves, supported by long stalks, float on the water surface. Flowers vary from white to red and are arranged spirally.
	Ceratophyllaceae	<i>Ceratophyllum demersum</i>	A rootless, submerged aquatic plant. Leaves are dark green, finely divided, and arranged in whorls along the stem, with variable spacing between whorls.
	Polygonaceae	<i>Polygonum spp.</i>	These are erect, rooted, herbaceous plants with alternate, oblong leaves. Flowers are small, usually pink, and clustered. The plants can be emergent in shallow waters or submerged with flowers above the surface.
	Trapaceae	<i>Trapa natans</i>	Plants have large, triangular, fan-shaped leaves with toothed edges. They produce numerous fine, long roots, and the fruits resemble nuts.
Liliopsida / Equisetopsida	Hydrocharitaceae	<i>Hydrilla verticillata</i>	A submerged perennial herb with both monoecious and dioecious forms. Leaves are arranged in whorls (3–8 per node) with reddish midribs. Small flowers float on the water surface. Vegetative reproduction occurs via tuber-like turions along the stems.
		<i>Vallisneria americana</i>	This species roots in the mud and produces long, ribbon-like, flexible leaves. Flowers become noticeable toward the end of summer.
	Potamogetonaceae	<i>Potamogeton crispus</i>	A submerged, perennial aquatic herb with linear, sessile leaves. It forms spindle-shaped turions at terminal or axillary positions. Its stems are flattened, and flowers are brownish-green.
	Araceae	<i>Lemna polyrhiza</i>	A small aquatic perennial that reproduces vegetatively through turions—rootless, dark green structures. Flowers are small and white, each with two stamens and one style.
		<i>Spirodela polyrhiza</i>	Characterized by 2–3 rounded leaves often attached together, with several roots hanging beneath each leaf. The underside of



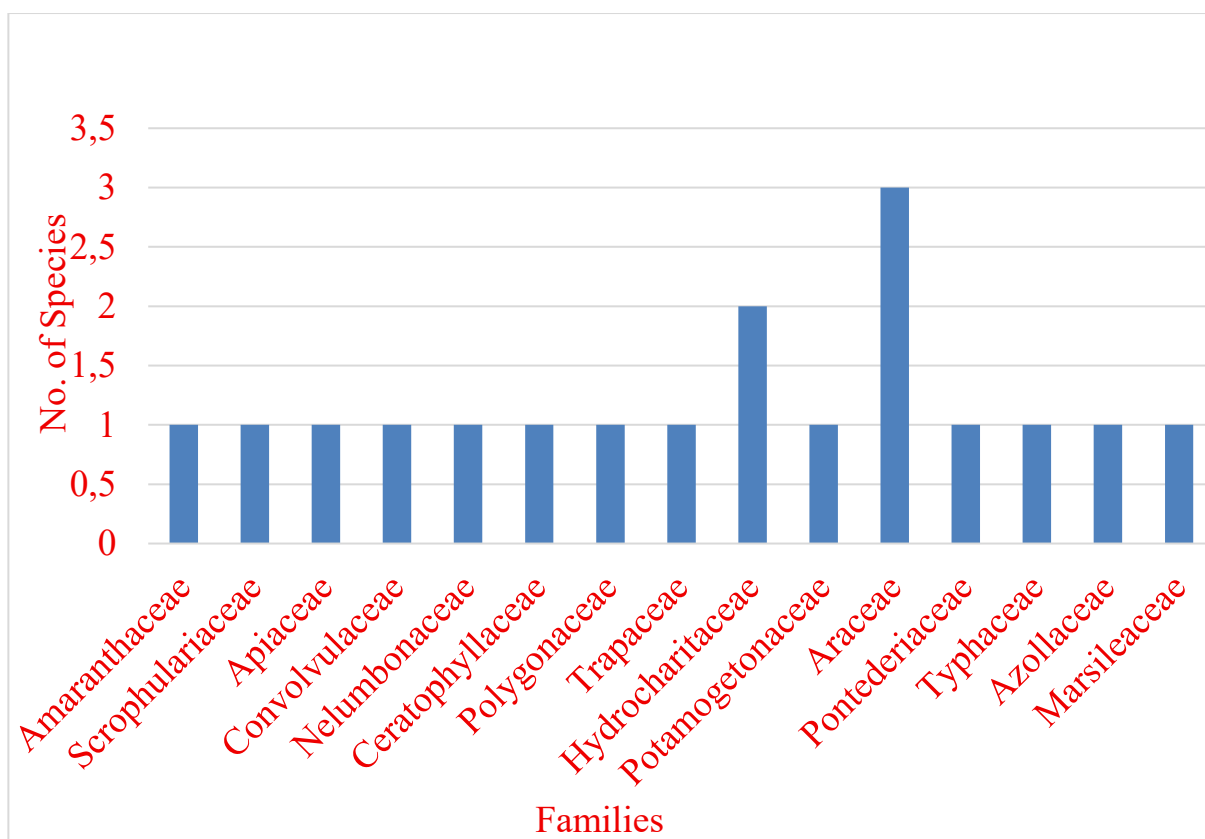
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			the leaves is typically dark red.
		<i>Pistia stratiotes</i>	This plant forms distinct rosettes with light yellow-green leaves. It has dense tufts of long, fibrous, unbranched roots. The leaves feature clearly defined veins radiating from the base.
	Pontederiaceae	<i>Eichhornia crassipes</i>	Known for its broad, large leaves and striking violet-blue flowers. Roots are free-floating, feathery, and dark.
	Typhaceae	<i>Typha spp.</i>	Features tall, grass-like stalks that can reach up to 10 feet. It thrives in wet lowlands and in waters up to 4 feet deep.
Polypodiopsida	Azollaceae	<i>Azolla pinnata</i>	A small, evergreen, floating water fern commonly found in stagnant waters. It has feathery roots and tiny leaves that are brownish-green to reddish.
	Marsileaceae	<i>Marsilea quadrifolia</i>	An aquatic fern with glabrous, triangular-obovate leaves that float on water. It reproduces via oval to elliptical sporocarps.

Aquatic plants are key components of freshwater ecosystems, contributing to oxygen production, nutrient cycling, habitat provision and sediment stabilization. Their diversity and distribution depend on environmental factors such as water depth, temperature, nutrient levels and light availability. In this study, aquatic vegetation was surveyed in four water bodies of Churu District—Sethani ka Johara, Kalera Johara, Gajsar Genani and Pithrano ka Johara—where species were identified and classified into taxonomic groups.

Fig 2: Number of Species observed in Different Angiosperm Families



The vegetation included submerged, floating and emergent species from Magnoliopsida, Liliopsida/Equisetopsida and Polypodiopsida classes. Magnoliopsida showed wide diversity with plants like Alternanthera, Bacopa, Centella and Ipomoea, while Nelumbo and Trapa represented floating-leaf forms and Typha and Polygonum dominated emergent vegetation. Liliopsida/Equisetopsida species such as Hydrilla, Vallisneria and Potamogeton were important submerged



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plants, whereas *Lemna*, *Pistia*, *Spirodela* and *Eichhornia* formed floating mats in nutrient-rich waters. Aquatic ferns like *Azolla* and *Marsilea* further enriched diversity, contributing to nitrogen fixation and wetland stability. The presence of invasive species such as *Eichhornia crassipes* and *Alternanthera philoxeroides* indicates ecological stress from nutrient enrichment and human activities. Overall, the aquatic plant diversity of Churu District reflects a heterogeneous and dynamic ecosystem, vital for maintaining biodiversity and ecological balance while facing pressures that warrant careful management.

Medicinal Properties of Aquatic Plants:

The aquatic plants found in the water bodies of Churu district demonstrate remarkable medicinal potential, contributing significantly to both traditional and modern therapeutic practices. *Alternanthera philoxeroides* is renowned for its applications in treating stomach and liver disorders and injuries, with its megastigmanes showing promising anticancer, antimicrobial, antioxidant, and antiviral activities. *Bacopa monnieri* is highly valued for its neuroprotective properties, making it useful in managing neurological conditions such as dementia, Parkinson's disease, schizophrenia, Alzheimer's disease, and epileptic seizures. *Centella asiatica* exhibits strong antioxidant, anti-inflammatory, anticellulite, and anti-aging properties, which have led to its widespread use in skincare formulations. *Ipomoea aquatica* shares similar properties and is known for its benefits in promoting skin health and reducing oxidative stress. The revered *Nelumbo nucifera*, apart from its cultural significance, is used to treat digestive problems such as vomiting, diarrhea, and cholera, and addresses heart ailments, fever, and tissue inflammation. Its seeds possess anti-inflammatory, antiemetic, diuretic, and antioxidant properties. *Ceratophyllum demersum* is employed in treating biliousness, diarrhea, dysentery, and is acknowledged for its anti-inflammatory, pain-relieving, anticancer, anti-diabetic, and anti-ulcer capabilities. *Polygonum* species regulate immune responses and help in lowering blood glucose and lipid levels, indicating broad pharmacological effects. *Trapa natans* or water caltrop plays a role in Ayurvedic treatments for stomach, liver, kidney, and spleen-related issues, including diarrhea and dysentery.

Among submerged aquatic plants, *Hydrilla verticillata* aids in wound healing, improves digestion and circulation, and treats diarrhea and abscesses, offering comprehensive nutritional benefits. *Vallisneria americana* is traditionally used for treating leucorrhea and appetite enhancement when combined with sesame. *Potamogeton crispus* holds significance in medicine for treating digestive ailments like dyspepsia, piles, burning sensations, and respiratory disorders. Tiny floating plants like *Lemna polyrrhiza* have advanced applications, being used to produce monoclonal antibodies to treat tissue inflammation and autoimmune diseases. Similarly, *Spirodela polyrrhiza* acts as a diuretic, detoxifier, fever reducer, and is traditionally utilized in East Asia for skin diseases like eczema and pruritus.

Pistia stratiotes (water lettuce) is notable for treating ringworm, skin conditions, inflammation, arthritis, and promoting wound healing, while also relieving headaches. *Eichhornia crassipes* (water hyacinth) provides antimicrobial, antioxidant, wound-healing, cytotoxic, and antitumor benefits, being useful in the treatment of skin ailments and dysentery. *Typha* species, with their pollen rich in sterols, flavonoids, and hydrocarbons, exhibit immunosuppressive, antiplatelet aggregation, and cholesterol-lowering activities. Floating ferns like *Azolla pinnata* offer antimicrobial, anti-inflammatory, anti-allergic, antibacterial, antifungal, anticancer, and antioxidant properties, apart from being traditional remedies for diarrhea and dysentery. Finally, *Marsilea quadrifolia* is recognized for its antibacterial, diuretic, depurative, cytotoxic, and antioxidant properties, though further research is needed to fully validate its medicinal potential. Overall, the aquatic flora of Churu district presents a diverse and rich repository of bioactive compounds, offering treatments across a wide range of ailments including digestive, neurological, dermatological, metabolic, and inflammatory diseases. This highlights not only their ecological significance but also their value as an indispensable resource for pharmaceutical research and traditional healthcare systems.

Table 2: Medicinal properties of aquatic plants

Plant Species	Medicinal Properties
<i>Alternanthera philoxeroides</i>	Known for treating stomach and liver issues, as well as injuries. Its megastigmanes possess anticancer, antimicrobial, antioxidant, and antiviral properties.
<i>Bacopa monnieri</i>	<i>Bacopa monnieri</i> offers neuroprotection, aiding in the treatment of dementia, amnesia, Parkinson's disease, schizophrenia, Alzheimer's disease, and epileptic seizures.
<i>Centella asiatica</i>	This herb is beneficial for its antioxidant, anticellulite, anti-inflammatory, and anti-aging



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	properties, making it popular in skincare products.
<i>Ipomoea aquatica</i>	This herb is beneficial for its antioxidant, anticellulite, anti-inflammatory, and anti-aging properties, making it popular in skincare products.
<i>Nelumbo nucifera</i>	Indian lotus, with religious significance, is used to treat digestive issues such as vomiting, diarrhea, cholera, fever, and heart diseases. Its seeds are anti-inflammatory, antiemetic, diuretic, and also used for tissue inflammation and cancer treatment. The plant also has antioxidant properties in various parts.
<i>Ceratophyllum demersum</i>	This plant is applied for treating biliousness, digestive issues like diarrhea and dysentery, and is recognized for its pain-relieving, anti-inflammatory, anti-diabetic, anticancer, and anti-ulcer activities.
<i>Polygonum spp.</i>	Known for regulating immunity and lowering blood glucose and lipids, offering a range of beneficial pharmacological activities.
<i>Trapa natans</i>	Water caltrop is used in the treatment of diarrhea, dysentery, and issues with the stomach, liver, kidneys, and spleen in Ayurvedic medicine.
<i>Hydrilla verticillata</i>	Hydrilla is used for wound healing, abscesses, diarrhea, and dysentery. It also improves digestion and circulation, offering complete nutrition.
<i>Vallisneria americana</i>	The plant is known for treating leucorrhea and is used in combination with sesame to improve appetite.
<i>Potamogeton crispus</i>	Used in sugarcane breeding and in medicine for treating dyspepsia, piles, burning sensations, and respiratory troubles.
<i>Lemna polyrrhiza</i>	This plant has been used to produce monoclonal antibodies for tissue inflammation and autoimmune diseases.
<i>Spirodela polyrrhiza</i>	Spirodela is used to induce sweating, reduce fever, and act as a diuretic and detoxifier. It has been traditionally used in China, Japan, and Korea to treat epidemic fever, dysuria, and skin ailments like eczema and pruritus.
<i>Pistia stratiotes</i>	Water lettuce treats ringworm, skin diseases, and acts as an anti-inflammatory and anti-arthritis. It also promotes wound healing and cures headaches.
<i>Eichhornia crassipes</i>	Used for skin diseases and dysentery, this plant exhibits antimicrobial, antioxidant, wound-healing, antitumor, and cytotoxic properties.
<i>Typha spp.</i>	Typha pollen contains sterols, terpenoids, flavonoids, and hydrocarbons, which possess various pharmacological activities, including immunosuppression, antiplatelet aggregation, and cholesterol lowering.
<i>Azolla pinnata</i>	Known for antimicrobial, anti-inflammatory, anti-allergic properties, it also treats diarrhea and dysentery. Additionally, Azolla has antioxidant, anticancer, antibacterial, and antifungal activities.
<i>Marsilea quadrifolia</i>	This plant is believed to have antibacterial, diuretic, depurative, cytotoxic, and antioxidant effects, although further investigation is required.

The paper comprehensively highlights the remarkable medicinal potential of aquatic plants, underscoring their significant role in healthcare, nutrition, and biotechnological applications. The study reveals that many aquatic plants, such as *Alternanthera philoxeroides*, *Bacopa monnieri*, and *Nelumbo nucifera*, possess a wide range of therapeutic properties, including antioxidant, anti-inflammatory, antimicrobial, neuroprotective, and anticancer activities. These plants not only serve in traditional medicine systems but are also increasingly valued in modern pharmacology and skincare industries for their bioactive compounds. The aquatic plants recorded from Churu district exhibit significant medicinal diversity, highlighting their important role in traditional and modern healthcare. Many species, such as *Bacopa monnieri* and *Centella asiatica*, offer potent neuroprotective and antioxidant benefits, making them valuable in treating neurodegenerative diseases and promoting skin health. Other plants like *Nelumbo nucifera*, *Ceratophyllum demersum*, and *Azolla pinnata* display anti-inflammatory, anticancer, and digestive-supportive properties, demonstrating their multifaceted pharmacological importance. Several species (*Trapa natans*, *Hydrilla verticillata*,



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Typha spp.) show activity against gastrointestinal disorders, while others like *Pistia stratiotes* and *Eichhornia crassipes* are utilized for treating skin diseases and infections due to their antimicrobial and wound-healing properties. Remarkably, plants like *Lemna polyrrhiza* have even been harnessed for biotechnological applications like the production of monoclonal antibodies. This rich medicinal profile underlines the therapeutic potential of aquatic plants not only in traditional systems like Ayurveda but also in modern pharmaceutical research, emphasizing the need for their conservation and deeper scientific investigation.

IV. CONCLUSION

Aquatic plants have long been valued for their medicinal properties, being rich in bioactive compounds such as alkaloids, flavonoids, tannins and saponins. Used in Ayurveda, Unani and folk practices, they are applied in treating ailments ranging from skin and digestive disorders to respiratory issues and infections. In the present study, aquatic plants documented from water bodies of Churu District were also examined for their known ethnomedicinal uses, emphasizing their ecological, economic and healthcare significance. Several species show remarkable therapeutic potential. *Alternanthera philoxeroides* is used for stomach, liver and wound-related problems and exhibits anticancer and antimicrobial activities. *Bacopa monnieri* is highly valued for neurological health, while *Centella asiatica* and *Ipomoea aquatica* are recognized for antioxidant and skin-protective benefits. *Nelumbo nucifera* holds cultural and medicinal importance in treating digestive, cardiac and inflammatory conditions. *Ceratophyllum demersum*, *Polygonum species* and *Trapa natans* demonstrate anti-inflammatory, anticancer and metabolic-regulating properties. Submerged plants such as *Hydrilla verticillata*, *Vallisneria americana* and *Potamogeton crispus* aid in wound healing, digestion and respiratory health. Smaller floating plants like *Lemna polyrrhiza* and *Spirodela polyrrhiza* have advanced pharmacological applications, while *Pistia stratiotes* and *Eichhornia crassipes* contribute to treating skin disorders, wounds and infections. *Typha* species show anti-inflammatory and cholesterol-lowering effects and *Azolla pinnata* offers a wide range of antimicrobial and antioxidant benefits. Similarly, *Marsilea quadrifolia* possesses antibacterial and diuretic properties. Overall, the aquatic flora of Churu district represents a rich repository of medicinally valuable plants, supporting traditional healthcare while offering immense scope for modern pharmaceutical research and sustainable utilization.

The macrophyte assemblage this study recorded—comprising submerged beds (*Hydrilla*, *Vallisneria*, *Potamogeton*), floating mats (*Lemna*, *Spirodela*, *Pistia*, *Eichhornia*), emergent stands (*Typha*, *Polygonum*) and floating-leaf species (*Nelumbo*, *Trapa*)—is highly consistent with floristic inventories by **Khan & Verma (2014, 2015)** and other regional surveys. These commonalities indicate a shared species pool across northeastern Rajasthan and reflect similar ecological niches created by shallow, nutrient-enriched waters. The occurrence of both native functional groups and aggressive invaders (notably *Eichhornia crassipes* and *Alternanthera philoxeroides*) aligns with broader regional observations: invasive expansion is repeatedly reported in disturbed, nutrient-rich habitats. The comparison suggests that the joharas are following the same successional and invasion trajectories observed elsewhere in the state, wherein nutrient loading and anthropogenic disturbance create conditions favourable to fast-growing, opportunistic and non-native taxa.

Ethnobotanical documentation in this study of medicinal uses dovetails with regional studies (**Pareek & Trivedi 2011; Dubey & Singh 2012; Siddiqui & Husain 1992**), reinforcing the cultural continuity of wetland plant use in Rajasthan and neighbouring regions. The consistency of species-level uses (e.g., *Bacopa*, *Centella*, *Nelumbo*, *Azolla*) supports the reliability of local knowledge and highlights an important applied dimension: these water bodies are not only ecological assets but also reservoirs of locally important bioresources. This concordance with past ethnobotanical surveys strengthens the argument for integrating traditional knowledge into conservation planning and for exploring sustainable value-chain opportunities that can incentivize protection.

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