PHARMACOGNOSTICAL AND PHYTOCHEMICAL STUDIES ON CURCUMA AMADA (LINN.) RHIZOME (ZINGIBERACEAE)

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ABSTRACT: The macroscopic and microscopic characters, physical constant values, extractive values, ash values and the behaviour of powder drug on treatment with different chemical regents, microchemical and histochemical analyses were conducted to characterize some pharmacognostical parameters of Curcuma amada linn. (Zingiberaceae).

Key words: Curcuma amada, Zingiberaceae, Pharmacognostic study Phytochemistry.

INTRODUCTION

Curcuma amada Linn. belonging to Zingiberaceae family is known as mango ginger in English; Manghainchi and Kathumachal in Malayalam; Amragangadiharidra, Karpuraharidra, Darve, Darveebheda, Amragandha, Surabhidaru, Darooka, Daroo, Padmapatra, and Suraniyika in Sanskrit. (Wealth of India, 1952; Warrier et al., 1994; Kirtikar & Basu, 1984).

The plant is found wild in Bengal, Tamil Nadu, Konkan and on the hills of West Cost of India and Often cultivated in gardens in rotation with vegetable crops (Warrier et al., 1994; Kirtikar & Basu, 1984 Nadkarni et al., 1954). The rhizomes are bitter, aromatic, cooling, appetizer, carminative, digestive, demulcent, febrifugal, aphrodisiac, diuretic and antipyretic (Warrier et al., 1994). The paste of drug with the juice of Jasminum grandiflora is applied to skin complaints of children (Nadkarni et al., 1954). In the present study attempts are made to evaluate this plant pharmacognostically by studying its macroscopic and microscopical features, histological characters, qualitative physical, chemical and analytical characteristics, etc.

MATERIALS AND METHODS

The rhizome of Curcuma amada were collected locally from mature plants during October – January 2001.

The plant material was identified and authenticated. The voucher specimens were deposited in the Herbarium, Department of Botany, University of Calicut for future reference. The collected rhizomes were washed with tap water to remove adhering dust, followed by rinsing with distilled water, shade dried and used for the study.

The macroscopic characters of the rhizome were observed (Wallis, 1985). Thinnest possible section of the rhizome was taken and treated with 5% KOH to make the section clear. Sections were stained with safranin and mounted.

The microslides were scanned under a compound microscope and the anatomical
details were drawn with the help of a prism type camera Lucida.

Measurements of the cells/tissues were made with the help of micrometers under a compound microscope (Johansen, 1940). The characteristics of the drug powder was analysed (Wallis, 1985) after homogenizing the shade dried, flaked rhizomes with the help of a mortar and pestle. The ash values, alcohol soluble and water soluble extractive values of rhizomes were determined as per the Indian pharmacopoeial methods (Kokate, 1994; Anonymous, 1990). Other extractive values were determined by extracting the plant material successively by Soxhlet extraction apparatus with various solvents in increasing order of polarity (Kokate, 1994; Anonymous, 1990). The behaviour of the powdered rhizome with different chemical reagents was studied (Siddique et al., 1989).

Preliminary phytochemical tests of different extracts were performed by using specific reagents (Trease & Evans, 1983; Harborne, 1973).

RESULTS AND DISCUSSION

Macroscopic Characters of C. amada Rhizome

Length : 3.0 -15 cm
Width : 1.5 – 3.5 cm
Branching : Sympodial
Nodes and Internodes : Present

Surface characters : The outer surface in pale brown in colour
Surface characters : Externally demarcated into modal and internodal ragions. The branches arise obliquely from the rhizome and terminate in depressed scars or in undeveloped buds. Scale leaves are present at the nodal region while the rest of the portion is smooth.

Odour : Aromatic
Teste : pungent

Roots : The roots are Cylindrical, fragrant and slightly curved. They occur along with rhizome and are rarely found separate.

Fracture : Short
Direction of growth : Horizontal

Histological Studies

The transverse sections of the rhizome of Curcuma amada Linn. (Fig.1) shows the following characters.

Periderm: Consists of 8-10 Layers of thin walled cork cells.

Cortex: The inner cortical region consists of three rings of collateral closed vascular bundles. Scattered in the cortex are numerous oil cells.

Endodermis: Composed of vessels with annular or spiral thickening.

Vascular bundles: Stelar bundles are scattered. The ground mass of the stele is composed of parenchyma containing prismatic crystals of calcium oxalate, starch grains and numerous oil cells.

Starch grains: are flattened and ovoid oblong and have concentric striations.

Powder Characteristics
The powder is light yellow in colour with mango like odour and pungent taste. It show the following characters.

1. Fragments of brown thin walled cork cells are present.
2. Parenchyma cells are filled with starch grains and oleoresin containing yellow colouring matter.
3. Vessels are abundant with annular, spiral, scalariform or reticulate thinkening.
4. Starch grains are elliptical, ovoid elongated or globular, hilum being in the centre with prominent striations.

TABLE 1. Micrometrial measurement of cells/Tissues of C. amada rhizome

| Cells/Tissue      | Size in microns     |
|-------------------|---------------------|
| Cork cells        | 40-85 µ x 25-35 µ   |
| Parenchyma cells  | 80-11 µ x 80-95 µ   |
| Endodermal cells  | 50-75 x 40-50 µ     |
| Xylem vessels     | 40-80 µ             |
| Tracheids         | 25-30 µ             |
| Starch grains     | 15-38 µ             |

TABLE 2. Ash values of C. amada rhizome

| Nature of ash         | % age (W/W) ash |
|-----------------------|-----------------|
| Total ash             | 20              |
| Acid insoluble ash    | 0.94            |
| Water soluble extractive | 19.53       |

TABLE 3. Extractive values of C. amada rhizome

| Solvent used          | Percentage of extractive value |
|-----------------------|--------------------------------|
| Petroleum ether (60-80oC) | 4.94                          |
| Benzene               | 1.12                          |
| Chloroform            | 0.44                          |
| Acetone               | 0.38                          |
| Methanol (90%)        | 1.52                          |
| Distilled water       | 7.2                           |
### TABLE 4 The colour and consistency of the extracts of C. amada rhizome

| Extract          | Colour            | Consistency |
|------------------|-------------------|-------------|
| Petroleum ether  | Blackish brown    | Sticky      |
| Benzene          | Brown             | Sticky      |
| Chloroform       | Yellowish brown   | Powdery     |
| Acetone          | Brown             | Slightly sticky |
| Methanol         | Pale brown        | Sticky      |
| Distilled water  | Brown             | Powdery     |

### TABLE 5. Histochemical analyses of the T.S. of rhizomes of C. amada

| Reagents                  | Test for   | Nature of change                        | Histological zone | Result |
|---------------------------|------------|-----------------------------------------|-------------------|--------|
| Phloroglucinol +conc. HCl +alcohol | Lignin     | Pink                                    | Xylem vessel      | +      |
| Iodine solution           | Starch     | Black                                   | Cortex & Stele    | +      |
| Aqueous ferric Chloride   | Tannin     | Yellow                                  | Whole section     | -      |
| Sudan III                 | Oil        | Pink                                    | Cortex & stele    | +      |
| H2SO4 (20%)               | Calcium Oxalate | Diminishes Slowly & is replaced by crystals of calcium sulphate | Stele             | +      |
| Methylene blue            | Mucilage   | No Change                               | Whole section     | -      |

### TABLE 6. Behaviour of root powder of C. amada with Different chemical reagents

| Treatment                        | Colour developed |
|----------------------------------|-------------------|
| Powder as such                   | Light yellow      |
| Picric acid                      | Yellowish brown   |
| Nitric acid (sp. gr 1.42)        | Pale orange       |
| Hydrochloric acid (sp. gr. 1.16) | Brown             |
| Chemical                  | Color               |
|--------------------------|---------------------|
| H2SO4 (80%)              | Black               |
| Glacial acetic acid      | Pale Brown          |
| Sodium hydroxide (5N) aq. Soln.) | Brown           |
| Iodine solution (aq.)    | Blackish Brown      |
| Ferric chloride (5% aq.soln.) | Pale Brown     |
| Antimony trichloride (5% aq.soln.) | Blackish Brown |
| Potassium hydroxide (5N) aq.soln. | Brown            |

The macroscopic as well as microscopic studies of Curcuma amada Linn revealed that by using these diagnostic features one can identify this plant easily from adulterants. The information obtained from ash values and extractive values are useful during the time of collection of rhizomes and also during extraction process. Using these standards, especially histological and chemical studies the plant can be authenticated, identified and differentiated from other related species, also these pharmacognostic parameters help in the detection of adulteration in commercial samples.

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**LEGENDS FOR THE FIGURES PROCIDED**

Fig 1-13. Macroscopic and microscopic details of curcuma amada rhizome

(1) Macroscopic appearance of the rhizome of Curcuma amada.
(2) T.S of the primary rhizome showing cork, cortex, endodermis and stele.
(3) T.S of the secondary rhizome showing cork, cortex, endodermis and stele.
(4) A portion of epidermis and cortex.
(5) A portion of endodermis with vascular strands X 450
(6) Cortical bundle X 450
(7) Stelar bundle X 450
(8) Starch grains X 450
(9) Xylem fibres X 100
(10) Xylem tracheids X 100
(11) Xylem vessels X 100
(12) Oil cell X 100
(13) Calcium oxalate crystals X 100
