

An Overview on *Acorus Calamus* (Sweet Flag): A Gift from Nature

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Abstract: Researchers are increasingly interested in the pharmacological effects of several plants. *Acorus calamus*, also recognized for its another name sweet flag. This is holistic herb from rhizomatous family *Acoraceae*. It is well known for the beneficial effects in Ayurvedic and other medicinal systems. This plant having longstanding tradition of use along with various conventional as well as ethnomedicinal uses. In Ayurvedic medicine, sweet flag is believed as beneficial for treating various ailments. This herb claims to exhibit various properties like anti-inflammatory, antimicrobial, anti-oxident, antitumor, anticonvulsant, antiproliferative, antidiabetic, antifungal, and immunosuppressive properties. *A. calamus* consist of good range of phytochemicals. It has been discovered to contain significant amounts of sesquiterpenes and phenylpropanes, including *cis*-isoasarone, monoterpenes, bitter substances; ketones, tannins, mucilage, resins. It also contains The existence of glycosides, flavonoids and phenolic compounds. The diverse range of properties exhibited by *Acorus calamus* renders it a promising plant species for numerous applications. The present review provides useful insights into traditional uses, active constituents and various pharmacological properties.

Keywords: Sweet flag; traditional medicine; chemical constituents; geography

1. Introduction

Acorus calamus is a valuable herbal, medicinal, and economic plant that has been employed in Ayurveda for centuries. This plant belongs to family named as *Acoraceae* which is recognized for "Bach" in Hindi. or Sweet Flag in English. Botanicals having crucial function in achieving a balance through Modernization, accessible healthcare, as well as diversity of life. Beyond the multitude of herbal and redolent plants found within India, *Acorus calamus* is among the most commonly encountered. ^[1]

This is a submerged species that thrives upon damp environments, including pond banks, rivers, streams, and swamps, found across Asia, North America, and Europe. *Acorus calamus* grows both as a wild plant and as a cultivated crop across India, with its habitat extending up to 1800 meters in the Himalayas. ^[2] The rhizomes and leaves emit a pleasant, mildly sweet fragrance attributed to the existence of an essential oil. Several research institutes worldwide are investigating this herb. This review explores research conducted on *Acorus calamus* from various study locations. ^[3] Mother Earth has bestowed healing powers on mankind and numerous plants in order to cure human illnesses. This distinguishing trait has been identified since prehistoric times. According to the WHO, Traditional medicine serves as the primary source of healthcare for roughly 80% worlds community. Plant based medicines are characterized by the occurrence of secondary compounds and remain potential reservoirs of therapeutic compounds used in medications due to their extensive list of compounds and therapeutic properties. ^[4]

In Ayurvedic medicine, *A. calamus* holds significance as a crucial herb, esteemed for its properties as a "cerebrospinal system reimposer" moreover for the treatment of gastrointestinal ailments. *Calamus* rhizome utilized as diverse healing purposes, including improving hunger, alleviating shivering, relieving abdominal pain, soothing toothaches, as well as addressing coughs. ^[5] *Calamus* is employed in treating a variety of conditions including high body temperature, chest cold, swelling, distress, malignant

growth, piles, cutaneous issues, paralysis, fatigue, also serves as antidote to numerous poisons. This herb as well recognized among Siddha herbal remedies due to application in infant care. In rural southern India, a paste made from the rhizome is utilized to enhance children's speech and memory. ^[6]

Taxonomical Classification: ^[7]

Kingdom	Plantae
Subkingdom	Tracheobionata (Vascular Plant)
Division	Magnoliophyta
Class	Liliopsida
Subclass	Arecidae
Order	Arales
Family	Acoraceae
Genus	<i>Acorus</i> L. .
Species	<i>Calamus</i> , <i>Acorus calamus</i> , <i>Acorus calamus</i> var <i>americanus</i>
Other Species	<i>Acorus gramineus</i>

Geographic Range:

This plant is prevalent within tropical and semitropical zones, especially found in the middle of India as well as Sri Lanka. This species can be found in marshes, both wild and cultivated, and can reach elevations of 1800 meters in Sikkim, Himalayas. The region rich in marshy terrain includes Kashmir, Sirmoor, and Purvanchal hill. The plant be frequently cultured within Koratagere taluk attributed to Karnataka. It thrives within muddy loam as well as riverine soil found along riverbanks.

This extensively distributed along edges about ponds as well as streams throughout various regions of England. ^[8]



Figure 1: Distribution Area of *Acorus Calamus*^[9]

Traditional Medicinal Uses

Acorus Calamus, or Sweet flag for the past two millennia, it has been utilized across Asia for its numerous beneficial and medicinal properties. In Ayurvedic tradition, *A. calamus* has been revered as a miraculous root capable of treating conditions such as asthma, fevers, bronchitis, and acting as a sedative. Externally, a mixture of this plant is applied to articular inflammation as well as arthritic areas, effectively reducing ache with edema regarding rheumatism and rheumatic fever. Administering it nasally is known to alleviate headache, epilepsy, and symptoms of hysteria.^[10] Combining the decoction of this plant with camphor enhances its effectiveness in cleansing wounds and ulcers due to its inherent antibiotic properties.

The outer layer of rhizome is believed through have haemostasis properties. Rootstalk have been utilized to make powders, balms, enemas, and tablets, as well as ghee. The rhizome of *A. calamus* have been utilized in herbal shower, to make perfumes, also to prepare tea. Pulverised rhizomes are utilized for killing fleas, bedbugs, moths, and lice. It effectively eliminates bugs in reserved cereal and this intended superior towards pesticides for this purpose due to its lack of residual effects. The root serves as both a pesticide and a defense against insect infestations.^[11] A sweet flag has value internally in a wide spectrum of illnesses. It works well for stomach disorders like worms, gas, appetite loss, and dull ache in the abdomen. When combined with lukewarm saltwater, sweet flag powder produces vomiting, breaks up mucus), and eases asthma attacks and coughs. The combination of powders from *Vacha* (*Acorus Calamus*, *Bacopa monnieri*, as well as *Nordostachys jatamansi*, along with honey, has shown effectiveness in cases of epilepsy.^[12] The paste made from *A. calamus* rhizomes is administered with cow milk for gastric disorders. The ash of rhizomes is applied with castor oil for the treatment of paralysis. After collecting the rhizome during autumn and processing it into infusion after drying is used as as carminative, flavourings, tonic, and in head lice infestations.^[13]

Chemical Constituents:

Photochemical analyses have identified Glycosidic compound, Flavonoid compound, Saponaceous compound, Tannic compound, Polyphenolic chemicals, Mucilaginous substance, Essential oil, and Bitter compounds. This herb contains glucosides, alkaloids, and essential oils, including calamen, clamenol, asarone that is acorus oil, and sesquiterpene compounds. This includes acrid glycosides such as acorine, along with eugenol, pinene, and camphene.

^[4] Healing herb serves as the botanical origin, such as accountable to its therapeutic as well as pesticidal attributes.

The fragrant components, specifically Asarylaldehyde present in the roots also asarone present in the leafage contribute with the fragrance of the essential oil.^[14] Numerous sesquiterpene were identified and seperated from *Acorus calamus*. Besides sesquiterpenes, several monoterpenes have been documented in the plant. The n-butanol extract of *Acorus calamus* leaves exhibited the topmost total polyphenol and flavonoid properties among different extracts. Additionally, a lignan named acoradin was isolated from the rhizome.^[15] The volatile oil contains two active substances: α -asarone and β asarone, which are monoterpene hydrocarbons and sequestrine ketones. GC-MS discovered and quantified several volatile oil components, including acorenone, iso-acorone, sesquilavandulol, and dehydroxy isocalamendiol.^[16]

Pharmacological Activities:

Antimicrobial Activity:

Acorus calamus rhizomes demonstrated antibacterial efficacy against clinically isolated bacteria and fungi. Rhizome efficacy was evaluated based on the existence of inhibitory zones and their diameter. The alcoholic solution derived from *Acorus calamus* had modest antibacterial efficacy against *Pseudomonas*, *Staphylococcus aureus*, and *Aspergillus flavus*.^[17]

Anti inflammatory Activity:

The extract of the leaves using 80% ethanol was tested for Anti-inflammatory efficacy utilising animal models, including Swelling in the paw caused by carrageenan and the formation of granulomas in rats using cotton pellets. The extract at 240mg/kg post-treatment significantly reduced paw oedema in rats. The research revealed that the ethanolic extract, specifically at an 80% concentration, obtained from the leaves of *Acorus calamus* possesses anti-inflammatory characteristics. This is likely due to the considerable reduction of biochemicals such as histamine, 5-HT, and kinins implicated in early stages of inflammation.^[18]

Antioxidant Activity:

The extract of leaves demonstrated significant DPPH radical scavenging activity, ferric ion chelation capacity, as well as reducing power, but the extract from the rhizome exhibited the most potent capability in scavenging superoxide anions. The effectiveness of both *Acorus calamus* leaves and root extract was resembling conventional anti-oxidants in use. Research also established a correlation between the phenolic content and anti-oxidants prowess of *Acorus calamus* leaves as well as rhizome extract.^[19]

Antitumor Activity:

Extracts from *Acorus calamus*, whether methanolic or aqueous, were noted to exhibit cytotoxic effects in breast cancer cell line which is MD Anderson-Metastatic to Bone-435S and Hepatoma3B. using *Allium cepa* root tip and XTT assays. The study's findings suggest that the plant has antitumor capabilities and could be used to investigate and create anticancer medications.^[20]

Analgesic and Anticonvulsant Activity:

The pain-relieving properties of sweet flag root have been assessed through the acetic acid induced writhing test along with the Rat caudal immersion method. This extract's ability to mitigate seizures was examined using pentylenetetrazol-induced convulsion techniques. The methanolic extract derived from the roots of this plant Considerably prolonged dormancy period during PTZ-induced epilepsy in mice. These results provide evidence for the pain-relieving as well as anti-epileptic influence of *Acorus calamus* rhizomes. ^[21]

Anticellular and Immunosuppressive Activity:

The study assessed the extract from ethanol obtained from *Acorus calamus* roots demonstrates anticellular as well as immunomodulatory effects. The extract Suppressed the growth of mitogen and antigen stimulated human PBMC. The extract additionally diminished progression of different mice and human cell lines. This as well hindered the Nitric oxide formation, Interleukin-2, as well as Tumor Necrosis Factor-alpha. The research demonstrates that extract from ethanol of *Acorus calamus* rhizome possesses in vitro antiproliferative with immunosuppressive characteristics. ^[22]

Wound-healing Activity:

The research uncovered that the extract from ethanol of *Acorus calamus* leaf promotes faster wound healing compared to controls. *A. calamus* has been shown to improve The study examined Wound closure, Mechanical resistance, and Collagen content, suggesting its potential as a topical treatment for wounds. The study suggests that an ointment containing the extract from *A. calamus* leaves potentially exhibits notable wound-healing properties. ^[23]

Antidiabetic Activity:

The study investigated the effect of the plant in methanolic extract from both normal as well as STZ-induced diabetic rat. The male albino rats induced with STZ at a dose of 40mg/kg were orally treated with 200mg/kg of *Acorus calamus* extract over the course of 21 day to assess its antidiabetic activity. Observations shows the extract from methanol possess potent antidiabetic effect and could be further helpful for controlling of diabetes. ^[24]

2. Conclusion

Based on this evaluation, it can be inferred that sweet flag or *Acorus calamus*, is an excellent plant that can be used from the ancient times for its beneficial and traditional medicinal values. This plant is known to cure many diseases and ailments. The active constituents present in the plant help the researchers to further isolate the compounds and to investigate the biological activity of the plant.

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