Pharmacognosy of volatile oil containing drugs

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Abstract
The most complex and perhaps the most fascinating of herbal constituents, providing the herbal practitioner with one of the more potent aids to treatment, volatile oils are nevertheless barely recognized as useful by conventional pharmacologists. Generally speaking volatile oils are mixtures of hydrocarbons and oxygenated compounds derived there from. As the oxygenated form is more soluble in both water and alcohol, it is this form that on the whole determines the taste and smell of the mixture. In Ayurveda Zingiber officinale, Cuminum cyminum, Santalum album and Acorus calamus are most commonly used due to medicinal values. The present study shows various pharmacognostic parameters of Zingiber officinale, Cuminum cyminum, Santalum album and Acorus calamus which includes organoleptic characters, physico-chemical parameters including foreign matter, loss on drying, ash value, extractive value, powder microscopy and phytochemical screening.

Keywords: Zingiber officinale, Cuminum cyminum, Santalum album, Acorus calamus, physico-chemical parameters, phytochemical screening

Introduction
The Medicinal plants have been regarded as sacred and used by early civilizations to treat sickness and to embellish mans well being.¹ It has been estimated that from 25,000 to 75,000 species of higher plants exist on the earth. A reasonable estimate of about 10% has been used in traditional medicine. However perhaps only about 1% of these (250-750 species) are acknowledged through scientific studies to have therapeutic value when used in extract form by human.² Volatile (essential) oils are the reservoir of biologically active compounds and there has been increased interest in looking at their antimicrobial properties. These are products which are generally complex in composition, consisting of the volatile principles contained in plants, and are more or less modified during the preparation process.³ Only two procedures may be used to prepare official oils
i. Steam distillation
ii. Expression
Four main types of volatile oils
i. Concretes
ii. Pomades
iii. Resinoids
iv. Absolutes
In Ayurveda Zingiber officinale, Cuminum cyminum, Santalum album and Acorus

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Calamus are most commonly used due to medicinal values. Ginger (Zingiber officinale Roscoe) is widely used as a food spice and a herbal medicine around the world. For centuries, it has been an important ingredient in Chinese, Ayurvedic, and Tibb- Unani systems of medicine and widely used in the treatment of unrelated ailments like arthritis, rheumatism, sprains, muscular aches, pains, sore throats, cramps, fever, infectious diseases and helminthiasis. Cuminum cyminum (Linn.) belonging to the family Umbelliferae is widely used in ayurveda for the treatment of dyspepsia, diarrhoea and jaundice. C. cyminum linn seeds have long been considered stimulant, carminative, stomachic and astringent. Santalum album Linn. belonging to family Santalaceae & occurs naturally in India, SriLanka and the Malay Archipelago (Indonesia and surrounding islands). In India it is found in the drier regions in the south of the country, especially the states of Karnataka and Tamil Nadu, up to 1400 m. It is useful in biliousness, fever and thirst. Also, use in skin eruption, hemicranias and skin diseases. It is commonly used in cosmetic and hair oil. Sandalwood oil relieves itching, heat, pruritus, inflammation of the skin. Santalum album Linn. Is bitter, cooling, sedative diuretic, expectorant, stimulant and astringent. Acorus calamus Linn. (Commonly called as ‘Sweet flag’) of family Araceae, is a semi-aquatic, perennial, aromatic herb with creeping rhizomes, sword shaped leaves and spadix inflorescence. A. calamus grows either as wild or cultivated crop throughout India ascending up to 1800 m in the Himalayas. It is widely employed in modern herbal medicine as its sedative, laxative, diuretic and carminative properties. The present study was undertaken to analyze the pharmacognosy of different plants containing volatile oil.

**MATERIALS AND METHODOLOGY**

**Plant material**
The dried parts of Zingiber officinalis, Cuminum cyminum, Santalum album and Acorus calamus were collected from local market of Jaipur in the month of October. The shade dried powder was used for the determination of macroscopic, microscopic, physicochemical parameters and phytochemical screening.

**Macroscopical studies**
The dried plant parts were subjected to macroscopical studies which comprised of organoleptic characteristics of the drug viz., size, colour, odour, taste, shape.

**Microscopical studies**
Powder characteristics of Zingiber officinalis, Cuminum cyminum, Santalum album and Acorus calamus rhizome powder were studied using reported method.

**Physicochemical parameters**
Various physicochemical parameters such as total ash, water soluble ash, acid insoluble ash, sulphated ash, water extractable matter, alcohol extractable matter, foreign matter, moisture content, were calculated.

**Preliminary phytochemical screening**
The aqueous and alcoholic extracts were subjected to qualitative chemical examination for the identification of various plant constituents. Following tests were performed.
Tests for Carbohydrates and Glycosides
200 mg of aqueous extract was dissolved in 5ml of distilled water and this solution was subjected to Molisch test for the detection of carbohydrates. Small portion of the extract was hydrolyzed with dilute hydrochloric acid for few hours in water bath and was subjected to Liberman-Burchard's test, Legal's and Borntager's test to detect the presence of different glycosides. Another small portion of extract was treated with Fehling's reagent, Barfoed reagent to detect the presence of various sugars. For the detection of saponin glycosides, Foam test and Hemolytic tests were carried out.\(^{10,11}\)

Tests for protein and free amino acids
A small quantity of alcoholic extract was dissolved in few ml of water and was subjected to Millon's test, Biuret test and Ninhydrine test.\(^ {10,11}\)

Tests for phenolic compounds and tannins
Small quantities of alcoholic extracts were treated with 5 % FeCl\(_3\) solution, 1 % of gelatin containing 10 % NaCl, 10% lead acetate and aqueous bromine solution for the detection of phenolic compounds and tannins.\(^ {10,11}\)

Tests for alkaloids
The small portion of dried alcoholic extract was stirred with a few drops of dilute Hydrochloric acid and was filtered. The filtrate was tested with various alkaloidal reagents such as Mayer's reagent, Dragendroffs reagent, Hager's reagent, Wagner's reagent.\(^ {10,11}\)

RESULTS
1) Macroscopical studies

The macroscopic character was useful in quick identification of plant material and also serves as an important standardization parameter. Organoleptic characteristics are described in (table 1)

- The *Acorus calamus* rhizome is brownish in color with 12-14.5cm in length and 1- 2 cm thick, cylindrical and branched shape, aromatic odour, tasteless in taste.

- Rhizome of *zingiber officinalis* is laterally compressed bearing short, flattish, ovate, oblique, branches on upper side each having at its apex a depressed scar, pieces about 5-15 cm long, 1.5-6.5 cm wide (usually 3-4 cm) and 1-1.5 cm thick, externally buff colored showing longitudinal striations and occasional loose fibres, fracture short, smooth, transverse surface exhibiting narrow cortex (about one-third of radius), a well-marked endodermis and a wide stele showing numerous scattered fibro-vascular bundles and yellow secreting cells odour agreeable and aromatic, taste, agreeable and pungent.

- Fruit of *Cuminum cyminum* a cremocarp, often separated into mericarps, brown with light coloured ridges ellipsoidal, elongated, about 4-6 mm long, 2 mm wide, tapering at ends and slightly compressed laterally, mericarps with 5 longitudinal hairy primary ridges from base to apex, alternating with 4 secondary ridges which are flatter and bear
conspicuous emergences odour characteristic, taste, spicy.

- Wood of *Santalam album* is Yellowish-brown to pale-reddish orange, heavy, dense, hard but split easily; transversely smooth surface shows alternating light and dark concentric zones with numerous pores, traversed by very fine medullary rays; odour, persistently aromatic; taste, slightly bitter.

2.) **Powder Microscopy**

- *Acorus calamus* powder shows Fibre, Starch grain, Vessel.(Fig 1)
- *Zingiber officinalis* powder has thin-walled parenchyma, reddish brown oleo-resin, spiral vessel, oil globules and starch grains.(Figure 2)
- *Cuminum cyminum* powder shows polygonal cells, aleurone grains, oil globules, fibres (Figure-3).
- *Santalam album* powder is Light-brown and aromatic; shows pitted vessels with tails, isolated or associated with fibres, fragments of fibres, square to rectangular-shaped parenchyma, prismatic crystals of calcium oxalate, and numerous oil globules.(Figure 4)

3.) **Physicochemical parameters**

The Ash value, Extractive value, Loss on drying, foreign matter are observed in the following table 2, 3&4

4.) **Phytochemical screening**

Presence of various constituents is observed in table 5

**DISCUSSION**

The plants are useful in traditional medicine for the treatment of various ailments and it is important to standardize it for use as a drug. The pharmacognostic constants of the plants, the diagnostic microscopic features and the numerical standards reported in this work could be useful for the compilation of a suitable monograph for it proper identification.

**REFERENCES**


8 Ayurvedic Formulary of India, 2nd vol. Part-I. New Delhi; Govt. of India, Ministry of health and family welfare. Department of Indian system of Medicine and Homeopathy; 2003. 177-179.


### TABLE- 1 Organoleptic Characteristic

<table>
<thead>
<tr>
<th>Botanical name</th>
<th>Plant part used</th>
<th>Image</th>
<th>Organoleptic characteristics</th>
</tr>
</thead>
</table>
| *Zingiber officinalis* (Zingiberaceae) | Rhizome         | ![Image](image1.jpg)   | COLOUR : Buff  
ODOUR : Aromatic  
TASTE : Pungent  
SIZE : Length (6.1cm)  
Width (1.7cm)  
SHAPE : Ovate with bud at apex |
| *Santalam album* (Santalaceae)  | Wood            | ![Image](image2.jpg)   | COLOUR : Creamish brown  
ODOUR : Characteristic  
TASTE : Tasteless  
SIZE : Length (6.1cm)  
Width (2.1cm)  
SHAPE : Longitudinal |
| *Cuminum cyminum* (Umbelliferae) | Fruit           | ![Image](image3.jpg)   | COLOUR : Blackish brown  
ODOUR : Characteristic  
TASTE : Characteristic  
SIZE : Length (0.6cm)  
Width (0.1cm)  
SHAPE : Elongated |
| *Acorus calamus* (Araceae)      | Rhizome         | ![Image](image4.jpg)   | COLOUR : Brownish  
ODOUR : Characteristic  
TASTE : Tasteless  
SIZE : Length (12cm)  
Width (1cm)  
SHAPE : Elongated |
### TABLE-2 Ash values of powdered drugs

<table>
<thead>
<tr>
<th>S.N</th>
<th>Constituents</th>
<th>Total ash</th>
<th>Acid insoluble ash</th>
<th>Water soluble ash</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Inference</td>
<td>Observed</td>
<td>Inference</td>
</tr>
<tr>
<td>1</td>
<td>Zingiber officinalis</td>
<td>NMT 6%</td>
<td>3.23%</td>
<td>NMT 1.5%</td>
</tr>
<tr>
<td>2</td>
<td>Santalam album</td>
<td>NMT 1%</td>
<td>3.11%</td>
<td>NMT 0.2%</td>
</tr>
<tr>
<td>3</td>
<td>Cuminum cyminum</td>
<td>NMT 8%</td>
<td>3.175%</td>
<td>NMT 1%</td>
</tr>
<tr>
<td>4</td>
<td>Acorus calamus</td>
<td>NMT 7%</td>
<td>5%</td>
<td>NMT 1%</td>
</tr>
</tbody>
</table>

### TABLE-3 Extractive values of powdered drugs

| S.N | Constituents         | Alcohol soluble | Water soluble | |
|-----|----------------------|-----------------|---------------|
|     |                      | Inference       | Observed      | Inference | Observed |
| 1   | Zingiber officinalis | NLT 3%          | 3.4%          | NLT 10%   | 11.2%    |
| 2   | Santalam album       | NLT 8%          | 15.13%        | NLT 1%    | 11.3%    |
| 3   | Cuminum cyminum      | NLT 7%          | 11.36%        | NLT 15%   | 21.31%   |
| 4   | Acorus calamus       | NLT 9%          | 14.3%         | NLT 16%   | 25%      |

### TABLE-4 Foreign matter and loss on drying

<table>
<thead>
<tr>
<th>S.N</th>
<th>Constituents</th>
<th>Foreign matter</th>
<th>Loss on drying</th>
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<td></td>
<td></td>
<td>Inference</td>
<td>Observed</td>
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<td>1</td>
<td>Zingiber officinalis</td>
<td>NMT 1%</td>
<td>0.00%</td>
</tr>
<tr>
<td>2</td>
<td>Santalam album</td>
<td>NMT 1%</td>
<td>0.00%</td>
</tr>
<tr>
<td>3</td>
<td>Cuminum cyminum</td>
<td>NMT2%</td>
<td>0.3%</td>
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<tr>
<td>4</td>
<td>Acorus calamus</td>
<td>NMT 1%</td>
<td>0.25%</td>
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</table>

### TABLE-5 Phytochemical screening of drugs

<table>
<thead>
<tr>
<th>S.N</th>
<th>Constituents</th>
<th>Carbohydrate</th>
<th>Alkaloid</th>
<th>Protein</th>
<th>Glycoside</th>
<th>Tannin</th>
<th>Flavanoid</th>
<th>Steroid</th>
<th>Volatile oil</th>
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<tbody>
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<td>1</td>
<td>Zingiber officinalis</td>
<td>Aq Ext +</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
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<td></td>
<td>Aq Ext</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>2</td>
<td>Cuminum cyminum</td>
<td>Aq Ext +</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
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<td>Aq Ext</td>
<td>+</td>
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<td>+</td>
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<td>+</td>
</tr>
<tr>
<td>3</td>
<td>Santalam album</td>
<td>Aq Ext -</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<td></td>
<td>Aq Ext</td>
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<td>-</td>
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<td>+</td>
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<td>+</td>
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</tr>
<tr>
<td>4</td>
<td>Acorus calamus</td>
<td>Aq Ext +</td>
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<td>-</td>
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<td>+</td>
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</tbody>
</table>
FIGURE 1  Acorus calamus

FIBRE  STARCH GRAINS  VESSELS

FIGURE 2  Zingiber officinalis

OIL GLOBULES  STARCH GRAINS  PARENCHYMA CELLS

FIGURE 3  Cuminum cyminum

FIBRE  STARCH GRAINS  OIL GLOBULES
FIGURE 4 Santalam album

FIBRE

PITTED VESSELS

OIL GLOBULE

CALCIUM OXALATE CRYSTALS