

Pharmacognostic Study of *Acorus Calamus*

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Abstract

Acorus calamus is an aromatic marshy herb which is used in many Ayurvedic medicines. In Ayurveda, it is mentioned in the treatment of many diseases. Many drugs are sold in the market by the name of *Vacha*. In the present study, two samples of *Vacha* which are sold by the name of Ghor *Vacha* and *Sugandha Vacha*, are compared. Ayurvedic literature describes Ghor *Vacha* as the original *Vacha* i.e. *Acorus calamus* and *Sugandha Vacha* as its adulterant.⁵ In Ayurveda, *Sugandha Vacha* is called *Kulanjan* and its latin name is *Alpinia galanga*.⁵ A pharmacognostic study was carried out to standardize the original *Vacha* and differentiate it from the other drug/s. It was concluded that *Vacha* can be differentiated from the other drug by macroscopic and microscopic characters.

Keywords *Acorus calamus*, Microscopy, Macroscopy, Pharmacognosy

INTRODUCTION

Acorus calamus is commonly known as Sweet flag in English and *Vacha* in Hindi^{3,5}. It is distributed throughout India and in marshes of Ceylon, wild or cultivated. It is actually a native of Europe and North America³ and has been described by many names in Ayurvedic literature viz. *Aruna*, *Uragandha*, *Golomi*, *Jatilaa*, *Bhunaashni*, *Mangalya*, *Shadgrantha*⁵ etc. Many of these synonyms indicate the morphological features of this plant and its rhizome e.g. *Uragandha* (It has strong smell), *Aruna* (It shows the colour of rhizome), *Golomi* (Its fresh rhizome has abundant root hairs) and *Shataparvika* (Its rhizome has many nodes). In Ayurveda, *Vacha* has been mentioned for the treatment of Epilepsy, Non-bleeding

Hemorrhoids, *Aamajeerna*, *Mukha Roga*, *Charmadala* and *Kaphaja Hridroga*⁵. Its rhizomes contain essential oil, a bitter glycoside 'acarin' and an alkaloid named 'calamin' which is the mixture of methylamine and trimethylamine. Active principle of the drug α - and β - asarone lies in the volatile oil that are the trans and cis-isomers, respectively of 2,4,5- trimethoxy-1-propenyl benzene^{3,4}.

In the market, many drugs are sold by the name of *Vacha*. Ayurvedic literature also describes many types of *Vacha* like Ghor *Vacha*, *Sugandh Vacha*, *Baal Vacha*, *Doodh Vacha*, *Shukla Vacha*⁵ etc. In the present study, two samples of *Vacha* were

compared. These are sold by the name of Ghor Vacha and Sugandha Vacha. Ghor Vacha is the original Vacha i.e. *Acorus calamus* and the drug sold by the name of Sugandh Vacha is *Alpinia galanga*. It is an adulterant of the original Vacha. In the present study, original vacha was standardized and differentiated by means of Macroscopic and Microscopic characters.

2. MATERIALS AND METHODS

2.1 Plant Material

Dry Vacha samples were purchased from various suppliers of dry herbal drugs in Kurukshetra and Ambala. Fresh rhizomes were collected from the herbal garden of S. K. Govt. Ayurvedic College, Kurukshetra, Haryana.

2.2 Physical Constant Values

Physical constant values like Total ash value, Acid insoluble ash, Water soluble ash, Water soluble extractive, Alcohol soluble extractive of the two samples were determined at Dravyaguna Department of Shri Krishna Govt. Ayurvedic College, Kurukshetra, Haryana as per standard procedure^{1, 2, 7}.

2.3 Pharmacognostic Study

Pharmacognostical study of the two samples was done at Dravyaguna Department of Shri

Krishna Govt. Ayurvedic College, Kurukshetra, Haryana. Shape, size, colour, taste, organoleptic testing of the fresh and dry samples was done. Further, microscopies of the rhizomes were studied as per the standard procedure^{1, 2, 6}. The powder microscopy was performed according to the method of Khandelwal².

RESULTS AND DISCUSSION

Physical Constant Values of the two drugs:

Results are shown in Table 1

Macroscopic characters of *Acorus calamus*

Rhizome is woody, branched, light brown, cylindrical to flat and 9-15 mm in diameter with distinct nodes and internodes. Nodal regions are broad with leaf scars and hair like fibres. Internodes are 8-10 mm in length, ridged and furrowed. Undersurface is provided with zigzag line of circular root scars. Transversely cut surface is cream in color with pinkish tinge and differentiated into central and peripheral regions.

Table 1 Physical Constant Values of the two dry drugs (as % of dry drug)

Sr. No.	Particular	<i>Acorus calamus</i>	<i>Alpinia galanga</i>
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1.	Moisture Content	10.6	8.7
2.	Total Ash	6.56	9.4
3.	Acid Insoluble Ash	0.93	4.2
4.	Water Soluble Ash	3.2	4.8
5.	Water-soluble extractive	23.22	11.4
6.	Alcohol soluble extractive	16.43	10.2
7.	Qualitative Examination of organic matters	Essential Oil, Glucoside, Alkaloid	Essential Oil, Alkaloid, Carbohydrates
8.	Volatile Oil Content	0.9%	

Table 2 Macroscopic characters of the two drugs

Acorus calamus	Alpinia galanga
Rhizome is light brown in colour and cylindrical to flat in shape.	Rhizome is orange brown in colour and cylindrical in shape.
Rhizome is 9-15 mm in diameter	Rhizome is 18-24 mm in diameter
Nodal regions are broad with leaf scars and hair like fibres.	Nodal regions are with wavy light brown raised rings.
Internodes are 8-10 mm in length	Internodes are 4-13 mm in length
Transversely cut surface is cream in color with pinkish tinge.	Transversely cut surface is light orange brown

Macroscopic characters of *Alpinia galanga*:

Rhizome is woody, branched, orange brown, cylindrical and 18-24 mm in diameter with distinct nodes and internodes. Nodal regions are with wavy light brown raised rings. Internodes are 4-13 mm in length and unevenly ridged and furrowed. Transversely

cut surface is light orange brown and with central and peripheral regions.

Results are shown in Table 2

Microscopic characters of *Acorus calamus*:

Transverse section is differentiated into narrow cortical and large stelar regions. Epidermis is single layered having radially elongated cells with heavily thickened outer walls: Cortical region consists of thinwalled parenchymatous cells arranged in chains leaving large intercellular spaces, sheathed collateral vascular bundles and bundles of fibres. Stellar region is outlined by single layer of barrel-shaped endodermal cells with abundant starch grains. Mostly leptocentric and few collateral vascular bundles in association with the leptocentrics are observed in the ground tissue of the stele. Vessels are with simple and scalariform pits. Fibres are thickwalled and pitted. Large oil cells, dark brown oleoresin content and starch grains are scattered in the ground tissue of both the cortex and stele.

Microscopic characters of *Alpinia galanga*

Table 3 Microscopic Characters of the two drugs

Acorus calamus	Alpinia galanga
Transverse section is	Transverse section is

differentiated into narrow cortical and large stelar regions.	differentiated into outer covering, wide cortex and small stele.
Epidermis has a single layer with radially elongated cells with heavily thickened outer walls	The outer covering consists of several layers of thinwalled parenchymatous cells. These layers are outlined by cuticularised epidermis of tangentially elongated cells.
Cortical region consists of thin walled parenchymatous cells arranged in chains leaving large intercellular spaces, sheathed collateral vascular bundles and bundles of fibres.	Cortex shows thick walled parenchymatous ground tissue with less intercellular spaces, asymmetrically sheathed collateral vascular bundles, starch grains and light brown oleoresin massed in the intercellular spaces.
Stele is outlined by single layer of barrel-shaped endodermal cells with abundant starch grains.	Stele is surrounded by a single layer of thin walled irregular cells and 2-3 layers of discontinuous tangential scalariform vessels.
Mostly leptocentric and few collateral vascular bundles in association with the leptocentrics are observed in the ground tissue of the stele.	Collateral vascular bundles, starch grains and oleoresins are observed in the stele.

Transverse section is differentiated into outer covering, wide cortex and small stele. The outer covering consists of several layers

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of thinwalled parenchymatous cells outlined by cuticularised epidermis of tangentially elongated cells with oleoresin content. Cortex shows thickwalled parenchymatous ground tissue with less intercellular spaces, asymmetrically sheathed collateral vascular bundles, starch grains and light brown oleoresin massed in the intercellular spaces. Stele is surrounded by a single layer of thin walled irregular cells and 2-3 layers of discontinuous tangential scalariform vessels. Collateral vascular bundles, starch grains and oleoresins are also observed in the stele. Results are shown in Table 3

Powdered drug

Acorus calamus - Thinwalled quadrangular cells measuring 30-40 * 29-36 µm, thinwalled round and oval parenchyma cells, with brown oleo-resin content, thin walled polygonal cells with beaded appearance on the cell wall measuring 25-40 * 15-30 µm, spherical oil cells with yellowish content, round starch grains, pitted walled fibres and simple, scalariform pitted vessels.

Alpinia galanga - Thinwalled round and oval parenchyma cells, few silica crystals were found in the parenchyma cells of *A. galanga*, that are diamond shaped 80 to 100 µ in size. Pitted fibers are more prominent in *A. galanga*. Parenchyma cells near

vessels are at places studded with small prismatic crystals of Calcium Oxalate and less frequently found cluster crystals of Calcium Oxalate.

CONCLUSION

Sugandha Vacha i.e. *Alpinia galanga* is a common adulterant of Vacha (*Acorus calamus*). Macroscopic and microscopic detection is easy, reliable and cost effective tool for detection of this adulterant in medicinal plant materials. From the present study, it is clear that the adulterant, *Alpinia galanga* can be differentiated from the genuine drug, *Acorus calamus*, by macroscopic and microscopic studies.

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