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ACORUS CALAMUS (Sweet flag): A MEDICINALLY IMPORTANT PLANT

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ABSTRACT

Sweet flag (*Acorus calamus*) is mentioned in Ayurveda and belongs to the genus *Acorus* L. of the family Acoraceae and is widely distributed temperate to sub temperate regions. It is commonly used in traditional medicinal systems of Asian and European countries to treat appetite loss, diarrhoea, digestive disorders, bronchitis indigestion, chest pain, nervous disorders. This review focuses on the therapeutic potential of essential oils, phenyl propanoids, sesquiterpenes and monoterpenes as well as xanthone, glycosides, flavones, lignans, steroids and inorganic constituents. Its pharmacological uses include antiviral activity, antibacterial activity, antifungal activity, antidiabetic activity.

INTRODUCTION

The medicinally important plants are biochemical factory of secondary metabolites (which are potential sources of drugs) like essential oils , oxygenated sesquiterepenes etc with vast structural diversity. Sweet flag (*Acorus calamus*) has been mentioned in Ayurveda having many medicinal properties with a wide therapeutic range. It belongs to the genus *Acorus* L. of the family Acoraceae. *A. calamus* is an uncommon but widespread, semi-aquatic plant of aquatic habitats in temperate to sub-temperate regions It is native to most Northern Latitude countries around the World. [1]. The extracts of this herb has been reported to be used in the traditional Chinese prescriptions. The beneficial effects on memory disorders, learning performance, lipid peroxidase content and anti- aging effect in senescence have been reported [2]. Leaves, rhizomes and its essential oils have posses many biological activities like antispasmodic, carminative and also used for treatment of epilepsy, mental ailments, chronic diarrhoea, dysentery, bronchial catarrh, intermittent and tumours [3]. The herb also posses insecticidal, antifungal, antimicrobial properties [4]. The plant is known by different names in different names in India and abroad [5] viz;

Trade names: Sweet flag.

Vernacular names

Bengali: Bach;

Gujarat: Vekhand

Ayurvedic: Vacha

Unani: Bacch

Hindi: Bajai

Gora-bach, Vasa bach

Marathi: Vekhand

Tamil: Vasambu

Telugu: Vadaja, Vasa

Kannada: Baje

Malayalam: Vayambu

Sanskrit: Bhutanashini, Ugragandh, Jatila

Italy: Plant of Venus.

Botanical Classification

Kingdom : Plantae

Division: Magnoliophyta

Order : Arales

Family : Acoraceae

Genus : Acorus L.

Species: *calamus*

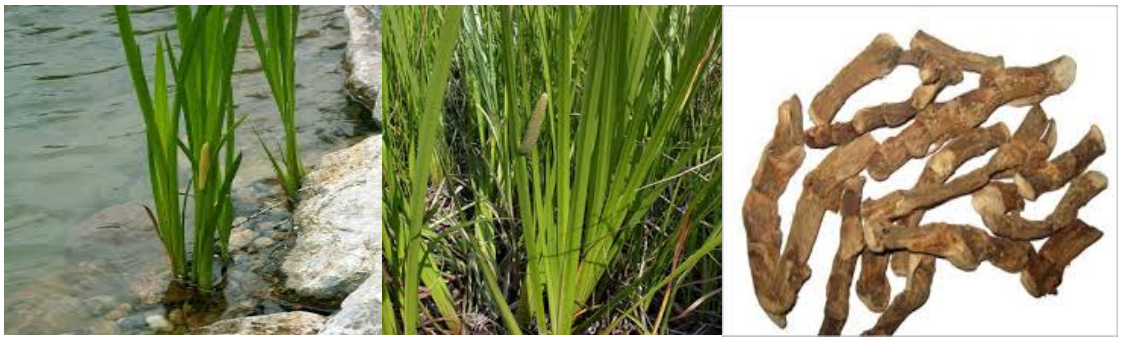
Historical background

From the ancient times *Acorus calamus* or sweet flag or buch plant has been known for its beneficial and medicinal value in Asia. The Ayurvedic science describes the therapeutic uses of sweet flag against wide varieties of illnesses. It is a native of Central Asia and Eastern Europe and also has widespread use in the traditional system of medicine for gastrointestinal disorders such as colonic pain and diarrhoea [6]. The rhizomes are also used by the ancient Greeks and now have been included in the traditional remedies of many other European cultures.

GEOGRAPHIC DISTRIBUTION

It is widely distributed in marshy land, shallow water and pond edges of the northern temperate, subtropical and warm regions [7]. This plant is mostly grown in the Northern latitude countries around the World.

MORPHOLOGY



a b c

Fig a, b: Aerial part with flower, c : Rhizomes

RHIZOMES

It consists of long creeping rhizomes which spread out just below the surface of the soil. The rhizomes are whitish-pink internally, cylindrical, 1-2 cm thick and up to a metre long.

LEAF

The leaves are thick, erect, sword-shaped leaves up to 2 m long emerge from a tortuous, branched, underground rhizome with V-shaped leaf scales and are very similar in appearance to the iris but edges are crimped. Leaves are free, alternate, green and wavy having thin testa which is cylindrical in shape.

FLOWER:

The flowers are very rarely grown in this plant if grown than it is 3-8cm long, cylindrical in shape greenish brown in color and covered with the multitudes of rounded spikes. The flowers are small, sessile and densely packed and 5-10 cm of spadix on all sides.

FRUIT:

The fruits are small and berry-like containing few seeds. The chemical constituents vary in ecotypes and containing few seeds.

Chemical constituent:

The oil is isolated from the leaves and roots using steam distillation and hydrodistillation methods. *Acorus calamus* contains yellow aromatic volatile oils β-asarone, α-asarone are the major constituent in the leaves (27.4 to 45.5%), whereas acorenone is dominant in the rhizomes (20.86%) followed by isocalamendiol (12.75%). Monoterpene hydrocarbons, sequestrine ketones, (trans- or alpha) asarone (2,4,5-trimethoxy-1- propenylbenzene), and β-asarone (cis- isomer) and eugenol have also been identified [8]. *A. Calamus* is also a source of alkaloids, falvanoids, gums, lecitins mucilage, phenols, quinine, saponins, sugars, tannins and triterpenes [9]. The constituents of the essential oils in *Acorus calamus* are phenylpropanes, mono-terpenes, and thermolabile sesquiterpenoids. The percentage of chemical components vary depending on the part of the plant from which the oil is extracted [10] The volatile oils also have terpenoids like calamine, calamenol, calamenone, eugenol, camphene, pinene and asaronaldehyde. Acorafuran is a new sesquiterpenoid has also been reported from *A. calamus* oil [11]. The content of β-asarone in essential oil of *Acorus* species varies with the grade of polyploidy of the various *Acorus* cytotypes, sub varieties and species [12]. Especially α and β- asarone are highly active in antioxidant, antilipidemic, antimicrobial, anticancer, immunosuppresive, antidiabetes activities.

As traditional medicine

Medicinal uses of *Acorus calamus* (root) as mentioned in ancient manuscripts of Unani medicine, as well as the phytochemical and pharmacological work done on the drug, have been reviewed [13]. *A. calamus* is well known for its rhizome which yield volatile aromatic oil used in Ayurvedic and Unani medicines, perfumery and flavour industries [14]. Properties and uses of *Acorus calamus* are mentioned in Ayurvedic texts with special reference to mental disorders [15].

Pharmacological action Extracts of different parts and essential oil of *Acorus calamus* are widely used in pharmaceuticals, traditional systems of medicines for a number of ailments.

Different drug types with varying content of β-asarone were obtained from *Acorus calamus* by [16]. In spite of its various medicinal uses, its fresh root can be poisonous[17]. The essential oil in the roots of some populations contains the compound asarone. This has tranquillizing and antibiotic activity, but is also potentially toxic and carcinogenic [18]. However, the root (but not the isolated essential oil) has been used in India for thousands of years without reports of cancer which suggests that the whole herb is completely safe, though more research is needed [19]. The plant extracts shows various biological activities including as anti-bacterial[20], anti-fungal[21], insecticidal[22], nematicidal[23] and The drug vacha was found to be effective in terms of improvement in chest pain, reduction of body weight index, improving in ECG, decreasing serum cholesterol, decreasing SLDL and in increasing SHDL[24].

1) Anti-bacterial activity

The leaf and rhizomes of *Acorus calamus* are found to possess the antibacterial activity. The ethanolic and aqueous extracts of *Acorus calamus* also showed the inhibitory effect against the [above organisms][25]. The methanolic extracts have been found to possess the inhibitory action against the bacterial strains like *Salmonella typhi, Pseudomonas aeruginosa, Klebsiella pneumoniae, Staphylococcus aureus*[26]. β-asarone the major constituent belonging to phenyl propanoid group has been reported to possess the highest inhibitory effect against *E.coli* strain[27].

2) Anti-oxidant activity:

Phenolic compounds present in the plants are well known for their ability of scavenging free radicals[28].The herb *Acorus calamus* has also been found to render the protection against γ-radiation induced oxidative stress [29].

3) Antihepatotoxic activity:

The antihepatotoxic activity of the ethanolic extract of the plant is due to the increase in level of hepatic enzymes present in serum such as glutamate oxaloacetate transaminase (GOT), glutamase pyruvate transaminase (GPT), alkaline phosphatase (ALP) and total bilirubin levels in the tested models which has in turn showed their hepatocellular damage in the hepatotoxicity induced animal model. This indicates that the ethanol extract brings the anti-lipid peroxidation and adaptive nature of systems against free radicals damaging effect [30].

4) Anticancer activity:

Cancer is caused by the abnormal proliferation of the tumour cells. Compounds isolated from rhizomes of *A. gramineus* exhibit both antitumor and anti-inflammatory property [31].

5) Antiulcer activity:

The ethanolic extract of *Acorus* rhizome is used as the antiulcer agent as they were found to inhibit the gastric secretion and also shows the protection against the gastro duodenal mucosa injuries that were caused by the pyloric ligation in rats [32].

6) Insecticidal activity:

Rhizomes of sweet flag possess the insecticidal properties against a variety of insect pests. The powder and extracted oil of rhizomes has been found to act as stomach / contact poison, anti-feedant and as the repellent. The observation of the toxic and sterilizing effect of vapours of rhizome oil against certain insect pests has been proved [33].

7) Anti-inflammatory activity:

Acorus calamus have been found to show the inflammatory activity in the tested rat model of vincristine induced painful neuropathy and chronic constriction injury induced neuropathic pain in rats[34, 35].

8) Antidiabetic activity:

The ethyl acetate fraction of *Acorus calamus L.* has been found to possess hypoglycemic, hypolipidemia and other beneficial effects through the mechanism of insulin sensitizing and hence possess the great potential for the treatment of diabetes and other cardiovascular complications without any body weight gain [36].

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