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Pharmacognostic and physico chemical study of rhizome of *Curcuma longa* L.

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Abstract

The present study was aimed to evaluate pharmacognostically and phytochemically the diagnostic features of *Curcuma longa* rhizome. The study includes Macroscopic, Microscopy, Powder study, histochemical and physicochemical evaluation of *Curcuma longa*. This study helps to provide diagnostic tool for identification of *Curcuma longa*. Powder microscopic analysis showed the presence of fragments of brown colored cork cells, Cortical cells, Fibers, vessels, oleo resin content in cortical parenchymatous cell, dissipated starch grains. Physico chemical analysis was done by the parameters mentioned in Ayurveda pharmacopeia of India. Pharmacognostic and Phytochemical evaluation can be used as a tool for identifying and confirming the authenticity, quality, purity and strength of *Curcuma longa* Rhizome.

Keywords: *Curcuma longa*, curcuminoids, turmeric, powder microscopy, phytochemical

Introduction

Plants have been used as safe solutions to treat numerous diseases since beginning of mankind. There has been a boost in plant study on across the globe in recent years, and numerous evidences point to the enormous potential of medicinal plants in various traditional systems ^[1, 2, 3]. Therefore, there is a need to evaluate and standardize the plant used in the formulations by employing various Pharmacognostic and Phytochemical evaluation tools like Macroscopy, Microscopy, Powder Microscopy, Histochemical, Phytochemical Screening and Physicochemical evaluation of crude medicinal plants ^[4].

Turmeric, also known as *Curcuma longa* L., is a medicinal herb used both alone and in combinations with various plants to provide relief from an array of ailments. *Curcuma longa* L. is a member of the zingiberaceae family. Its rhizome has been used in Ayurveda and traditional medicine to combat a wide array of ailments since it was found to have diverse medicinal properties. It is reported to have anti-inflammatory, anti-arthritis, antibacterial, Antioxidant, anti-allergic and anti-cancerous effects ^[5, 6].

Materials and Methods

Curcuma longa L rhizome was collected from the SRs farms of Gundlupet of Karnataka state. The rhizome was cleaned, scale roots and leaves are removed with a knife, washed and it was cured by boiling and dried in sunlight.

Macroscopic and organoleptic evaluation

Turmeric was studied macroscopically for examining its size, shape, texture, colour, odour and taste. Macroscopic examination of crude drug was carried out by naked eye by placing the individual raw materials on a white paper surface and organoleptic characteristics like shape, size, colour, taste, fracture, odour was evaluated ^[7, 8].

Microscopic evaluation

Free hand sections and microtome transverse sections of *Curcuma longa* was taken. Among the sections thin sections were selected and placed on the microscopic slide and stained with saffranine, mounted in glycerine ^[7, 8].

Powder Microscopic evaluation

Turmeric was powdered and sufficient quantity of Powder was taken on a microscopic slide and it is treated with 1-2 drops of safranin. The samples were evenly spreaded over the slide, followed by mounting it in glycerine^[7,8].

Histochemical evaluation

Turmeric powder was evaluated for the presence of tannins, starch, aleurone grains, lignin and oil globules. Free hand sections and microtome sections of Turmeric were taken. Among the sections thin sections were identified and selected and placed on the microscopic slide and stained with specific reagents /stains to determine the specific secondary metabolite.

The sections taken were treated with specific reagents to determine its presence

1. Determination of the presence of Starch Grains

The sections were stained with Iodine solution. The appearance of blue colour indicated the presence of starch grains in the crude drug.

2. Determination of the presence of Tannins

The sections were stained with ferric chloride solution. The appearance of Blue or greyish black colour indicated the presence of starch grains in the crude drug.

3. Determination of the presence of Lignin

The sections were treated with Phloroglucinol solution followed by the addition of one drop of Hydrochloric acid. The Presence of Lignified cells were indicated by the appearance of pink stain

4. Determination of the presence of Fixed oils

The sections were Stained with Sudan Red. Appearance of

orange pink coloured indicated the presence of Fixed oils in the crude drug.

Visualisation of Pharmacognostic characteristics

The microscopic slides of Transverse Section and powder were covered with cover slip and were observed through Leica DM 1000 LED. Trinocular 'Leica' microscope.

The photos of transverse section, powders and histochemical analysis were taken with the help of 'Leica DFC 295' digital camera connected to the computer and Leica Application Software LAS Version 3.6.1 were used.

Phytochemical evaluation

Phytochemicals that have physiological effects are believed to come from plants. The phytochemical that delivers medicinal properties are known as secondary metabolites. The preliminary phytochemical study will provide insight into the plant's chemical structure. The preliminary phytochemical study was performed to detect the presents of Phytoconstituents such as Alkaloids, Carbohydrates and Glycosides, Flavonoids, Tannins, saponins and terpenoids

Physico chemical evaluation

The parameters employed to analyse dried rhizome of *Curcuma longa*^[11, 12] were performed as per the guidelines of Ayurveda pharmacopeia of India^[13].

Results and Discussions

Pharmacognostic Study

Macroscopic and Organoleptic evaluation of Crude Turmeric

Macroscopic and Organoleptic of crude turmeric sample are shown in Table .1

Table 1: Macroscopic and Organoleptic of crude *Curcuma longa*.

Parameters	Observations
Appearance	Consists of Primary and secondary rhizomes. Primary rhizomes or round turmeric: short pieces, bulb shaped, condensed and swollen with longitudinal wrinkles found. Secondary rhizomes or long turmeric: Elongated and branched with 0.5-1.5 cm thickness. The external surface of the rhizome is yellow to yellowish brown with root scars and annulations of leaf bases
Colour	Yellowish to orange colour,
Odour	Aromatic and characteristics
Taste	Bitter taste with slight peppery spice
Fracture	Short fracture with orange to reddish brown fractured surfaces

The macroscopic examination is the qualitative approach for identifying herbs and it works as an evaluation tool for identifying herbal drugs.

Microscopic evaluation of *Curcuma longa*

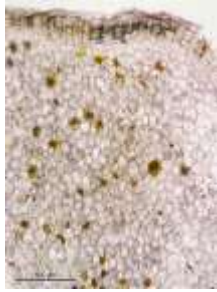


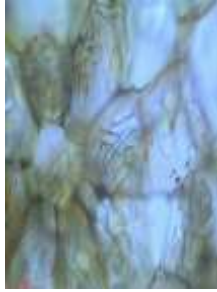
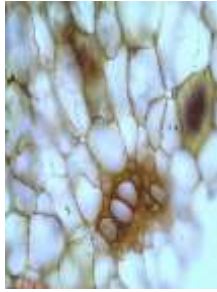
The transverse section of *Curcuma longa* rhizome revealed following diagnostic characteristics.

The outline of the rhizome is almost circular.

Epidermis: 5-6 layers of tangentially elongated cells. Thick walled

Cortex: Broad cortex with 15-20 rows of thin-walled rounded parenchymatous cortical cells. Some parenchymatous cell contain deposition of oleoresins, yellowish oil globules and scattered vascular bundles.

Stele portion: Contains parenchymatous cell similar to cortical region containing vascular bundles, starch grains, oil cells with suberised walls with either orange-yellow globules of volatile oil or amorphous resinous matter.



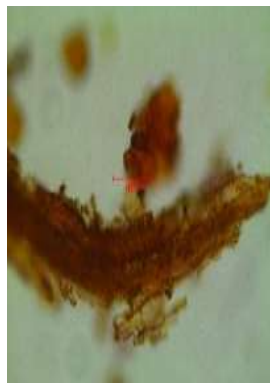


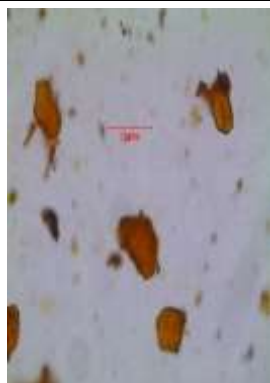
				
Fig 1: Cortical parenchyma cells with oil globules, Oleoresins, vascular bundles	Fig 2: Epidermal region & cortical region	Fig 3: Secondary vascular bundle	Fig 4: Starch Grains	Fig 5: Prism Bundle

Transverse section of *Curcuma longa* Showing

Powder microscopy of *Curcuma longa*

Following features were observed on surface view of powdered *Curcuma longa* rhizome

1. Fragments of brown coloured cork cells.
2. Fragments of cortical cells.
3. Fragments of fibres and vessels.
4. Cortical parenchymatous cells with oleo resin content.
5. Dissipated starch grains
6. Cells containing curcumin cells.

		
Fig 1: Cork cells in surface Veiw	Fig 2: Cortical Parenchyma with fragments of oleoresin cells	Fig 3: Fibre and Vessel
		
Fig 4: Starch Grains	Fig 5: Cells containing Oleoresin Content	Fig 6: Curcumin Cells

Diagnostic characters of *Curcuma longa* in Powder microscopy showing

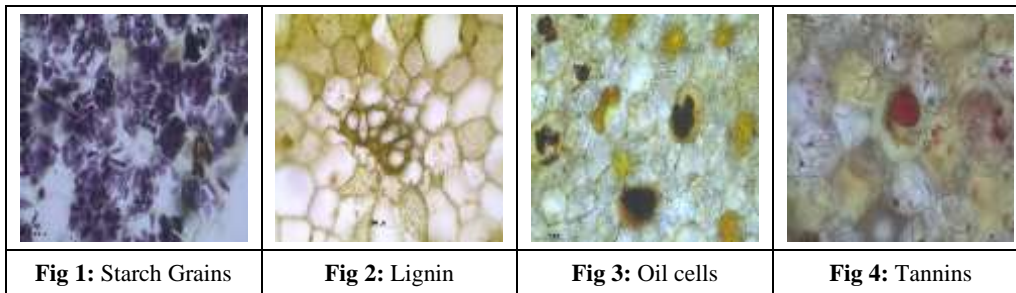
Histochemical evaluation of *Curcuma longa* rhizome

Curcuma longa rhizome sections were subjected to

histochemical analysis to determine the presence of starch grains, tannins, Oil cells and Lignified cells

Table 2: Histochemical characteristics of *Curcuma longa* rhizome

	Treated with	Observations	Inference
Microtome and Free hand sections of <i>Curcuma longa</i>	Iodine solution	Bluish Black Colour	Presence of starch grains detected
	Ferric Chloride solutions	Black/Greyish Black Colour	Presence of Tannins detected
	Phloroglucinol +Hydrochloric acid	Pink Colour	Lignified cell not detected
	Sudan red	Orange Pink	Presence of oil detected

Histochemical analysis of *Curcuma longa* for testing the presence of**Phytochemical investigation**

Phytochemical investigation of *Curcuma longa* rhizome performed shows the presence of alkaloid, carbohydrate, glycosides, flavonoids, tannins, terpenoids and saponins (Table 3).

Table 3: Qualitative Phyto chemical screening of *Curcuma longa* rhizome

Test Reagent	Observation	<i>Curcuma longa</i>
Alkaloids		
Dragendorff's reagent	Reddish brown ppt	++
Mayer's reagent	White/cream ppt	++
Hager's test	Yellow ppt	+
Carbohydrates and Glycosides		
Molisch's test	Red violet ring	+++
Fehling's test	Brick red ppt	++
Benedict's test	Brick red ppt	++
Flavonoids		
Shinoda test	Magenta colour	+
10% NaOH	Yellow colour	++
Tannins		
10% K ₂ Cr ₂ O ₇ solution	Yellowish brown	++
5% FeCl ₃ solution	Greenish black	+
Anthraquinone Glycoside		
Bontrager's test	Pink Colour	-
Saponins		
Froth test	Foaming	+
Phenol		
Ferric Chloride Test	Red colour	++
Terpenoids		
Salkowski's test.	Reddish brown	++

+++ denotes Strong intensity reaction, ++ denotes medium intensity reaction, +denotes Weak intensity reaction, - denotes Not detected.

Physico chemical analysis of *Curcuma longa* rhizome

The rhizome of *Curcuma longa* was subjected to arrays of ash and extractive values. Total ash, Acid insoluble ash, water soluble ash, Water soluble extractive value, alcohol soluble extractive value, Loss on drying (Table 4)

Table 4: Physico chemical analysis of *Curcuma longa* rhizome

Parameters	Observation
Foreign matter	0.05% w/w
Total Ash % w/w	4.07% w/w
Acid insoluble Ash % w/w	0.41 5 w/w
Water Soluble Extractives % w/w	40% w/w
Alcohol soluble extractives % w/w	11.5 w/w

Foreign matter is used to determine the percentage of other parts of plants apart from the part mentioned in the plant monograph. Ash value is used to determine the inorganic content present in the crude drug which comprises of

silicates, carbonates and oxalates. The acid insoluble ash implies the silica present in the crude drug which indicates the contamination of crude drugs with earthy materials. Extractive values help to determines the chemical constituents present in the herbs and also helps in determination of particular bio constituents in specific solvent.

The macroscopic, Microscopic, histochemical, powder characteristics and Physico chemical evaluation of herbs serves as an important tools for identification and standardisation of herbs .In present study the plant diagnostic techniques helps in the identification and standardisation of Turmeric rhizome and it can be used as the standardisation parameter to identify the authentic turmeric rhizome from its substitutes and adulterants .This could serve as in establishing data's on plant monograph of *Curcuma longa* rhizome ^[14, 17].

Conclusion

The bioactive principles in turmeric are found to be of potential therapeutic benefits for management of many diseases ^[19, 20, 21]. The distinguishing characteristics mentioned in the study can be used as an authentication tool for the *Curcuma longa*. The utilisation of right quality raw materials helps to provide Quality finished formulations.

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