CHAPTER 1

Acorus calamus: A wetland medicinal plant of India

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Abstract: Wetland plants play a crucial role in maintaining the health and functionality of wetland ecosystems. *Acorus calamus*, commonly known as sweet flag or "Vacha" in Ayurveda, a perennial, valuable medicinal plant in Indian wetlands, has been studied here for its medicinal properties and traditional therapeutic uses in Odisha. This present study examines the medicinal properties of *A. calamus* and documents its traditional therapeutic uses through field surveys of wetland plants in various regions of Odisha and through literature survey from various sources. This study aims to raise awareness about the importance of wetland medicinal plant such as *A. calamus* that contribute to future drug development and promote the establishment of protected wetland areas to conserve medicinal plant species, maintain ecosystem balance, and encourage sustainable utilization.

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Key words: *Acorus calamus*, medicinal plant, sustainable use, swamps, therapeutic values, traditional uses



INTRODUCTION

Wetland plants play a vital role in maintaining the health and functionality of wetland ecosystems. They provide habitat for diverse species, filter out impurities and excess nutrients from the water, stabilize shorelines, and sequester carbon dioxide. By absorbing excess nutrients and removing pollutants, wetland plants improve water quality and reduce the risk of eutrophication. They support biodiversity, serving as a food source for various aquatic and terrestrial species. Many Wetland plants provide valuable natural remedies and contribute human health. Additionally, such wetland plants regulate the climate, influence local weather patterns, and offer numerous human benefits, including recreation, water supply, and flood control. *Acorus calamus* Linn., also known as sweet flag is a perennial wetland plant with various medicinal properties from the family Acoraceae (Derymedvid et al., 2021). Its rhizome is most commonly used in traditional medicine for various purposes, including treating digestive issues, leveraging its anti-inflammatory and antimicrobial properties, and potentially enhancing cognitive function. *Acorus calamus* is valued in Ayurveda, Unani, and traditional Chinese medicine. *A. calamus* is also known as Vacha which also means to improve speech and enhances speech power. There different vernacular names given to this plant like Sweetflag (English), Vaj (Arabic), Bach (Hindi, Urdu, Unani), Vacha (Ayurveda); Bhadra (Sanskrit) (Imam et al., 2013) and Baryaan in Kangri dialect in Himachal Pradesh. It is known to improve memory and intellect. It China, its leaves are considered sacred and symbolic due to its shape of a sword. The leaves, inflorescence and rhizome are used in traditional medicine. It helps to clean water and hence are cultivated in many places (Cheng et al., 2020; Das and Duarah 2024). Across American and Indonesian folk medicine, it has long been valued for treating digestive disorders including colic and diarrhea and for its role in diabetes therapy. This remedy also finds application in addressing ailments like fever, cough, and bronchitis, along with inflammatory and depressive conditions, skin problems, hemorrhoids, tumors, numbness, and general fatigue. It's even used to counteract certain poisons. In industrialized nations like the United States, Germany, France, and the European Union, complementary medical systems are currently in the spotlight. The traditional use of medicinal plants holds significant importance due to its deep-rooted connection to cultural practices, serving as a primary source of healthcare for many communities, especially in rural areas. According to data from the World Health Organization (WHO), over 80% of people in underdeveloped nations get their primary medical care from traditional medicine, with about 85% of

these treatments coming from plant extracts (Neog and Borkataki 2025; Rajput et al., 2014; Subha et al., 2011). Such medicinal plants offer diverse therapeutic options, complementing modern medicine and providing alternative treatments. Many modern medicines have been developed from traditional medicinal plants and encourage the preservation of medicinal plant species and their ecosystems. Native to the Indian mountain marshes, *A. calamus* is a plant that originated in central Asia and eastern Europe. It is grown all over India, reaching elevations of roughly 2200 meters. Tamil Nadu, Andhra Pradesh, Maharashtra, Karnataka, Himachal Pradesh, Manipur, Naga land, Uttarakhand, Uttar Pradesh, and Jammu & Kashmir are among the states where it is naturally found or grown (Rajput et al., 2014). Essential oils from *A. calamus* are employed in both the cosmetic and brewing sectors (Subha et al., 2011).



Figure 1: *Acorus calamus* in its natural habitat

The present study investigates the medicinal properties of *Acorus calamus*, a valuable wetland plant species and documents its traditional therapeutic applications through field surveys in various regions of Odisha. Additionally, a thorough literature review is conducted to gather insights from existing research and traditional knowledge. The primary objectives of this study are multifaceted i.e., to raise awareness about the significance of wetland medicinal plants, contribute to the development of future pharmaceuticals, and advocate for the establishment of protected wetland

areas. Thus, this research aims to conserve medicinal plant species, maintain ecosystem balance, and promote sustainable utilization of these valuable natural resources. Ultimately, this study seeks to focus on the importance of preserving wetland ecosystems and their potential to support human health and well-being.

METHODOLOGY

The present study undertakes a broad investigation into the medicinal properties of *Acorus calamus*, a wetland plant species renowned for its therapeutic potential. Authors employed a multi-faceted approach, combining field surveys of wetland plants in specific wetland regions of Odisha like Ansupa lake and wetlands in Athagarh Forest Division. Additionally, an extensive literature review on *A. calamus* was carried out using POWO, IPNI, PubMed, Web of Science, ScienceDirect, BioMed Central, Scopus, JSTOR, PLOS (Public Library of Science), NCBI (National Center for Biotechnology Information) databases, EMBASE and BIOSIS Preview (Kumar 2025).

RESULTS AND DISCUSSION

Plant description

It is a perennial, semi-aquatic, creeping, and stout herb commonly found in wetlands and marshy areas, capable of growing up to two meters in height. The leaves are erect, aromatic, distichous, sword-shaped, approximately 13-75 cm long, glabrous, with striate parallel venation, and are weakly differentiated into petiole and blade. The inflorescence is a spadix, accompanied by a long, narrow, leaf-like spathe. The flowers are densely packed on the spadix, greenish-yellow in color, and lack bracts and bracteoles. The rhizome is aromatic, sub-cylindrical or compressed, broad, and light brown, with triangular leaf scars on the upper surface and small root scars on the lower surface (Figure 1& 2) (Rajput et al., 2014; Sharma et al., 2014).



Figure 2: Rhizome of *A. calamus*

Therapeutic properties

During our field survey in Odisha's wetlands, including Ansupa lake and parts of Athagarh Forest Division, local tribal communities revealed the multifaceted therapeutic value of a particular plant. Notably, the rhizome is widely used by the residents to alleviate symptoms of cold, fever, and respiratory issues. This traditional knowledge is consistent with findings from other researchers, who have documented additional therapeutic applications of the plant in different parts of the world. Although the plant's parts have supposedly been used to treat a variety of illnesses, rhizomes are the part most commonly employed in traditional medicine around the world. Parawansah and colleagues demonstrated the potential of *A. calamus* rhizome in the treatment of rheumatoid arthritis. The rhizomes are believed to exhibit a range of therapeutic properties including relieving spasms, reducing gas, expelling worms, and acting as an aromatic expectorant, while also have a calming effect on the nerves and sedative properties. Additionally, they are used to treat various health conditions, such as epilepsy, mental health issues, chronic diarrhea, dysentery, respiratory issues, intermittent fevers, and tumors in the glands and abdomen (Imam et al., 2013; Parawansah et al., 2024). The leaf extract of *Acorus calamus* has been reported to possess anti-exudative, anti-inflammatory, and antioxidant activities. Earlier research has established that the presence of polyphenols, flavonoids, and oxycinnamic acids such as rosmarinic, caffeic, ferulic, and p-coumaric acids is responsible for its antioxidant, anti-inflammatory and neuroprotective effects (Derymedvid et al., 2021). Significant antinociceptive and anti-inflammatory properties are present in the ethanolic extract of *A. calamus* rhizome. The antibacterial, antifungal, anti-helminthic, cytotoxic activity of the rhizome is shown by various researchers (Khanal 2019; Derymedvid et al., 2021; Datchanamurthy et al., 2023). Additionally, its therapeutic values against dysentery and diarrhoea have been noted in the earlier reports (Shanmugam et al., 2011). All therapeutic uses of the plant are listed in Table 1. Considering the therapeutic uses of the plant, the tribal people in Odisha were also observed to cultivate it in their home gardens (Figure 3).

Table 1: Therapeutic properties of *Acorus calamus*

Therapeutic properties	Plant part Use(s)	Source(s)
Brain tonic	Rhizome	Kharkwal et al., (2024)
Speech enhancer	Rhizome and leaves	Kharkwal et al., (2024)

Anti-diarrhoeal	Rhizome	Neog and Borkataki (2025)
Anti-tuberculosis	Leaves	Neog and Borkataki (2025)
Antitussive	Rhizome	Neog and Borkataki (2025)
Cytotoxic	Rhizome and leaves	Derymedvid et al., (2021); Khanal (2019)
Central nervous system ailments	Rhizome	Cheng et al., (2020); Jiji and Muralidharan (2020); Manohari et al., (2024); Rajput et al., (2014)
Anti-rheumatic	Rhizome	Parawansah et al., (2024)
Antioxidant	Rhizome and leaves	Derymedvid et al., (2021); Rakkamuthu et al., (2022); Rajput et al., (2014)
Hepatoprotective	Rhizome	Derymedvid et al., (2021)
Gastroprotective	Rhizome and leaves	Derymedvid et al., (2021)
Bronchodilator	Rhizome	Das and Duarah (2024)
Antibacterial	Rhizome and leaves	Khanal (2019); Rakkamuthu et al., (2022); Ranjan et al., (2016); Rajput et al., (2014)
Antifungal	Rhizome and leaves	Khanal (2019); Rawal et al., (2015); Rajput et al., (2014)
Anti-dysenteric	Rhizome	Shanmugam et al., (2011)
Anthelminthic	Rhizome	Imam et al., (2013)
Digestive aids	Rhizome	Imam et al., (2013); Manohari et al., (2024)
Anti-epileptic	Rhizome	Imam et al., (2013); Rajput et al., (2014)
Labor augmentation	Rhizome	Imam et al., (2013)

Anticancer	Rhizome	Akhter et al., (2024); Rakkamuthu et al., (2022); Rajput et al., (2014)
Respiratory disorders (Cough, cold, asthma, pneumonia, chest pain, bronchitis)	Rhizome	Gautam and Timilsina (2022); Ranjan et al., (2016)
Appetizer	Rhizome	Kharkwal et al., (2024)
Restores lost consciousness	Rhizome	Kharkwal et al., (2024)
Sedative	Rhizome	Kharkwal et al., (2024)
Toothache relieving	Leaves	Ranjan et al., (2016)
Antispasmodic	Rhizome	Ranjan et al., (2016)
Purgative	Rhizome	Ranjan et al., (2016)
Antinociceptive	Rhizome	Datchanamurthy et al., (2023)
Anti-inflammatory	Rhizome	Datchanamurthy et al., (2023); Rajput et al., (2014)
Anti-diabetic	Rhizome	Rajput et al., (2014)
Hypolipidemic	Rhizome	Rajput et al., (2014)

Phytochemical constituents

Acorus calamus is rich in diverse bioactive compounds, including glucosides, alkaloids, and essential oils. Key constituents include calameon, calamen, calamenol, asarone. Acorine, a bitter glycoside, is one of the key components found in the plant, along with other substances such as eugenol, pinene, and camphene. Extensive research has identified numerous chemical components in its rhizomes, leaves, and roots, such as β-asarone, α-asarone, elemicine, and various terpenoids. Other identified compounds include 4-terpineol, spathulenol, borneol, and linolenic acid (Chandra and Prasad 2017). The composition of these compounds varies depending on the plant part and extraction method. Notably, β-asarone dominates in the leaves, while acorenone is prevalent in the rhizomes.



Figure 3: Tribal people in Odisha cultivating *A. calamus* for traditional medicinal uses

The essential oils contain phenylpropanes, monoterpenes, and sesquiterpenoids, including calamenone and acorafuran (Imam et al., 2013). Using an LC-MS analysis of an ethanol extract of

the rhizomes of *A. calamus*, Parawansah and associates revealed presence of asaryldehyde, β-asarone, acoramol, acoronene, calamusenone, tritylamine, berberubine, neotatarine, magnosalicine, benzoyl formic acid (Parawansah et al., 2024). This complex phytochemical profile underlies the plant's medicinal properties and therapeutic potential.

Habitat and ecology

Acorus calamus is a semi-aquatic plant commonly found in wetlands, including swamps, marshes, sedge grassland prone to flooding. It also grows along the edges of lakes, ponds, rivers, and streams, preferring shallow water or moist, loamy soil. Because of its therapeutic values, people cultivate it in their home garden. It reproduces vegetatively through rhizomes and can form colonies. The plant thrives in wet environments and can grow in shallow water. Some wild animals like the wild boar consume the rhizome of it (Rajput et al., 2014).

CONCLUSION

This study highlights the significance of *Acorus calamus*, a wetland medicinal plant with diverse therapeutic properties, including anti-inflammatory, antimicrobial and antioxidant activities. Highly regarded in traditional medicine, the rhizome is utilized to address a range of health conditions, including epilepsy, fever, respiratory ailments like cough and bronchitis, mental disorders, and digestive issues. Beyond its medicinal importance, *A. calamus* plays a crucial role in maintaining ecosystem balance, supporting biodiversity, and promoting sustainable resource use. However, the increasing threats to wetlands due to human activities, such as urbanization, pollution, and habitat destruction, pose a significant risk to the survival of this and other wetland medicinal plants, potentially leading to the loss of associated species and valuable natural resources. Protecting these ecosystems is essential for preserving both biodiversity and the medicinal potential of plants like *A. calamus.*

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