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REVIEW ARTICLE

Development of quality standards of *Alpinia galanga* (Linn.) Willd. Rhizome

Parwaiz Akhtar[1], Mohd Ali[2], M.P Sharma[4], Humaira Farooqi[3], Showkat R. Mir[2], Mohammad Yusuf[2] and Hamid Nawaz Khan[2]

1 Drug Standardisation Research Unit (Central Council for Research in Unani Medicine), Jamia Hamdard, (Hamdard University) Hamdard Nagar, New Delhi-110062, India

2 Department of Pharmacognosy and Phytochemistry, Research Laboratory, Faculty of Pharmacy, Jamia Hamdard (Hamdard University) Hamdard Nagar, New-Delhi- 110062, India

3 Department of Biotechnology, Faculty of Science, Jamia Hamdard (Hamdard University), Hamdard Nagar, New Delhi 110062; India

4 Department of Botany, Faculty of Science, Jamia Hamdard, (Hamdard University) Hamdard Nagar, New Delhi-110062, India

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CORRESPONDENCE

Hamid Nawaz Khan, Department of Pharmacognosy and Phytochemistry, Research Laboratory, Faculty of Pharmacy, Jamia Hamdard (Hamdard University) Hamdard Nagar, New-Delhi-110062, India

E-mail:

EDITOR

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ABSTRACT

Alpinia galanga (Linn.) Willd. belonging to family Zingiberaceae is a perennial herb bearing rhizomes growing throughout the Eastern Himalayas and South West India. It is herbal medicine of day to day life. In present investigation an attempt has been made for the pharmacognostical standardization and evaluation of A. galanga rhizome. The pharmacognostical evaluation comprises of detailed macroscopy, powdered microscopy, fluorescence analysis and physical constants such as ash and extractive values. The rhizome extracts were subjected to preliminary phytochemical screening. The data obtained in present study will serve as valuable tool for identification, authentication and detection of adulterants, standardization and quality control of the drug. The developed technique will also be useful for the standardization of formulations containing *A. galanga*.

Introduction

Alpinia galanga (Linn.) Willd is a native of Java and Sumatra mainly found in the Eastern Himalayas and Southwestern region and popularly known as 'Khulanjan' in Arabic and 'Galanga' in English [1].

'Khulanjan' is popularly known as a remedy for many respiratory ailments. Antispasmodic action is also proved useful in conditions like asthma. The drug is used as stomachic, aphrodisiac, tonic, diuretic, expectorant, carminative, and useful in headache, lumbago, rheumatic pains, throat troubles, sour erructations, pain in chest, tubercular glands, diseases of kidney catarrhal affections to destroy bad smell in mouth and other part of the body [1,2,3,4].

A. galanga rhizome is a good quality of aphrodisiac drug [5] as well as it also possess antiulcer activity [6], anthelmintic activity [7], positive anti-inflammatory activity [8] and essential oils it showed antimicrobial activity against Gram-positive bacteria [9].

Later an antimicrobial diterpene was isolated from *A. galanga*, which showed enhanced antifungal activity of quercetin and against *Candida albicans* [10].

A. galanga contains volatile oil, consisting of cineol and resin composed of galangol and the tasteless yellow crystalline bodies called kaempferide and galangni, starch etc.

The plant attains 1.8 to 2.5 m height and bears tuberous, aromatic deep orange-brown rhizomes. Leaves 23 to 45 cm long and 3 to 12 cm broad, oblong-lanceolate, acute, glabrous, green above and paler beneath which slightly callous white margins, ligule short, rounded and ciliated; inflorescence panicle, terminal, erect, composed of many spreading simple, dichotomous branches, each supporting 2-3-6 pale-greenish or pinkish white, faintly fragrant flowers; calyx long tubular, irregularly 3-toothed; corolla tube 2-3 cm long, lobes oblong, obtuse, sub-equal lip 2.2 cm, claw green 6 x 2.5 mm blade white striated with red, shortly 2-lobed at the apex, two subulate glands are present at the base of the claw; stamen 2 cm long; fruits deep orange red capsule, 1.3 cm long constricted in the middle; seeds 3-6, often only one in each cell [1].

Pharmacognostical work on the rhizome of 'Khulanjan' has been done earlier but their studies are mainly based on macro and microscopic characters of the drug. In the present investigation few more parameters such as powder analysis, maceration, microchemical test, infloroscense analysis, ash values and extractive values have been studied to make the study more holistic [11,12,13].

Material and Methods

Chemicals and reagents

All the chemicals and reagents used were of analytical grade, purchased from Sigma chemical co. (St Louis, MQ, USA) and Merck (Darmstadt, Germany). Khulanjan (*A. galanga*)

rhizomes were also collected from Hamdard University campus (New Delhi) which was identified by Taxonomist (Professor M.P. Sharma), Department of Botany, Hamdard University New Delhi. The voucher specimen was deposited in Department of Pharmacognosy and Phytochemistry, Faculty of Pharmacy, Jamia Hamdard.

Morphological studies

The morphological studies were carried out for shape, size, colour, odour, taste and fracture of the *A. galanga* rhizome.

Microscopic studies and powder analysis

The transverse section of rhizome was prepared by standard method. Slides of powdered rhizome material were also prepared and studied. Microphotography on different magnifications was carried out with motic microscopic unit. Polarized light was used for the study of crystals, starch granules and lignified cell.

Physicochemical standardization

The various physico-chemical values of rhizome such as ash values, extractive values were determined according to the Pharmacopoeial method which are given in Table 3,4.

Fluorescence analysis

The fluorescence nature of powder drug was analyzed and the observations with different chemicals were also carried out and recorded which are given in Table 1,2.

Results and Discussion

Macroscopical evaluation

The rhizomes are woody, branched, 2-2.5 cm in diameter with distinct nodes and internodes; the skin is deep orange or reddish-brown and internally pale buff colour. The nodal regions are marked with wavy annulations of leaf bases, which possess a lighter colour than the remainder of the surface. Internodes are 4-13 mm in length and unevenly ridged and furrowed. Broken parts are fibrous with aromatic and agreeable odour and having spicy and pungent taste.

Whole Plant

Rhizome

Inflorescence

Microscopical evaluation

The slides of T.S of rhizome of plant was prepared and subjected to microscopical examination. The histology was examined and the observations were recorded. Sectional view of the rhizome shows the distinct thick walled endodermis that divides the whole rhizome into cortical region and inner ground tissue. The epidermis consists of single layered oval to round, thin walled parenchymatous cells with very thick outer walls and ranging from 54-86 x 22-45 µ. The cortex usually comprises of several layers of oval to rectangular, 121-148 µ in length and 89-113 µ in width, thin walled parenchymatous cells and most of these cells contain oleo-resin and starch. There are numerous closely scattered vascular bundles, which are completely sheathed in the cortex, forming a most diagnostic feature. The vascular bundle is enclosed within a sheath of 3-4 layers of fibres and is of collateral type. Endodermis forms a continuous ring and the cells are rectangular to polygonal and their outer wall is quite lignified. The vascular bundles just beneath the endodermis are comparatively more close to each other forming almost a ring and these are little different from other bundles due to the presence of lesser amount of phloem elements and lesser thick fibre sheath. Ground tissue comprises of rectangular to oval, thin walled parenchymatous cells; a few contain oleo-resinous matter and starch grains, which are oval to elliptical and 8-54 µ in diameter.

Powder analysis

Powder of the crude drug is yellowish brown, coarsed, free flowing .The taste is spicy and pungent and odour is higher aromatic but agreeable. Small amount of powdered material (sieved through 40 mesh) is placed on microscopic slide; mixed with few drop of 40 % w/v aqueous chloral hydrate and heated gently under Bunsen-burner. After adding few drops of 1% alcoholic phloroglucinol, it is warmed by mixing one drop of concentrated hydrochloric acid. The slides are mounted in glycerine and observed under microscope which revealed the presence of fragments of epidermis, parenchyma, oleo-resinous cells; the fibres are elongated, lignified with tapering ends; the vessels which are thick walled, elongated and with spiral thickenings; starch grains are mostly oval and abundant.

Maceration

Maceration of rhizome is carried out as per the method described. The macerated tissues are stained in 1% saffranin in alcohol and mounted in glycerine to examine non-protoplasmic cellular contents, e.g., cells, fragments of epidermis, oleo-resinous cells, parenchyma, cortical cells, vessels and fibres.

Plate-1

Fig. 1- Microphotograph of T.S of Khulanjan rhizome

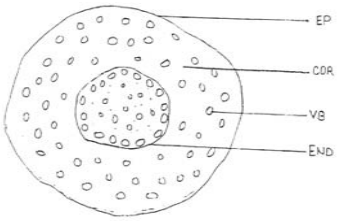

Fig. 2- Diagrammatic T.S of the Khulanjan rhizome

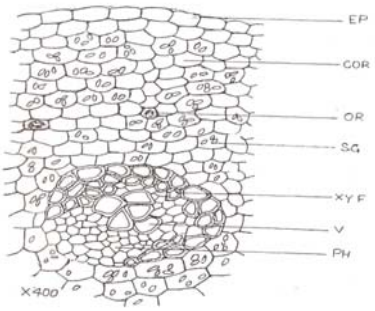

Fig. 3- T.S through cortex showing vascular bundle

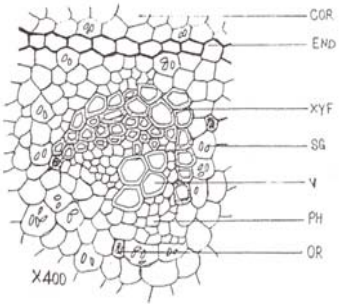

Fig. 4- T.S through endodermal portion with a vascular bundle

Plate-2

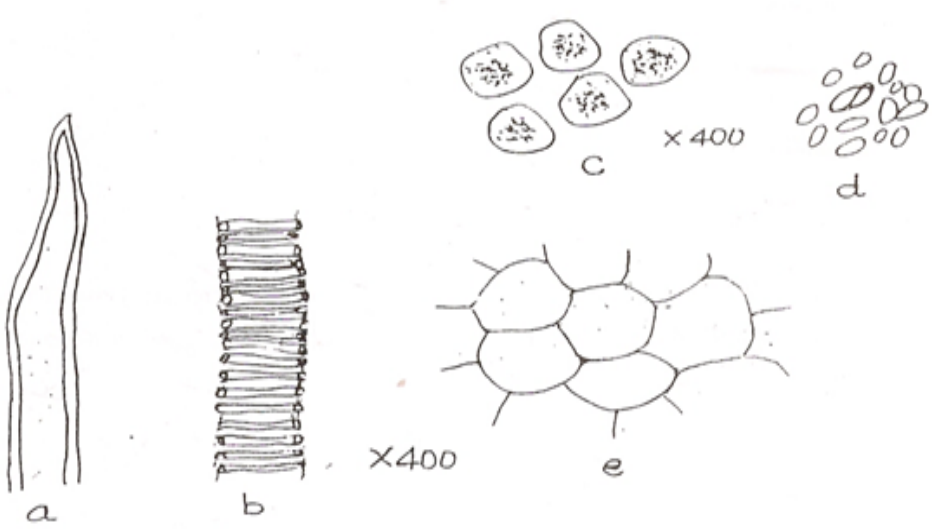

Fig. 5- Maceration: Surface view of –
(a) Fibre
(b) Vessel
(c) Oleo-resinous cells
(d) Starch grains
(e) Cortical cells.

Abbreviation
COR = Cortex; END = Endodermis; EP = Epidermis; OR = Oleo-resinous cell; PH = Phloem; SG = Starch grain; V = Vessel; XYF = Xylem fibre.

Table-1 Reactions with Powdered Rhizome of *A. galanga* with Different Chemical Reagents

S. No.	Chemical Reagents	Observation
1.	Conc. sulphuric acid	Reddish black
2.	Conc. hydrochloric acid	Dark brown
3.	Conc. nitric acid	Orange brown
4.	Pot. hydroxide solution (aqueous) (5%)	No Change
5.	Sodium hydroxide solution (aqueous)(5%)	No Change
6.	Ferric chloride (aqueous)	No Change
7.	Iodine solution	Bluish black
8.	Picric acid	No change
9.	Acetic acid glacial	No change
10.	Powder as such	Yellow brown

Table-2 Fluorescence Analysis of Powdered Rhizome of *A. galanga*

S.No.	Reagents	Colour In Day Light	Observation Under UV Light		
			Modifying Colour	Colour Quality	Radiance Degree
1.	Mounted in nitrocellulose	Brown	Brown	Light	Dull
2.	1N NaOH in methanol	Straw yellow	Pale green	Light	Bright
3.	Treated with 1N NaOH in methanol and mounted in nitrocellulose	Light yellow	Pale green	Dark	Bright
4.	1N Hydrochloric acid	Brown	Brown	Dark	Dull
5.	Treated with 1N HCl and mounted in nitrocellulose	Dark brown	Brown	Dark	Bright
6.	1N NaOH in water	Yellow	Yellowish brown	Light	Bright
7.	Treated with 1N NaOH in water and mounted in nitrocellulose	Yellow	Brown	Light	Dull
8.	Diluted nitric acid (1:1)	Orange yellow	Brown	Light	Bright
9.	Diluted sulphuric acid (1:1)	Dark brown	Pinkish brown	Light	Dull
10.	Powder as such	Yellowish brown	Brown	Light	Dull

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Table-3 Ash Values of Rhizome of *A. galanga*

S.No.	Determinants	Values in Percentage
1.	Total ash	6.17
2.	Acid insoluble ash	3.78
3.	Water soluble ash	2.26

Table-4 Extractive Values of Rhizome of *A. galanga*

S.No.	Extractive Solvents	Values in Percentage *
1.	Petroleum ether (b.p. 60-80°)	3.19
2.	Benzene	2.08
3.	Chloroform	0.26
4.	Acetone	0.52
5.	Ethanol	2.24
6.	Distilled water	12.31

* Values are average of three determinations

Table-5 Preliminary Phytochemical Screening for Detection of Phytoconstituents from Ethanolic Extract of Rhizome of *A. galanga*

S.No	Phytoconstituents	Ethanolic Extract
1.	Acidic compounds	+
2.	Alkaloids	-
3.	Carbohydrates	+
4.	Flavonoids	-
5.	Glycoside	+
6.	Phenolic compounds and tannins	-
7.	Proteins and free amino acids	+
8.	Resins	+
9.	Saponins	-
10.	Sterols and Triterpenoids	+

+ : Positive - : Absent

Discussion

'Khulanjan', commonly known as the greater galangal or galanga major, is used in the indigenous system of medicine in the treatment of catarrhal affections [3]. Two species of *Alpinia* (Zingiberaceae), *A. galanga* and *A. officinarum* are reported to be the source plant of galangal. However they have been referred to as greater galangal or galanga major (*A. galanga*) and galangal minor or lesser galangal (*A. officinarum*) in most of the publications on medicinal plants. *A. galanga* rhizome is also used as the source plant of another Ayurvedic drug 'Rasna' through the South India [14]. A large quantity of the drug is sold in the Indian crude drug markets under the name 'Bach', source plant of which is *Acorus calamus* Linn.

The rhizomes are fibrous with aromatic agreeable odour and have pungent taste. The skin is deep orange or reddish brown and internally rhizome is pale buff in colour. The nodal region of the rhizomes is marked with waxy annulations of the leaf bases. Epidermis is thickened in the outer wall. Endodermis forms a continuous chain and the outer walls of the endodermal cells are lignified. Vascular bundles of the ground tissues are numerous and closely scattered. Those bundles just under the endodermis are more close to each other and form almost a ring just under endodermis. Phloem elements are less and fibre sheath is thinner in these bundles as compared to cortical bundles. Oleo-resinous cells and starch grains are present in the cortical region as well as inner ground tissue.

Observations regarding macro and microscopic features are in conformity with earlier findings [11,12,13]. The microscopical features of *A officinarum*, which is used as substitute of *A galanga*, are almost similar to the of *A. galanga*; they differ only

in the measurement of dimensions of the cells However, *A. galanga* (Greater galangal) can be recognized from the lesser galangal (*A. officinarum*) by its larger size, feebler odour and tasted and by its deep orange brown skin which is prominently contrasting with the pale buff colour of the internal structure.

Powder analysis of drug revealed the presence of fragments of epidermis, parenchyma, oleo-resinous cells; the fibres are elongated lignified with tapering ends; the vessels with spiral thickenings and starch grains are oval and abundant. Fluorescence analysis and microchemical colour indicative tests were also carried out. Results are shown in Table-2. Total ash, acid insoluble ash and water soluble ash were 6.17%, 3.78% and 2.26% respectively. The preliminary phytochemical tests evinced that acidic compounds, carbohydrates, glycosides, proteins and free amino acids, resins, sterols and triterpenoids were present. In the present investigation, some more additional aspects such as microchemical tests, fluorescence analysis, ash values, preliminary phytochemical screening have been studied and reported for the first time. These parameters will provide additional support in identifying and distinguishing *A. galanga* rhizome from its adulterants and substitutes.

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