

CHAPTER 7

Medicinal Applications of *Nelumbo nucifera*: An Aquatic Plant with Ancient Roots

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Abstract: *Nelumbo nucifera* Gaertn., commonly known as the sacred lotus, is a culturally, ecologically, nutritionally, and medicinally significant wetland plant widely distributed across Asia. Revered in religious and cultural traditions for centuries, it symbolizes purity, prosperity, and spiritual transcendence, with profound representation in Hinduism, Buddhism, ancient Egypt, and Chinese culture. All parts of the plant rhizomes, seeds, leaves, flowers and stamens are utilized as food, medicine or in rituals. Phytochemical studies reveal that lotus is rich in alkaloids, flavonoids, phenolics, tannins and terpenoids, contributing to its antioxidant, anti-inflammatory, antimicrobial, cardioprotective, hepatoprotective, and anticancer activities. Ecologically, lotus stabilizes wetland habitats, supports aquatic biodiversity and sustains rural livelihoods through its multifaceted applications. This review synthesizes ethnobotanical, nutritional, medicinal, ecological and cultural aspects of *N. nucifera*, focussing its enduring importance as a sacred and multifunctional plant across Asian societies.

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INTRODUCTION

Nelumbo nucifera Gaertn., commonly known as the sacred lotus, holds a unique position in India and as a plant of profound cultural, ecological, nutritional and medicinal importance. Revered across Asia for centuries, the lotus symbolizes purity, prosperity and spiritual transcendence, as reflected in ancient sculptures, iconography and ritual practices (Sahu *et al.*, 2017; Beni and Bajpai 2024). Beyond its cultural symbolism, it is integral to wetland ecosystems where its growth stabilizes aquatic habitats and sustains rural livelihoods, as seen in regions such as Manipur and Chhattisgarh, where lotus cultivation contributes significantly to household economies (Jain *et al.*, 2004; Sahu and Chandravanshi 2018; Devi *et al.*, 2023a). It is widely distributed across Asia, including India, China, Korea and Japan, where it thrives in lakes, ponds, marshes and other wetland ecosystems (Figure 1). Recognized as the national flower of India and Vietnam, the lotus holds immense cultural, religious, and ornamental value, symbolizing purity, divinity, and resilience in many Asian traditions (Beni and Bajpai 2024). The plant is characterized by its large floating leaves, striking pink or white flowers, and distinctive rhizomes anchored in muddy substrates. The lotus is a multipurpose plant, with nearly all parts including rhizomes, seeds, leaves and flowers being edible

or medicinally significant. Traditionally, it has been employed in Ayurveda, Traditional Chinese Medicine and diverse folk practices to treat ailments such as diarrhoea, fever, inflammation, diabetes, skin diseases and cardiovascular disorders (Savita *et al.*, 2022). Phytochemical studies reveal that lotus contains alkaloids, flavonoids, tannins, terpenoids, and phenolic compounds, which underlie its antioxidant, anti-inflammatory, antimicrobial, hepatoprotective, cardioprotective and anticancer activities (Lin *et al.*, 2019; Wei *et al.*, 2024). Its seeds and rhizomes are valued as energy-rich foods, while extracts from flowers and leaves are increasingly used in nutraceuticals, cosmetics and herbal teas. Ecologically, lotus plays a vital role in wetland sustainability by stabilizing sediments, improving water quality, and providing habitat for aquatic fauna. Economically, its cultivation supports rural livelihoods through uses in food, medicine, ornamentals and religious ceremonies, contributing significantly to household economies (Jain *et al.*, 2004; Sahu and Chandravanshi 2018).

Beyond its practical value, the lotus is revered as a sacred plant across Asia. It holds profound cultural and spiritual importance across civilizations. In Hinduism and Buddhism, it symbolizes purity, enlightenment, and transcendence, often depicted with deities and Buddha. In ancient Egypt, it

represented rebirth and creation, while in Chinese culture it signifies purity, harmony, and marital happiness. Thus, the lotus endures as a timeless emblem of spirituality and cultural heritage (Beni and Bajpai 2024; Koley 2018).

Given the wide-ranging applications of *N.nucifera*, this review attempts to document its ethnobotanical, nutritional, medicinal, ecological and cultural significance.

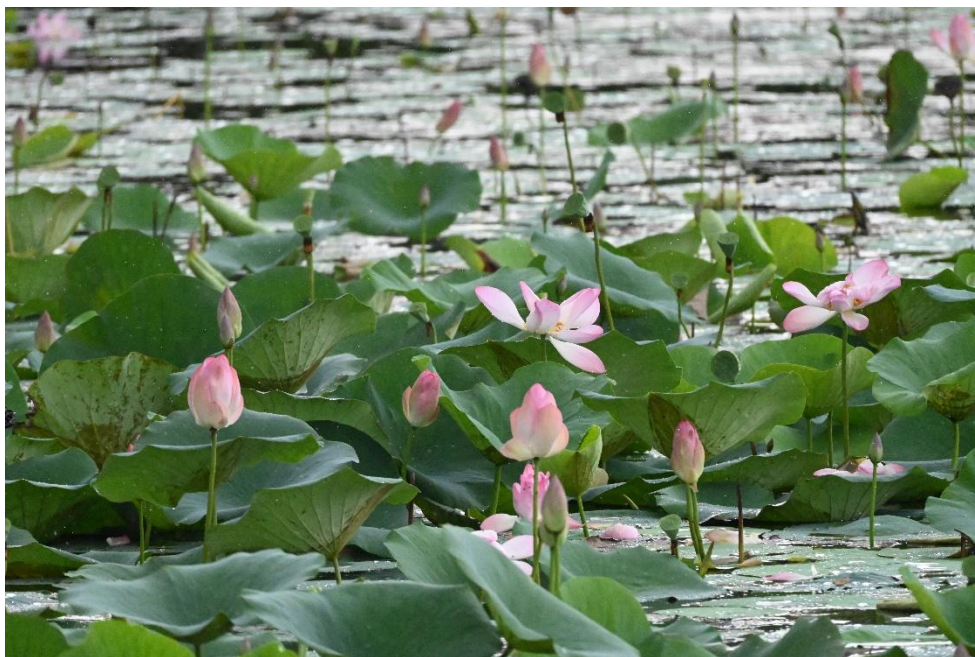


Figure 1: *N. nucifera* in its natural habitat

METHODOLOGY

The review was conducted through systematic research on the published literatures, using electronic databases including PubMed, Scopus, Web of Science, and Google Scholar covering ethnobotany, phytochemical constituents, habitat and ecology and cultural aspects (Kumar 2025). Relevant books, reports and reference lists of selected articles were also

screened to capture additional sources. Studies were included if they provided data on traditional uses, phytochemical profiles, ecological roles or cultural significance of *N. nucifera*; duplicates and irrelevant works were excluded. Data from eligible studies were extracted on plant parts used, medicinal and cultural applications, bioactive compounds, ecological functions and socio-economic importance and then

synthesized thematically (Yang *et al.*, 2024).

RESULT AND DISCUSSION

Ethnobotanical Uses

All parts of the lotus are utilized. The seeds, popularly consumed fresh, roasted, or ground into flour, are valued for their nutritional richness and medicinal benefits, including their role as an immunity booster and anti-inflammatory food (Zaidi *et al.*, 2019; Zaidi *et al.*, 2021). The rhizomes form a staple ingredient in several Asian cuisines and seeds as snacks are widely consumed in regions such as Manipur, where lotus cultivation contributes significantly to local economies (Figure 2 and 3) (Jain *et al.*, 2004; Devi *et al.*, 2023a). The tender stalks and leaves are used as vegetables and in traditional dishes, while lotus leaves also serve as natural food wrappers and in herbal tea preparations with notable sensory appeal (Ridhowati *et al.*, 2023). The plant's flowers, apart from their ornamental and sacred roles in rituals, are traditionally used for treating diarrhea, bleeding disorders, and as a cooling agent (Mehta *et al.*, 2013; Ranchana *et al.*, 2023). Lotus stamens and petals are also incorporated into herbal infusions and cosmetics due to their soothing and skin-enhancing properties (Joshi *et al.*, 2025; Beni and Bajpai 2024). In folk

traditions, the plant is associated with fertility, prosperity and spiritual purity, reflected in sculptures and iconography across India (Sahu *et al.*, 2017). Medicinally, *N. nucifera* has been applied for managing ailments such as fever, inflammation, cardiovascular disorders, and diabetes (Kaur *et al.*, 2019; Mukherjee *et al.*, 2009). Modern research substantiates its pharmacological potential, with alkaloids, flavonoids, and phenolic compounds exhibiting antioxidant, antitumor, hepatoprotective and neuroprotective effects (Hu *et al.*, 2022; Wei *et al.*, 2024; Lin *et al.*, 2019). Beyond medicine, lotus cultivation also sustains rural livelihoods, particularly in wetland-based economies of states like Manipur and Chhattisgarh (Sahu and Chandravanshi 2018; Devi *et al.*, 2023b).

Phytochemical Constituents

Nelumbo nucifera or the sacred lotus, is a rich source of diverse phytochemicals that contribute to its wide spectrum of therapeutic applications. Its bioactive compounds particularly alkaloids, flavonoids, phenolic acids, tannins, terpenoids, and glycosides have been extensively studied for their disease-related pharmacological potential (Mukherjee *et al.*, 2009; Mehta *et al.*, 2013; Lin *et al.*, 2019).



Figure 2: Rhizome of *N. nucifera* as food in Imphal Market, Manipur



Figure 3: Fruit and seeds of *N. nucifera* as food sold in Imphal Market, Manipur

Table 1: Phytochemical Constituents of *Nelumbo nucifera* and Their Potential Bioactivities

Phytochemical Constituents	Potential bioactivity	Source(s)
Alkaloids (Benzylisoquinoline derivatives) like Nuciferine, Neferine, Liensinine and Isoliensinine	Antitumor, cardioprotective, anti-arrhythmic and neuroprotective activity	Hu <i>et al.</i> , 2022; Wei <i>et al.</i> , 2024; Mukherjee <i>et al.</i> , 2009; Mehta <i>et al.</i> , 2013
Flavonoids like Quercetin, Kaempferol, Luteolin and Myricetin	Antioxidant, anti-inflammatory, hepatoprotective, anti-diabetic and neuroprotective activity	Zaidi <i>et al.</i> , 2021; Ranchana <i>et al.</i> , 2023; Beni and Bajpai 2024; Kaur <i>et al.</i> , 2019
Phenolic Compounds like Gallic acid, Ellagic acid and Catechins	Free radical scavenging and antioxidant, anti-obesity and antidiabetic, antihyperlipidemic activity	Zaidi <i>et al.</i> , 2019; Yang <i>et al.</i> , 2024; Lin <i>et al.</i> , 2019
Tannins like Hydrolyzable tannins (ellagitannins and gallotannins)	Antimicrobial, astringent, wound healing activity	Kaur <i>et al.</i> , 2019; Mehta <i>et al.</i> , 2013
Saponins like Triterpenoid saponins	Antimicrobial, immunomodulatory and skin diseases	Joshi <i>et al.</i> , 2025; Beni and Bajpai 2024
Terpenoids and Essential Oils like Monoterpenes and Sesquiterpenes (from flowers, rhizomes)	Anti-inflammatory, hepatoprotective, cosmetic and aromatherapeutic potential	Joshi <i>et al.</i> , 2025; Ranchana <i>et al.</i> , 2023
Polysaccharides	Immunomodulatory, anti-fatigue and hypoglycaemic activity	Mukherjee <i>et al.</i> , 2009; Lin <i>et al.</i> , 2019

Glycosides like Flavonoid glycosides (e.g., quercetin glycosides)	Antioxidant and cardioprotective activity	Mehta <i>et al.</i> , 2013; Beni and Bajpai 2024
Proteins and Amino acids including essential amino acids	Nutritional, antioxidant activity and support in metabolic health	Zaidi <i>et al.</i> , 2019; Yang <i>et al.</i> , 2024
Vitamins & Minerals like Vitamin C, B-complex, Iron, Zinc and Magnesium	Nutritional support, immunity boosting, anti- inflammatory activity	Zaidi <i>et al.</i> , 2021; Devi <i>et al.</i> , 2023a; Devi <i>et al.</i> , 2023b

Alkaloids, especially benzyloquinoline derivatives such as nuciferine, neferine, liensinine, and isoliensinine, have shown potent antitumor activity by modulating apoptosis, cell cycle arrest and signaling pathways in cancer models (Hu *et al.*, 2022; Wei *et al.*, 2024). Neferine and liensinine also exhibit cardioprotective and anti-arrhythmic effects, making them promising agents against cardiovascular diseases (Mukherjee *et al.*, 2009; Kaur *et al.*, 2019). Flavonoids like quercetin, kaempferol, and luteolin are key contributors to the plant's antioxidant, anti-inflammatory and hepatoprotective activities, thereby offering protection against oxidative stress related disorders, liver damage and inflammatory conditions (Zaidi *et al.*, 2021; Ranchana *et al.*, 2023). These compounds also support neuroprotection by mitigating neuroinflammation and oxidative damage (Beni and Bajpai 2024). Phenolic compounds such as gallic acid, ellagic acid and catechins provide

strong free radical-scavenging activity, aiding in the prevention of metabolic disorders including diabetes, obesity, and hyperlipidemia (Zaidi *et al.*, 2019; Yang *et al.*, 2024). Tannins and saponins are linked to antimicrobial and wound-healing properties, supporting their use in folk medicine for skin and infectious diseases (Kaur *et al.*, 2019; Joshi *et al.*, 2025). Terpenoids and essential oils derived from lotus flowers and rhizomes further contribute to anti-inflammatory, hepatoprotective and cosmetic applications (Joshi *et al.*, 2025; Beni and Bajpai 2024). Traditional applications, particularly in Manipur and other wetland regions, align with modern pharmacological evidence, where lotus parts are consumed as functional foods for boosting immunity, reducing inflammation, and maintaining metabolic health (Devi *et al.*, 2023a; Devi *et al.*, 2023b; Jain *et al.*, 2004). Detail phytochemical constituents with potential bioactivity are listed in Table 1.

Habitat and ecology

N. nucifera plays a pivotal role in ecological role in wetland ecosystems across Asia. As a semi-aquatic perennial, it thrives in lakes, ponds, marshes, and floodplains, contributing to biodiversity maintenance, nutrient cycling, and habitat stabilization (Yang *et al.*, 2024; Lin *et al.*, 2019). Its dense rhizome and leaf structures help in sediment stabilization, water oxygenation, and reduction of eutrophication, thereby supporting the ecological health of wetlands (Mukherjee *et al.*, 2009).

Cultural significance

In Hinduism, it symbolizes purity, divine beauty, and spiritual awakening; deities such as Goddess Lakshmi and Lord Vishnu are often depicted on lotus thrones, representing transcendence above worldly impurities. The unfolding of its petals is associated with self-realization and enlightenment. In Buddhism, the lotus signifies purity of body, speech, and mind, rising unstained from the mud to bloom in beauty, mirroring the journey to enlightenment. Colors also carry symbolic meaning: the white lotus represents purity, the red conveys love and compassion, and the blue denotes wisdom. Similarly, the image of Buddha seated on a lotus throne epitomizes spiritual elevation. Historically, the lotus has held significance in other cultures as well. In

ancient Egypt, it symbolized creation, rebirth, and the sun, as it blooms in the morning and closes at night. In Chinese culture, it is revered as a symbol of purity, harmony, and marital happiness (Beni and Bajpai 2024; Koley 2018).

CONCLUSION

N. nucifera, the sacred lotus, exemplifies the integration of ethnobotanical knowledge, pharmacological potential, ecological importance and cultural symbolism. Its diverse plant parts are utilized as nutritious foods, therapeutic agents, and functional ingredients, with bioactive compounds offering validated health benefits. Ecologically, lotus enhances wetland stability, biodiversity, and water quality, while culturally it continues to symbolize purity, prosperity, and spiritual awakening across traditions. Future research should focus on sustainable cultivation, advanced phytochemical characterization, clinical validation of therapeutic properties and the conservation of wetland habitats, ensuring that this iconic plant continues to benefit both human society and ecological systems.

REFERENCES

- Beni B and Bajpai N. (2024). Lotus Plant: Ancient Wisdom Meets Modern Beauty. *International Journal of Novel Trends and Innovation*. 2(7): 34-46.

- Devi LG, Devi AKN and Devi HC. (2023a). Non-Conventional food Plants available in and around Loktak Lake, Bishnupur (Manipur). Journal of Agriculture and Ecology. 16: 88-93.
- Devi OA, Saikia MB and Ningthoujam SS. (2023b). Traditional usage of underutilized aquatic plants found in the Imphal valley of Manipur. Agricultural and Biological Research. 39(1): 449-456.
- Hu P, Ge X, Gao MT, Wang XZ, Zhang YY, Li Y, Xiao J, Ni YW, Guo QL and Pan Y. (2022). *Nelumbo nucifera* Gaertn: An updated review of the antitumor activity and mechanisms of alkaloids. Pharmacological Research - Modern Chinese Medicine. 5 (2022) 100167. DOI: 10.1016/j.prmcm.2022.100167
- Jain A, Singh RS and Singh HB. (2004). Economic evaluation of Lotus (*Nelumbo nucifera* Gaertn.) Cultivation in Sanapat Lake, Manipur Valley. Natural Products Radiance. 3(6): 418-421.
- Joshi M, Thakwani C, Singh K and Jaiswar D. (2025). The Cosmetological Potential of *Nelumbo Nucifera* Gaertn: A Systematic Review. International Journal of Scientific Research in Science and Technology. 12(2): 257-268.
- Kaur P, Kaur L and Singh A. (2019). A brief review on ethnobotanical and therapeutic uses of *Nelumbo Nucifera*. International Journal of Life Sciences Research. 7(2): 412-417.
- Koley K. (2018). Lotus' A Symbol of Growth, Purity, Birth and Enlightenment: A Perspective from Mythology to Spirituality. Online International Interdisciplinary Research Journal. 8 (2): 245-249.
- Kumar S. (2025). Data collection from literature for biological sciences, medicinal plants research, ethnobotany, and pharmacology: a methodological overview. Journal of Biodiversity and Conservation. 9(2): 167-169.
- Lin Z, Zhang C, Cao D, Damaris RN and Yang P. (2019). The Latest Studies on Lotus (*Nelumbo nucifera*)-an Emerging Horticultural Model Plant. International Journal of Molecular Sciences. 20(3680). DOI:10.3390/ijms20153680
- Mehta NR, Patel EP, Patani PV and Shah B. (2013). *Nelumbo Nucifera* (Lotus): A Review on Ethanobotany, Phytochemistry and Pharmacology. Indian Journal of Pharmaceutical and Biological Research. 1(4):152-167.
- Mukherjee PK, Mukherjee D, Majia AK, Raia S and Heinrich M. (2009). The sacred lotus (*Nelumbo nucifera*) – phytochemical and

- therapeutic profile. *Journal of Pharmacy and Pharmacology*. 61: 407–422.
- Ranchana P, Thamaraiselvi SP, Baranidharan R, Mangaiyarkarasi R, Arunkumar M, Mirunalini SP and Praiselin K. (2023). Lotus (National Flower of India): A review on floral biology, ornamental, nutritional and medicinal importance. *The Pharma Innovation Journal*. 12(5): 2810-2818.
- Ridhowati S, Rachmawati SH, Pitayati PA and Kriska. (2023). Sensory characteristics of lotus (*Nelumbo nucifera*) leaves-flower herbal tea. *World Journal of Advanced Research and Reviews*. 19(01): 995–999.
- Sahu R and Chandravanshi SS. (2018). Lotus Cultivation under Wetland: A Case Study of Farmers Innovation in Chhattisgarh, India. *International Journal of Current Microbiology and Applied Sciences*. 7: 4635-4640.
- Sahu SK, Panda T, Mishra N, Satapathy KB and Chand PK. (2017). Sculptures Associated with Indian Lotus (*Nelumbo Nucifera* Gaerten.) In Odisha, India. *World Wide Journal of Multidisciplinary Research and Development*. 3(121): 387-393.
- Savita, Kumari S, Yadav M and Beniwal BS. (2022). Recent Research on Therapeutic Properties of Lotus: A review. *Journal of Agriculture Research and Technology*. 1: 15-22.
- Wei X, Zhang M, Yang M, Ogutu C, Li J and Deng X. (2024). Lotus (*Nelumbo nucifera*) benzyloisoquinoline alkaloids: advances in chemical profiling, extraction methods, pharmacological activities, and biosynthetic elucidation. *Vegetable Research*. 4: e005. DOI: 10.48130/vegres-0024-0004
- Yang H, He S, Feng Q, Liu Z, Xia S, Zhou Q, Wu Z and Zhang Y. (2024). Lotus (*Nelumbo nucifera*): a multidisciplinary review of its cultural, ecological, and nutraceutical significance. *Bioresources and Bioprocessing*. 11:18. DOI: 10.1186/s40643-024-00734-y
- Zaidi A, Srivastava AK and Parveen K. (2021). Role of *Nelumbo nucifera* (lotus) stem as immunity booster and anti-inflammatory food era. *Era's Journal of Medical Research*. 8(2): 1-5.
- Zaidi A., Srivastava A.K., Ahmad S. (2019). Nutritional And Therapeutic Importance of *Nelumbo nucifera* (Sacred Lotus). *Era's Journal of Medicinal Research*. 6(2): 98-102.