



PHYSICOCHEMICAL AND PRELIMINARY PHYTOCHEMICAL STUDIES ON THE RHIZOME OF
ACORUS CALAMUS LINN

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ABSTRACT

The present communication attempts to evaluate the physicochemical and preliminary phytochemical studies on the rhizome of *Acorus calamus* Linn. Araceae family. *Acorus calamus* is a perennial, semi-aquatic and smelly plant, found in both temperate and sub temperate zones. It is up to 6 feet tall, aromatic, sword-shaped leaves and small, yellow/green flowers with branched rhizome. It is widely distributed throughout India and Ceylon, in marshes, wild or cultivated, ascending the Himalayas up to 6000 feet in Sikkim, plentiful in the marshy tracts of Kashmir and Sirmoor in Manipur and Naga Hills. The rhizomes are considered to possess anti-spasmodic, carminative and anthelmintic, aromatic, expectorant, nauseant, nervine, sedative, stimulant and properties and also used for the treatment of epilepsy, mental ailments, chronic diarrhea, dysentery, bronchial catarrh, intermittent fevers and glandular and abdominal tumors. In Ayurvedic system of medicine the powder of this drug is being used to produce therapeutic emesis i.e. Vamana, one of the Panchakarma specialized therapeutic procedures of Ayurveda. As there is no detailed standardisation work reported on rhizome, the physicochemical parameters, preliminary phytochemical constants, toxic heavy metals, pesticide residue, aflatoxin and microbial contamination analysis are carried out. The study revealed specific identities for the particular crude drug which will be useful in identification and control to adulterations of the raw drug.

Keywords: *Acorus Calamus* Linn, Toxic metals, physicochemical studies, Aflatoxin

INTRODUCTION

Since origin of human's life, plants continue to play a curative and therapeutic role in preserving human health against disease and decay. The widespread use of herbal remedies and healthcare preparations, such as those described in ancient texts like the Vedas and the Bible have been traced to the occurrence of natural products with medicinal properties^{1,2}. In this context, India being a subtropical country is a good repository of plants that are widely used in the preparation of herbal therapies.

Acorus calamus Linn is a perennial, semi-aquatic and smelly plant, found in both temperate and sub temperate zones. It is up to 6 feet tall, aromatic, sword-shaped leaves and small, yellow/green flowers with branched rhizome. Rhizome horizontal, jointed, somewhat vertically compressed, spongy within, 1.25-2.5 cm in thickness, pale to dark brown or occasionally orange-brown in colour, leaves grass-like or sword shaped, long and slender flowers small, yellow-green, in spadix; berries green, angular, 1-3 seeded; seeds oblong³.

Acorus calamus Linn is commonly known as sweet flag is an aromatic medicinal plant belonging to the Araceae family. It has been long known for its medicinal value, it is wild or cultivated throughout Himalayas at an altitude ascending up to 6000 ft⁴. The rhizomes of *Acorus calamus* contain aromatic oil that has been used medicinally since ancient times and has been harvested commercially.

The rhizomes are considered to possess anti-spasmodic, carminative and anthelmintic, aromatic, expectorant, nauseant, nervine, sedative, stimulant and properties and also used for the treatment of epilepsy, mental ailments, chronic diarrhea, dysentery, bronchial catarrh, intermittent fevers and glandular and abdominal tumors. In Ayurvedic system of medicine the powder of this drug is being used to produce therapeutic emesis i.e. Vamana, one of the Panchakarma specialized therapeutic procedures of Ayurveda. The use of paste of the rhizome in children (chanting) to improve / rectify the speech defect and improving the memory power is in vogue in most of the rural areas of southern India. They are also employed for kidney and liver troubles, rheumatism, sinusitis, and eczema. This medicine is also being used in Unani, Sowa-rigpa and Siddha systems of medicine in various disease conditions. Some of the Ayurvedic formulations with this drug are Vachadi taila, Vachalasanadi taila, Sarasvata churna, Sarsvatarishta, Chandraprabha vati, Khadiradi

vati, Hinguvachadi churna etc⁵. It is used in the Phillipines for rheumatism and memory problems also. In Korea, it is an ingredient in a type of moonshine called Immortals' Booze. Research in China has shown the essential oil in this rhizome to be sedative and neuro-protectant.

Other virtues of this plant include its mature leaves, which act as an insect repellent when cut up and stored in dry foods. *Acorus calamus* Linn has threats due to harvest for medicines loss of habitat and trade⁶. The important adulterants of *Acorus calamus* are roots of *Athaea officinalis* Linn and rhizomes of *costus speciosus*^{7,8}.

Crude methanolic extract of *Acorus calamus* rhizomes possesses antimicrobial activity against bacteria, fungi and yeast. It shows strong effect against filamentous fungi like *Trichophyllum rubrum* and *Microsporum gypseum*, moderate inhibitory effect against yeast and low against bacteria^{9,10}.

Roots contain tricyclic sesquiterpene- Callaminon, acalamendiol and isocalamendiol. Rhizome, roots and leaves contain volatile oil, where asarone and β -asarone are the important constituents, Presence of small quantities of palmitic, heptylic and butyric.

Main chemical constituents and components are asarone, alpha pinene, beta asarone, calamenol, calamene, calamenone, eugenol, methyl eugenol, calamone, azulene, sugars, glucosides, and flavones¹¹.

Therefore, the present paper attempts to evaluate the physicochemical parameters, preliminary phytochemical screening and heavy metal analysis of the rhizome for identification of the drug in dry form and control the adulterants.

MATERIAL AND METHODS

The rhizomes of *Acorus calamus* Linn in Q.S. have been procured from the local market after surveying different suppliers of the raw drugs and after identification and authentication by the subject experts. The rhizome was analysed as per the parameters set for standardization as shown in tables I & II.

RESULT AND DISCUSSION

Rhizome of the *Acorus calamus* Linn was collected and analysed as per various standardisation parameters. Preliminary phytochemical results showed the presence or absence of certain phytochemicals in the drug. The tests performed using n-Hexane, Chloroform, Ethyl

acetate, alcoholic and water extracts. Phytochemical test revealed the presence of quinone, coumarin, flavone, steroid, phenol, glycosides, terpenoid, tannin, alkaloid and iridoid results are given in Table 1.

Table 1: Preliminary phytochemical tests for different solvent extract of rhizome for *Acorus calamus* Linn

S. No.	Natural product	Test performed	Result
1.	Alkaloid	Mayer's test Dragendorff's test Wagner's test Hager's test	+ve
2.	Coumarin	Alkaline test	+ve
3.	Flavone	Shinoda test	+ve
4.	Steroid	Liebermann-Burchard reagent	+ve
5.	Tannin	Neutral FeCl ₃	+ve
6.	Glycoside/Sugar	Molisch's test	+ve
7.	Terpenoid	Noller's test	+ve
8.	Saponin	NaOH solution	+ve

The presence of four heavy metals namely Arsenic, Mercury, Cadmium and Lead were analysed in the sample and the results are shown in Table 2. The concentration of all the heavy metals was below the WHO/FDA permissible limits^{12,13}. The presence of pesticide residue organochlorine pesticide, organophosphorous pesticides and Pyrethroids were not detected in the plant samples.

Quantitative standards revealed that the total ash content was 5.77 %. Negligible amount of acid-insoluble siliceous matter (0.55 %) was present in the plant. Amount of tannins and phenol are useful parameters for the identification of the drug. Alcohol soluble extractive values indicated the presence of polar and non-polar secondary metabolites present in the plant. Water-soluble extractive value was indicating the presence of sugar, acids and inorganic compounds the results given in Table 2¹³.

Table 2: Physico-chemical parameters of rhizome of *Acorus calamus* Linn

Parameters	Results
Description	Light brown powder
Loss on drying at 105 °C	7.75 % w/w
Total Ash	5.77 % w/w
Acid-insoluble ash	0.55 % w/w
Water-soluble extractive	19.13 % w/w
Alcohol-soluble extractive	13.66 % w/w
pH (10 % w/v aqueous suspension)	6.02
Particle size	
Passing through 40 mesh size sieve	71.42 % w/w
Passing through 18 mesh size sieve	96.59 w/w
Bulk density	0.3819 gm/ml
Tap density	0.5252 gm/ml
Heavy metals (by ICP-MS)	
Mercury	0.073 ppm
Lead	0.728 ppm
Cadmium	0.016 ppm
Arsenic	0.889 ppm
Microbial contamination	
Test for E.coli/g	Absent
Test for Salmonella/g	Absent
Test for S. aureus/g	Absent
Test for P. aeruginosa/g	Absent
Total viable count/g	65510 cfu/g
Total fungal count/g	37572 cfu/g
Total enterobacteriaceae/g	Absent

TLC of the ethanol extract developed in the mobile phase of Toluene: Ethyl acetate: Acetic Acid :: 5.0 : 4.2 : 0.8 (Figure. 1) and observed under UV 254 nm 4 spots at R_f value 0.23, 0.69, 0.74 and 0.83 (green colour) ; under UV 366 nm showed 6 spots at R_f 0.08, 0.20, 0.55,

0.65, 0.68, and 0.82 (blue), and after derivatization with iodine, showed 6 spots at R_f 0.37, 0.43, 0.52, 0.69, 0.73 and 0.84.

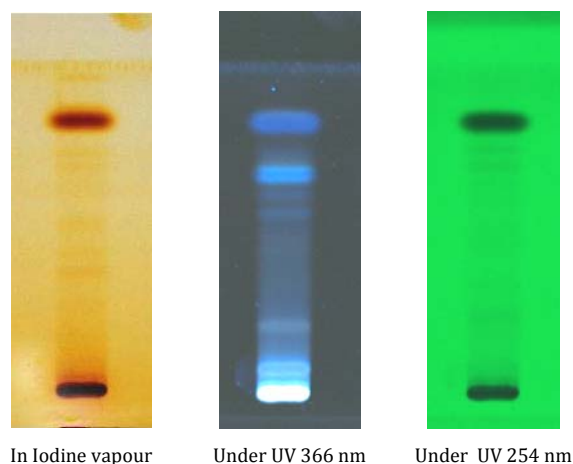


Fig. 1: TLC profile of *Acorus calamus* Linn

CONCLUSION

Morphology as well as various aspects of the rhizome sample were studied and described along with phytochemical, physico-chemical, toxic heavy metal, microbial contaminants, aflatoxin and TLC studies in authentication adulteration for quality control of raw drugs. Rhizome of *Acorus calamus* Linn exhibits a set of diagnostic characters, which will help to identify the drug in dried condition.

It has been concluded from this study that estimation of heavy metals and pesticides residue, aflatoxin and microbial contamination is highly essential for raw drugs or plant parts used for the preparation of compound formulation drugs. The periodic assessment is essential for quality assurance and safer use of herbal drugs.

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