

COMPARATIVE PHARMACOGNOSTICAL EVALUATION OF *COSTUS SPECIOSUS* (WILD GINGER) AND *ZINGIBER OFFICINALE* (GINGER) RHIZOME

CHANDRA KALA¹, SYED SALMAN ALI^{2*}, SUDHIR CHAUDHARY³

¹Glocal School of Pharmacy, The Glocal University, Delhi-Yamunotri Marg (State Highway 57), Mirzapur Pole, Saharanpur, Uttar Pradesh, India 247121, ²School of Pharmaceutical Sciences, IFTM University Lodhipur Rajput, Delhi Road NH-24, Moradabad, Uttar Pradesh 244102, ³Meerut Institute of Engineering and Technology, Department of Pharmaceutical Technology, NH-58, Baghpat Crossing, Bypass Road Meerut (250005), Uttar Pradesh, India
Email: chandrakala@theglobaluniversity.in

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ABSTRACT

Objective: *Costus speciosus* Koen. (Ginger) is an Indian ornamental plant, belonging to family Costaceae. The present research work deals with the establishment of standardization parameter regarding comparative pharmacognostic study between *Costus speciosus* and *Zingiber officinale* rhizome.

Methods: Macroscopic and microscopic evaluation, physicochemical parameters like ash values, moisture content, extractive value, fluorescence analysis and the preliminary phytochemical investigation was done.

Results: The Macroscopic difference was found as an absence of odor and taste in *Costus speciosus* and presence of pungent and aromatic odor in *Zingiber officinale*. Oil globule, tracheids, starch granules in *Zingiber officinale* was found whereas the absence of the same in *Costus speciosus* rhizome was found in the microscopic evaluation. Fluorescence study also exhibits differences. The presence of saponin, carbohydrate, glycosides in *Costus speciosus* whereas *Zingiber officinale* revealed the presence of alkaloids, glycosides, flavonoids and protein.

Conclusion: These finding can serve as the basis for Identification and investigation of *Costus speciosus* and *Zingiber officinale* rhizome and can also establish the characteristic differentiating features of both.

Keywords: *Costus speciosus*, *Zingiber officinale*, Physicochemical parameters

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INTRODUCTION

Costus speciosus Koen. (Keu, Crape ginger), an Indian ornamental plant, belonging to family Costaceae. The plant is widely distributed in India in the tropical or sub-tropical climate from the sea level to the Himalayas, excluding the arid and semi-arid areas of Punjab, Haryana, Rajasthan, Gujarat and the peninsular India. It is found throughout the country in moist tropical evergreen forests, up to an altitude of 1200 m. It is common along roadsides, streams and in wastelands. It is widely distributed in Assam, Meghalaya, Bihar, Khasi and Jaintia Hills, Uttaranchal, Orissa, MP, North Bengal [1]. The rhizomes are bitter and show anthelmintic, astringent, expectorant properties. The rhizome extract is used as a tonic and useful in relieving burning sensation, constipation, leprosy, asthma, bronchitis, anemia and other skin ailments, fever and has hepatoprotective properties. Rhizome paste is used for treating boils and also to make sexual hormones and contraceptive. Leaves are used for scabies and stomach ailments. Stems are ground into a paste and applied for blisters. Rhizome extract is used for treating snake bites. The rhizome is used internally in the treatment of abdominal pain, liver problems, jaundice, gall bladder pain, etc. The Leaves also possess hypoglycemic properties and insulin potentiating action in addition to decreasing blood glucose. The rhizome possesses antifertility, anticholinesterase, anti-inflammatory, antipyretic and antihelminthic activities. Pharmacological studies showed that the rhizomes of *C. speciosus* possess cardiotonic, hydrochloric, diuretic and CNS depressant activity [2-4].

Zingiber officinale was also one of the first oriental spices to be grown to the Europeans. But now it is found to grow extensively in the tropical and subtropical regions of the world particularly in Bangladesh, India, Taiwan, Jamaica, Africa, Mexico, China and Japan. It is a household remedy for dyspepsia, flatulence, colic and diarrhea. Ginger rhizomes contain both aromatic and pungent compounds. It has been shown to have an antipyretic, hypotensive, cardiotonic, antiplatelet, antiangiogenic, anti-inflammatory and

analgesic, cytotoxic, apoptotic and antitumor activities. Ginger oil is used primarily as food flavoring agent in soft drinks, like spices in bakery products, in confectionary items, pickles, sauces and as a preservatives, etc. It is used for treating nausea caused by sickness, morning sickness and chemotherapy [5, 6].

MATERIALS AND METHODS

Plant material

The semi-dried, the rhizome of the plant *Costus speciosus* was collected from the Karnal, in the month of September 2012, authenticated by VHCA herbals. The rhizome of *Zingiber officinale* was collected from local market of Meerut and authenticated by Dr. R. S. Saxena, Deptt. of Botany, Meerut college. The plant material was further size reduced and stored until further use in an air tight container. Fresh plant material was obtained for the microscopical evaluation of rhizome, and dried plant material was used for phytochemical screening and to estimate ash value, extractive values and fluorescence studies.

Chemicals

All the chemical were reagent grade and were purchased from CDH, New Delhi.

Pharmacognostic study

The Rhizome of *Costus speciosus* and *Zingiber officinale* was extracted with 50% ethanol. The coarse powder of plant was placed in soxhlet apparatus at 65-70 °C for 18 h. After 18 h evaporate the extract at 80 °C.

Macroscopic and microscopic analysis

The pharmacognostical evaluation was carried out by free hand sectioning of the plant material. Histochemical studies were conducted using various reagents such as phloroglucinol and HCl, Aniline blue, iodine and potassium iodide, lactophenol, ferric chloride, and FABIL (basic fuschin, aniline blue, iodine and

potassium iodide in lactophenol) [7, 8]. Photomicrographs were obtained by observing free hand section of the drug under compound binocular microscope OLYMPUS BX41 and photomicrography was done using Olympus C7070 Camera.

Physico-chemical analysis

The coarse powder of rhizome of *Costus speciosus* and *Zingiber officinale* was subjected to various physicochemical studies for determination of ash value (total ash, acid insoluble and water soluble ash) extractive values (water soluble, alcohol soluble and petroleum ether soluble and chloroform-soluble), and fluorescence properties [10].

Preliminary Phytochemical screening

Qualitative estimation of hydroalcoholic extract of *Costus speciosus* and *Zingiber officinale* were performed for the identification of various chemical constituents like alkaloid, carbohydrate, flavonoids, proteins, amino acids, phenols, tannins, glycosides and steroids [11].

RESULTS

Macroscopic character

Costus speciosus

Perennial herb with an erect stem about 3 m tall. Leaves are dark green, smooth, alternate, elliptic in shape and spirally arranged around the unbranched stem which itself is twisted at the upper part. The inflorescence is the spike with ovate, red bracts. Flowers are large and white in color. The rhizome is usually buff colored, tuberous, curved or straight, 10-20 cm in length and 1-3 cm in diameter. Upper and lower surface exhibit scars. Upper surface

contains remnants of leaf bases. The rhizome is usually buff colored, 10-30 cm in length and 1-3 cm in diameter. It does not have any characteristic odor or taste.

Zingiber officinale

Perennial herb with the erect stems about 1-2 m tall. Leaves are green, smooth, alternate, lanceolate in shape and is spirally arranged around the unbranched stem. The inflorescence is spike having bracteal flowers which are white to pink in color. The rhizomes are buff to yellow in color, fleshy about 10-15 cm in length and 1-3 cm in diameter. Rhizomes have a circular apical aperture and exhibit stiff hairs. They are laterally compressed and branched unlike that of *Costus speciosus* rhizome. The rhizome is usually buff to yellow colored, 10-15 cm in length and 1-3 cm in diameter. It has a spicy and aromatic odor and pungent taste.

Microscopic character

Costus speciosus: Rhizome showed periderm, the vascular bundle containing xylem, phloem, bundle sheath surrounded by fibers and parenchymatous ground tissue (fig. 1). The cortical region has several scattered vascular bundle (fig. 1-a). Periderm with stratified cork cells is also observed (fig. 1-b). The vascular bundles are crescent shaped consisting of sclerenchymatous fibers surrounding bundle sheath, xylem and phloem (fig. 1-c). T. S of rhizome showed thin walled, collenchymatous, broken Epidermis with a tangentially elongated cell (fig. 1-d). L. S of the rhizome shows lignified fibers (fig. 1-e). When R. L. S of the rhizome was observed, parenchymatous ground tissue, lignified fibers followed by annular xylem vessels which are again accompanied by phloem, can be seen (fig. 1-f).

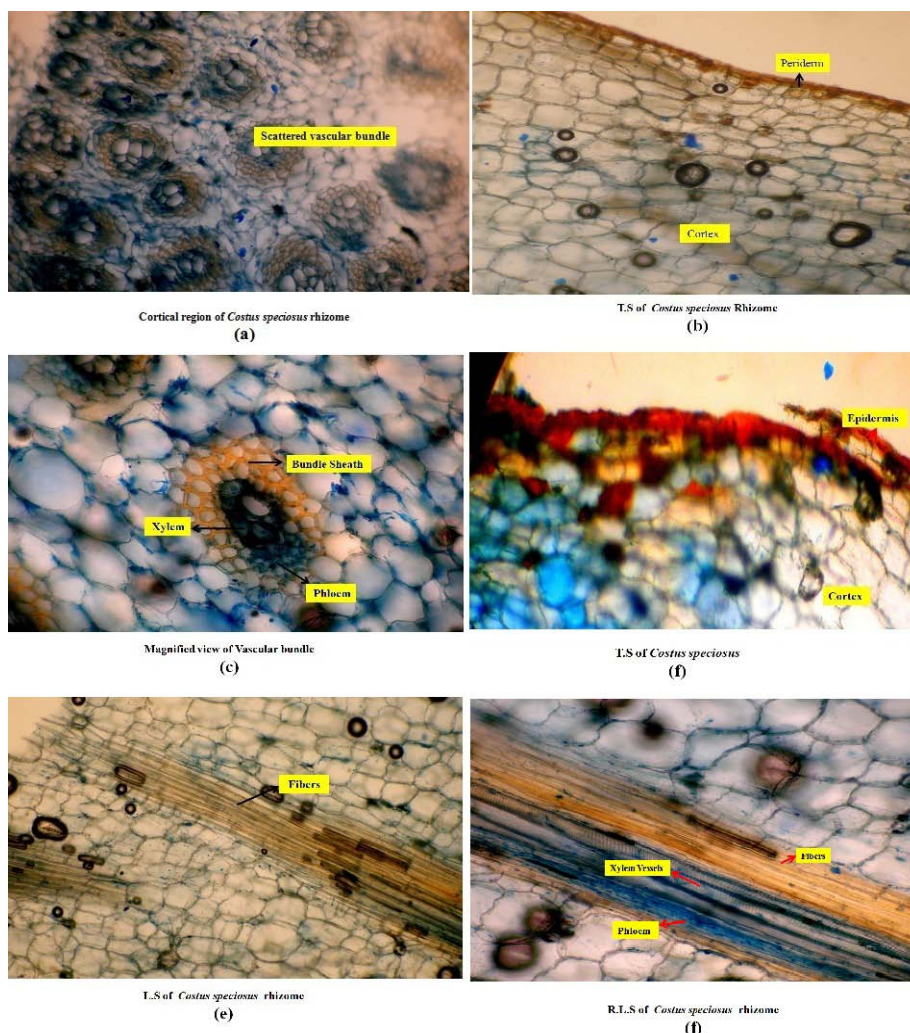


Fig. 1: Microscopic view of *Costus speciosus* Rhizome

Zingiber officinale

Transverse section of rhizome showed outer and inner cork, parenchymatous ground tissue, endodermis, a vascular bundle containing xylem, phloem, fibers and oleoresin cell (fig. 2). T. S of rhizome shows outer black outer cork followed by colorless inner cork cell (fig. 2-a). It is followed by cortex containing thin-walled polygonal parenchymatous tissue and scattered conjoint, collateral vascular bundle containing xylem and phloem and surrounded by sclerenchymatous fiber (fig. 2-a, d, e, f). Tracheids and yellow polygonal oleo-resin cell are also present in the cortical region (fig. 2-b, c). Endodermis is single layered and a ring of vascular bundle is

present below endodermis (fig. 2-d). L. S showed pitted fibers along with several rectangular oleo-resin cells (fig. 2-f).

Physicochemical studies

Costus speciosus

The physicochemical parameters total ash value, acid insoluble ash value, water soluble ash value and moisture content which was determined to be not more than 4.25%, 1%, 2.5%, 3.3% respectively (table 2). The extractive values (ethanol, methanol, petroleum ether, chloroform, aqueous) which were determined to be not more than 4.14%, 6.8%, 2.64%, 1% and 6.34% respectively (table 3).

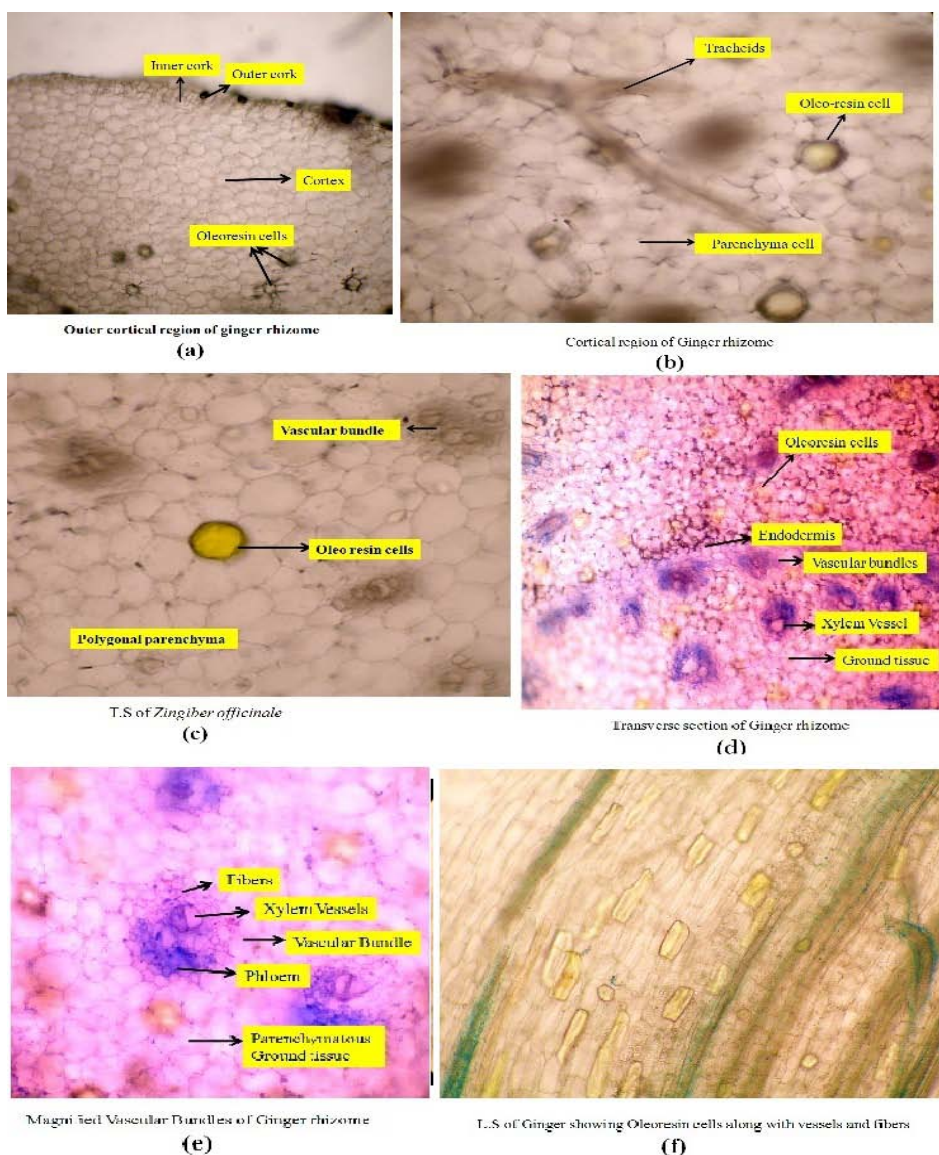


Fig. 2: Microscopic view of Zingiber officinale rhizome

Table 1: Microscopic differences between rhizome of Costus speciosus and Zingiber officinale

S. No.	Costus speciosus	Zingiber officinale
1	Broken epidermis, Periderm containing storied cork.	The presence of black outer cork and colorless inner cork.
2	Cortex containing lamellar parenchymatous ground tissue.	Cortex is containing polygonal, thin walled parenchymatous ground tissue.
3	Vascular bundles surrounded by bundle sheath.	Vascular bundles are not surrounded by bundle sheath.
4	Absence of oleo-resin cells.	The presence of oleoresin cells.
5	Absence of tracheids.	The presence of tracheids.
6	Absence of starch granules.	The presence of starch granules.
7	Presence of lignified fibers	The presence of lignified pitted fibers.
8	Endodermis is not prominent	Prominent endodermis followed by ring of vascular bundles

Zingiber officinale

The physicochemical parameters total ash value, acid insoluble ash value water soluble ash value and moisture content which was determined to be not more than 4.9%, 1.35%, 1.67%, 4.41 respectively (table 2). The extractive values (ethanol, methanol, petroleum ether, chloroform, aqueous) which were determined to

be not more than 4.0%, 7.79%, 1.8%, 1.2% and 10.8% respectively (table 3).

Preliminary phytochemical investigation

Preliminary phytochemical screenings were performed to find out the phytoconstituents (table 6).

Table 2: Ash value of *Costus speciosus* and *Zingiber officinale* rhizome

S. No.	Parameters	Values % of <i>Costus speciosus</i>	Values % of <i>Zinziber officinale</i>
1	Total ash	4.25	4.9
2	Acid insoluble ash	1.0	1.35
3	Water soluble ash	2.5	1.67
4	Moisture content	3.3	4.41

Table 3: Extractive value of *Costus speciosus* and *Zingiber officinale*

S. No.	Solvent	Values % (w/w) of <i>Costus speciosus</i>	Values% (w/w) of <i>Zinziber officinale</i>
1	Ethanol	4.14	3.1
2	Methanol	6.80	7.79
2	Petroleum ether	2.64	1.8
3	Chloroform	1	1.2
4	Aqueous	6.34	10.8

Table 5: Preliminary phytochemical screening of *Costus speciosus* and *Zinziber officinale*

S. No.	Phytoconstituents	Hydroalcoholic extract of <i>Costus speciosus</i>	Hydroalcoholic extract of <i>Zinziber officinale</i>
1	Alkaloid	-	+
2	Glycoside	+	+
3	Saponin	+	+
4	Flavanoids	-	+
5	Protein	-	+
6	Tannins	-	-
7	Carbohydrate	+	+
8	Volatile oil	-	-
9	Triterpenoid	-	+
10	Steroidal nucleus	-	-

Fluorescence study was also performed (table 5 and 6)

Table 5: Florescence study of *Costus speciosus*

S. No.	Material treatment	Observation under visible light	Observation under short UV at 254 nm	Observation under long UV at 365 nm
1	Powder	Brown	Light green	Cream
2	Powder+Conc. HNO ₃	Brick red	Dark green	Black
3	Powder+NH ₃	Brown	Light brown	Green
4	Powder+Dil. HCl	Brown	Green	Brown
5	Powder+Conc. HCl	Dark brown	Black	Black
6	Powder+1M H ₂ SO ₄	Brown	Light green	Light brown
7	Powder+Picric acid	Light brown	Green	Cream color
8	Powder+1M NaOH	Reddish brown	Dark green	Dark green
9	Powder+5% Iodine	Black	Black	Black
10	Powder+KOH	Brown	Green	Dark brown
11	Powder+Methanol	Brown	Green	Dark Brown
12	Powder+Chloroform	Brown	Dark green	Light brown
13	Powder+Ethanol	Dark brown	Green	Light brown

Table 6: Florescence study of *Zingiber officinale*

S. No.	Material/treatment	Observation under visible light	Observation under short UV at 254 nm	Observation under long UV at 365 nm
1	Powder	Off white	Light green	Cream
2	Powder+Conc. HNO ₃	Brown	Green	Dark brown
3	Powder+NH ₃	Brown	Green	Dark brown
4	Powder+dil. HCl	Light brown	Green	Light brown
5	Powder+Conc. HCl	Brown	Dark green	Dark brown
6	Powder+1M H ₂ SO ₄	Light brown	Green	Creamish brown
7	Powder+picric acid	Brown	Green	Dark brown
8	Powder+1M NaOH	Dark brown	Dark green	Dark brown
9	Powder+5% iodine	Black	Black	Black
10	Powder+KOH	Whitish	Brown	Dark brown
11	Powder+Methanol	Brown	Light brown	White
12	Powder+chloroform	Brown	Green	White
13	Powder+ethanol	Reddish brown	Greenish	Dark brown
14	Powder+FeCl ₃	Light brown	Light green	Dark brown

DISCUSSION

On the basis of the macroscopic study, we have found that there are some differences between both the plants. Leaves of *Costus speciosus* are elliptical in shape whereas that of *Zingiber officinale* is lanceolate in shape. The whole plant of *Costus speciosus* is slightly taller than that of *Zingiber officinale*. Flower of *Costus speciosus* is white in color whereas that of *Zingiber officinale* is white to pink in color. The rhizome of *Costus speciosus* is slightly longer and wider as compared to rhizome of *Zingiber officinale*. The most noticeable difference between *Zingiber officinale* and *Costus speciosus* is, the rhizome of *Costus speciosus* does not exhibit odor or taste whereas

The rhizome of *Zingiber officinale* exhibits spicy and aromatic odor and pungent taste.

Several characteristic differences are observed between *Costus speciosus* and *Zingiber officinale* on the basis of the microscopic study. The rhizome of *Costus speciosus* exhibit broken epidermis and periderm containing cork cell whereas *Zingiber officinale* rhizome exhibits outer black cork and inner transparent cork. Unlike *Zingiber officinale* rhizome, the vascular bundle of *Costus speciosus* rhizome is surrounded by bundle sheath. Also, unlike *Costus speciosus* rhizome, *Zingiber officinale* rhizome is characterized by the presence of an oleoresin cell, tracheids and starch granules and prominent thin-walled endodermis.

Total ash value of *Costus speciosus* rhizome and *Zingiber officinale* rhizome indicates that *Zingiber officinale* rhizome contains more amount of inorganic radical as compared to *Costus speciosus* rhizome since it is lower in the case of *Costus speciosus* rhizome when compared with *Zingiber officinale* rhizome. Similarly, acid insoluble ash value of *Costus speciosus* rhizome is lower than *Zingiber officinale* rhizome indicating the higher content of silica and oxalates in *Zingiber officinale* than *Costus speciosus*. The water soluble ash value of *Zingiber officinale* is lower than *Costus speciosus* rhizome again indicating the higher amount of foreign material in *Zingiber officinale* as compared to *Costus speciosus* since foreign material causes lowering of water soluble ash value. Moisture content of *Zingiber officinale* rhizome is higher than that of *Costus speciosus* rhizome

The phytochemical profiling of *Costus speciosus* revealed the presence of saponin, carbohydrate glycosides. Fluorescence analysis of the drug powder was carried out. Whereas that of *Zingiber officinale* revealed the presence of alkaloids, glycosides, saponins, flavonoids, protein, carbohydrates and Triterpenoid.

CONCLUSION

The comparative pharmacognostic standards for the *Costus speciosus* and *Zingiber officinale* are laid down for the first time in this study. *Costus speciosus* and *Zingiber officinale* are used for the treatment of the various medical condition. But, the benefits can only be enjoyed if the pure quality of drug is used, therefore, standardization of the particular plant is the initial step before the establishment of plant's pharmacological activity. Morphological and

anatomical studies of plant parts will enable to identify the crude drug. The information obtained from the preliminary phytochemical screening will be useful in finding out the genuinity of the drug. Ash values, extractive values can be used as a reliable aid for detecting adulteration. Moreover, there are certain plants that are somewhat similar to each other, therefore, the comparative study can be undertaken to observe the characteristic differentiating features. Further study should be carried out in future to isolate the specific chemical constituents as well as the detailed pharmacological activity in the proper scientific way.

CONFLICT OF INTERESTS

Declare none

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