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. In Ayurveda, Sugandha Vacha is called Kulanjan and its latin name is *Alpinia galanga*. 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. It is distributed throughout India and in marshes of Ceylon, wild or cultivated. It is actually a native of Europe and North America and has been described by many names in Ayurvedic literature viz. Aruna, Uragandha, Golomi, Jatilaa, Bhunaashni, Mangalya, Shadgrantha 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. Its rhizomes contain essential oil, a bitter glycoside ‘acorin’ 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.

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 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 Khandelwal 2.

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)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Particular</th>
<th>Acorus calamus</th>
<th>Alpinia galanga</th>
</tr>
</thead>
</table>

Greentree Group
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
8. Volatile Oil Content 0.9%

Table 2 Macroscopic characters of the two drugs

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

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. Stelar 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 erains 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

<table>
<thead>
<tr>
<th>Acorus calamus</th>
<th>Alpinia galanga</th>
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<tbody>
<tr>
<td>Transverse section is</td>
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<table>
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<tr>
<th>Differentiated into</th>
<th>Differentiated into outer covering, wide cortex and small stelae.</th>
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<tbody>
<tr>
<td>Narrow cortical and large stelar regions.</td>
<td>Epidermis has a single layer with radially elongated cells with heavily thickened outer walls. The outer covering consists of several layers of thin-walled parenchymatous cells. These layers are outlined by cuticularised epidermis of tangentially elongated cells.</td>
</tr>
<tr>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>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. Collateral vascular bundles, starch grains and oleoresins are also observed in the stele.</td>
<td></td>
</tr>
<tr>
<td>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.</td>
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Transverse section is differentiated into outer covering, wide cortex and small stele. The outer covering consists of several layers of thin-walled parenchymatous cells outlined by cuticularised epidermis of tangentially elongated cells with oleoresin content. 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 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**

*Acros calamus* - Thin-walled quadrangular cells measuring 30-40 * 29-36 μm, thin-walled 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 yellowinh content, round starch grains, pitted walled fibres and simple, scalariform pitted vessels.

*Alpinia galanga* - Thin-walled 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.

**REFERENCES**