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Pharmacognostic, phytochemical and physicochemical studies of *CURCUMA LONGA* linn. rhizome

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ABSTRACT

In recent year there has been rapid increase in the standardization of selected medicinal plant of potential therapeutic significance. Despite the morden techniques, identification of plant drug by Pharmacognostic study is more reliable. The rhizomes of *Curcuma longa* reported to have good medicinal values in traditional system of medicines. The present study deals with pharmacognostic parameters for the rhizomes of *Curcuma longa* which mainly consist of Macromorphology, Cytomorphology, Physico-chemical constants and Phytochemical screening. This information will be of used for further pharmacological and instrumental evaluation of the species and will assist in standardization for quality, purity and sample identification.

Keywords*: Curcuma longa*, Pharmacognostic study, Cytomorphology, Standardization.

INTRODUCTION

India has a rich history of using plants for medicinal purposes. Turmeric (*Curcuma longa* L.) is a medicinal plant extensively used in Ayurveda, Unani and Siddha medicine as home remedy for various diseases. *C. longa*, botanically related to ginger belongs to the Zingiberaceae family [1]. Turmeric is native to the monsoon forests of South East Asia. It is perennial herb, 1meter tall with underground rhizomes. Curcuma species contain turmerin (a water-soluble peptide), essential oils (such as turmerones, atlantones and zingiberene) and curcuminoids including curcumin [1, 7-bis-(4-hydroxy-3-methoxyphenyl)-1, 6-heptadiene-3, 5-dione]. Curcuminoids can be defined as phenolic compounds derived from the rhizomes of Curcuma species (Zingiberaceae). [2,3] Current traditional Indian medicine uses it for biliary disorders, anorexia, cough, diabetic wounds, hepatic disorders, rheumatism, and sinusitis. [4,5] Powder of turmeric mixed with slaked lime is a household remedy for the treatment of sprains and swelling caused by injury, applied locally over the affected area. The old Hindu texts have described it as an aromatic stimulant and carminative. [6] In some parts of India, the powder is taken orally for the treatment of sore throat. This nonnutritive phytochemical is pharmacologically safe, considering that it has been consumed as a dietary spice, at doses up to 100 mg/day, for centuries. [7]

MATERIAL AND METHODS

Collection of sample: The rhizomes of *Curcuma longa* were collected in month of December from Ozerde Satara district, Maharashtra. Their identity and authentication was confirmed by Department of Pharmacognosy Marathwada Mitra Mandal's College of Pharmacy, Pune by correlating their morphological and microscopic characters with those given in literature. The organoleptic characters of fresh rhizomes and dried rhizome powder like colour, odour and taste and the macroscopic characters like size, shape, surface, fracture were evaluated as per standard WHO guidelines. [8, 9, 10]

Cytomorphology: Fresh rhizomes of *curcuma longa* were subjected for the microscopical studies. The the sections were cut by free hand sectioning. The numerous temporary and permenant mounts of the microscopical section of the spicemen were made and

examined microscopically. Photomicrophs of the microscopical section were taken with the help of MOTIC Digital Microscope, provided with MOTIC IMAGE PLUS 2.0 software. [9,10,11]

Powder characteristics: Preliminary examination and behavior of the powder with different chemical reagents was carried out as per reported method. [11,12]

Micrometry: Quantitative microscopy of the transverse sections and rhizome powder were performed to determine the size and dimension of tissues, cell and cell content. [13,14]

Physicochemical Evaluation: Physicochemical parameters such as foreign organic matter, moisture content, ash values, extractive values, pH etc were determine as per procedures mentioned in accordance with WHO guidelines. [8,15]

Preliminary phytochemical screening: The chemical evaluation includes qualitative chemical tests which are used for identification of various phytoconstitients present in the powdered crude drug. [9,10]

Fluorescence analysis: Dried rhizomes were powdered and observed under visible light, short ultra violet light, long ultra violet light after treatment with different reagents like chloroform, ethyl acetate, methanol, petroleum ether (60-80^{0}C), 50% sulphuric acid, 50% hydrochloric acid, 50% nitric acid, 10% sodium hydroxide etc. [16,17]

RESULTS AND DISCUSSION

Macromorphological description: The central or primary rhizomes are ovate, irregularly ovoid, cylindrical or fusiform, curved, sometimes slightly branched into a Y-shape, 1.1-10.3 cm long, 5-30 mm in diameter to, rough, with wrinkled striations, distinct cyclic nodes, and rounded scars of root branches and rootlets. The organoleptic evaluation of the rhizomes revealed that the rhizomes were Yellowish to yellowish-brown in colour, with characteristic and aromatic odour and slightly bitter and pungent in taste. The results of morphological characters are mentioned in Table no.1.

Cytomorphological Description: The transverse section of the rhizome shows cork as an outer layer followed by epidermis, cortex, and endodermis and ground tissue. Cork composed of thin walled brown cells which is large and polygonal in shape. Epidermis is consist of thin walled cubical cells of various dimension. The cortex consist of thin walled rounded parenchymatous cells and having olioresin cells. These cells are filled with gelatinized starch grains and yellow colouring matter. The ground tisse is parenchymatous and cells filled with gelatinized starch grains and yellow pigment. Fibrovascular bundle and oil cells scattered throughout ground tissue. [15,18]

Powder Characteristics: The Powder of *Curcuma longa* rhizome is yellowish brown, with aromatic and characteristic odour and slightly bitter in taste consist of cork, cortex, fragments of parenchymatous cells filled with starch grains and oleoresins.[13]

Micrometry: The results of micrometric characters of tissue, cells and cell contents were depicted in Table no.2. Measurements of different cells are frequently necessary for the quantitative identification of closely allied substances. In most cases these allied substances are mixed with the original drugs as adultrants and substituent's. [14,15] Thus, the adulterants and/or substituent in crude drugs can be distinguished by this way with the aid of optical microscopy. (fig.4)

Physicochemical Evaluation: The results of the physicochemical constants of raw material lie within the limit which is mentioned in Table no.3. This signifies that the quality and purity of raw material was good enough; the results of foreign organic matter denote presence of any organism, part or product of an organism other than that named in the specification and description of the herbal material concerned [14,15] which was found to be 0.23±0.015%w/w, it indicates that their may be present of part or product of an organism in less amount. Insufficient drying favors spoilage by molds and bacteria and makes possible the enzymatic destruction of active principles.

Not only the ultimate dryness of the drug is important equally important is the rate at which the moisture is removed and the condition under which it is removed thus the determination of moisture content also provide the method of preparation of drug; [13, 14] and it is observed that the moisture content of the drug was found to be 8.92±0.021%w/w which signify that the drug is properly dried and properly stored. The total ash is particularly important in the evaluation of purity of drugs, i.e. the presence or absence of foreign matter such as metallic salts or silica [8, 15] An analytical result for total ash was found to be 8.39±0.03%w/w. The amount of acid-insoluble siliceous matter present was 0.91±0.040%w/w; As the ash values of the crude drugs lies within the fair

limit which signify its quality and purity and gives idea about the total inorganic content.

The water soluble extractive value indicated the presence of sugar, acids and inorganic compounds;[14,15] the water soluble extractive value found to be 20.12±0.01%w/w and alcohol soluble extractive values indicated the presence of polar constituents like phenols, alkaloids, steroids, glycosides, flavonoids.[8,15] The alcohol soluble extractive value was found to be 6.74±0.67%w/w which signify the nature of the phytoconstituents present in plant. As the pH was determined this was near to 3 that is in acidic range and may be because of acidic salts present in the rhizomes.

Preliminary Phytochemical Screening: The Preliminary Phytochemical Investigations of Aqueous extract, acetone extract,ethanolic extract and methanolic extract of *Curcuma longa* rhizome were preformed which reveals the presence of Phenolic compound, Tannins, Alkaloids, Terpenes, Saponin type of major secondary metabolites which revealed their potent therapeutic activity.[10] The results of the screening were expressed in Table no.5.

Fluorescence Analysis: Fluorescence analysis of the powder treated with different solvents and reagents is exhibited in Table no.4. Fluorescence is the phenomenon exhibited by numerous phytoconstituents present in the plant material. In fluorescence the fluorescence light is always of greater wavelength than the exciting light. Light rich in short wavelength is very active in producing fluorescence and for this reason ultraviolet light produces fluorescence in many substance which do not visible fluoresce in day light.[16,17]

CONCLUSION

Standardization is essential measure for quality, purity and sample identification. Macromorphology and microscopy along with the Quantitative analytical microscopy is one of the simplest and cheapest methods to start with for establishing the correct identity of the source materials. Physicochemical and chemical analysis of rhizome confirm thequality and purity of plant and its identification. The present study was useful for further pharmacological and therapeutic evaluation along with the standadization of plant material.

Figure 1: Macroscopy of *Curcuma longa* rhizome

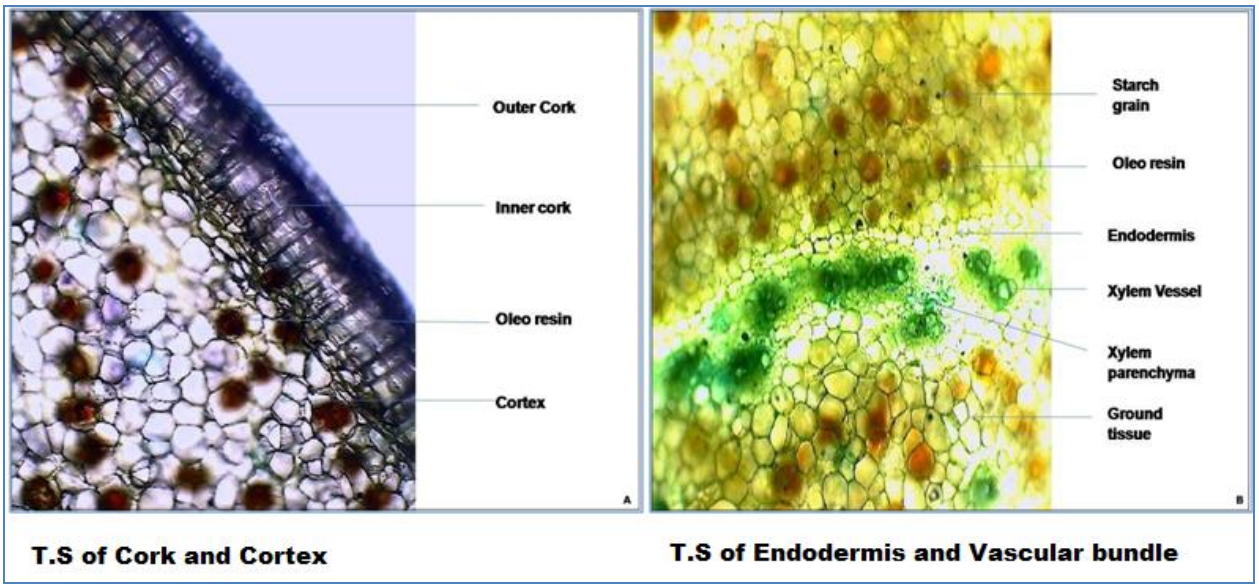

Figure 2:T.S of *Curcuma longa* rhizome

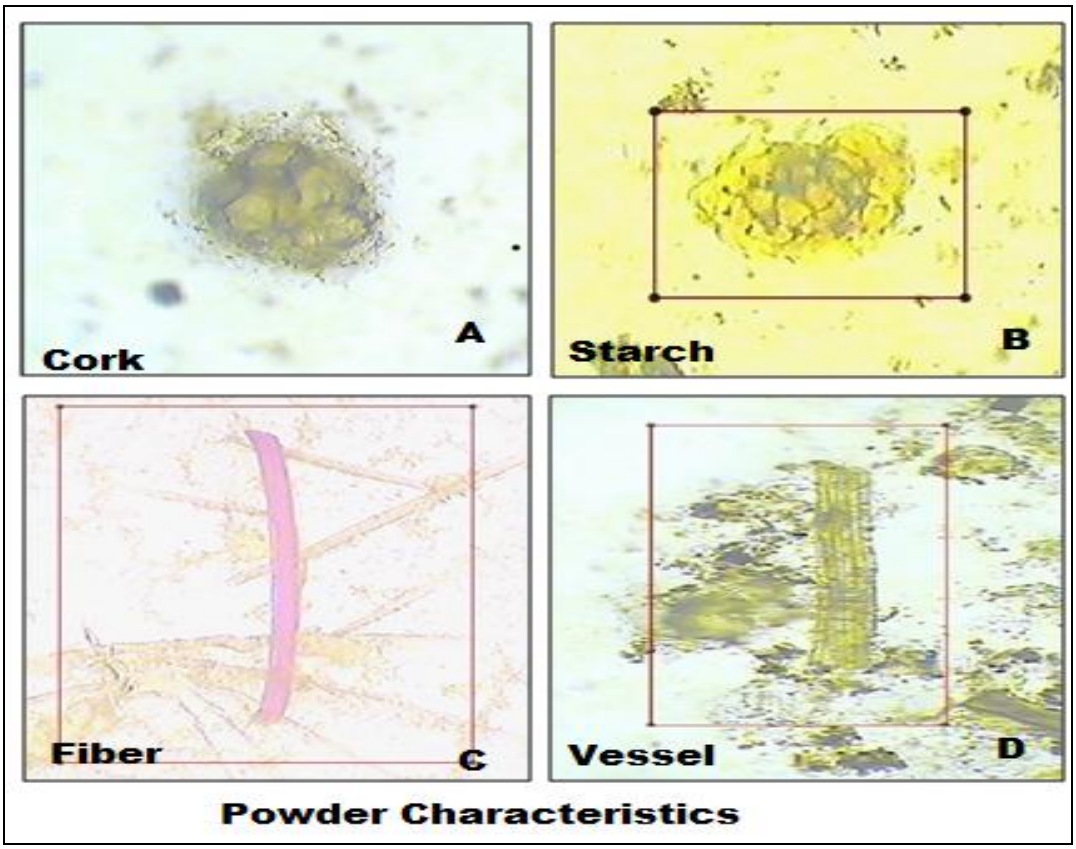

Figure 3: Powder Characteristics of *Curcuma longa* rhizome

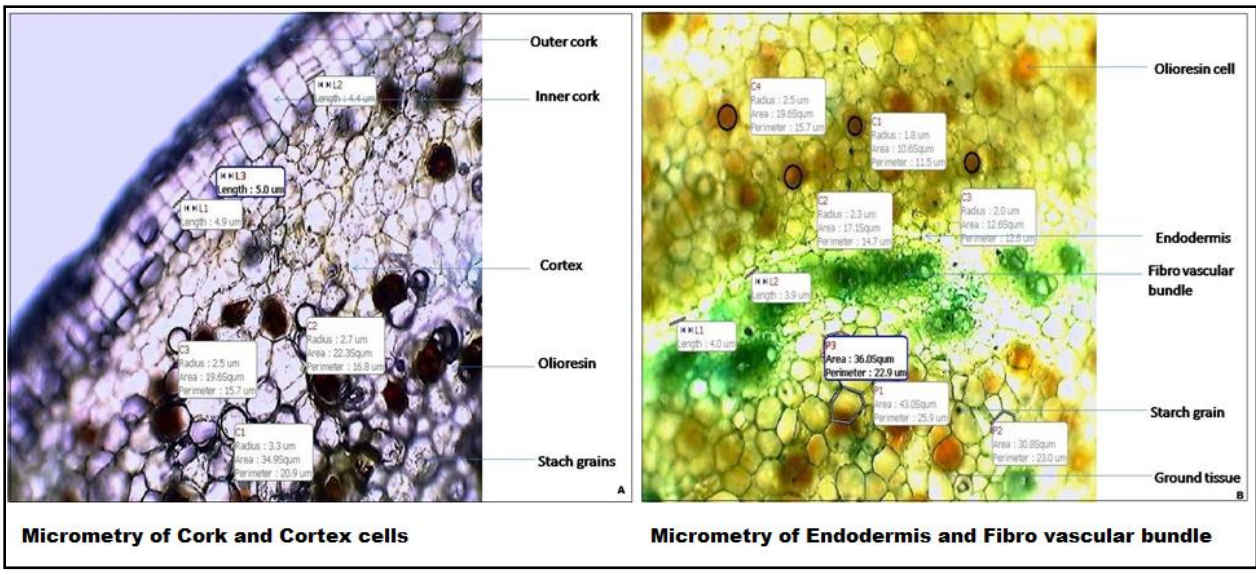

Figure 4: Micrometry of *Curcuma longa* rhizome

Table 1: Macromorphological Description

Characters	Observation
Organoleptic characters	
Colour	Yellow or yellowish brown
Odour	Aromatic and Characteristics
Taste	Slightly bitter
Quantitative Macromorphology	
Size	2-3 cm in diameter
Length	1-1.5 cm long
Macroscopical features	
Shape	Finger shaped
Surface	Smooth or slightly rough
Texture	Hard and Heavy
Fracture	Short

Table 2: Micrometry of some cells

Type of Cells	Dimension Area
Cork cells	4.93±0.55
Cortex	25.6±8.16
Oleoresins	2.26±0.25
Epidermis cells	3.95±0.07
Fragments of ground tissue	36.6±6.12

*Values are expressed as mean ± standard deviation

Table 3: Physicochemical parameters

Parameters(%w/w)	**Observation (%w/w)**
Foreign organic matter	0.23±0.015
Moisture content (LOD)	8.92±0.021
Ash Value	
Total ash	8.39±0.03
Acid insoluble ash	0.91±0.040
Water soluble ash	---
Extractive values	
Water soluble extractive value	6.74±0.675
Alcohol soluble extractive value	20.12±0.055
pH	03.00±0.00

* Values are expressed as mean ± standard deviation

Table 4: Fluorescence analysis of *Curcuma longa* Linn. Rhizome powder

Reagents	**Visible light**	**Short UV (254 nm)**	**Long UV (366 nm)**
Distilled water	Pale yellow	Greenish yellow	Dark yellow
Pet Ether (60-80^{0}C)	Light yellow	Light Yellow	Faint yellow
Chloroform	Faint yellow	Light green	Greenish yellow
Methanol	Yellow	Pale green	Yellow
Conc. HCL.	Yellow	Pale green	Yellow
Conc.HNO_3	Orange	Green	Brown
Conc.H_2SO_4	Brownish black	Dark brown	Greenish black
Picric acid	Yellow	Pale green	Dark green
Dil. Ammonia solution	Brown	Brownish black	Yellowish Green
10% NaoH	Reddish brown	Yellowish brown	Dark brown
Ferric chloride	Reddish brown	Dark brown	Dark brown
Ethyl acetate	Yellow	Pale green	Greenish yellow

Conc. – Concentrated, HCl- Hydrochloric acid, $HN0_3$- Nitric acid, H_2SO_4 – Sulphuric acid, NAOH- Sodium hydroxide

Table 5: Preliminary Phytochemical Screening

Parameters	**Observation**			
	Aqueous Extract	**Acetone Extract**	**Ethanolic Extract**	**Methanolic extract**
Carbohydrates	+	+	+	+
Phenols	+	+	+	+
Tannins	+	+	+	+
Terpenes	+	+	+	+
Saponins	+	+	+	+
Alkaloids	+	+	+	+

***** **+** indicates presence

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