

## Pharmacognostic studies on *Zingiber officinale* roscoe

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### Abstract

*Zingiber officinale* (Ginger), one of the best-known spices, is highly esteemed for its pleasant, aromatic odour and warm, pungent taste. It is widely used in dried, preserved and green forms. It is widely used for flavoring a great variety of foods and in several nations for its medicinal properties. Ayurvedic texts report several medicinal applications of ginger in India. Ginger is considered a tonic for the digestive tract, stimulating digestion and toning the intestinal muscles. Ginger preparations are clinically useful to alleviate osteoarthritis or other pain; it also exerts *in vitro* antioxidative, antitumorogenic and immunomodulatory effects and is an effective antimicrobial and antiviral agent. Keeping all these points in a view in the present study aims at standardization of *Zingiber officinale* by pharmacognosy approach. Physicochemical and microbial limit test results revealed that parameters were found to be within the permissible limits. The microscopic and anatomical studies characters were unique. Further, phytochemical screening exhibited the presence of secondary constituents and TLC profiling of the samples illustrated bands when observed in visible light, under UV and also when sprayed with reagen.

**Keywords:** *Zingiber officinale* ginger tlc physicochemical anatomical microbial limit

### Introduction

*Zingiber officinale* belongs to family Zingiberaceae, its rhizome is widely accepted as spices and is used as medicinal part. Traditional Chinese Medicine has recommended ginger for over 2,500 years. It is used for abdominal bloating, coughing, vomiting, diarrhea, and rheumatism. Ginger is commonly used in the Ayurvedic and Tibetan systems of medicine for the treatment of inflammatory joint diseases, such as arthritis and rheumatism. Ginger is grown in India, China, Mexico, and several other countries. The rhizome (underground stem) is used as spice, condiment, as a flavoring agent and as well as herbal medicine. Ginger is an herbaceous perennial with upright stems about 70 cm tall with narrow medium green leaves arranged in two ranks on each stem. The leaves are lanceolate. Ginger grows from an aromatic tuber like rhizome (underground stem) which is warty and branched. The rhizomes are white to yellowish brown in colour, irregularly branched, somewhat annulated and laterally flattened. The growing tips are covered over by a few scales. The surface of the rhizome is smooth and if broken a few fibrous elements of the vascular bundles project out from the cut end. The inflorescence grows on a separate stem from the foliage stem, and forms a dense spike, to 7.6 cm tall. The bracts are green with translucent margins and the small flowers are yellow green with purple lips and cream colored blotches. Most gingers in cultivation are sterile cultivars grown for the edible rhizome, and the flower is rarely seen [1]. They are known to Posses wide range of biological activities.

Ethanollic extracts of *Zingiber officinale* fed orally for 20 days in streptozotocin (STZ)-induced diabetes in rats, significant lowered serum total cholesterol, triglycerides and increased the HDL-cholesterol levels indicating that ethanollic extract can protect the tissues from lipid peroxidation and exhibit lipid lowering activity in diabetic rats [2]. In a combination trial of Garlic and Ginger, obtained

significant decrease in blood glucose, serum total cholesterol and serum alkaline phosphatase in all groups of the trial [3]. Methanolic extract of dried rhizomes produced a significant reduction in lipid levels, bodyweight, hyperglycemia and hyperinsulinemia which are the main factors leading to metabolic syndrome and the extent of activity was dependent on the concentration of 6-gingerol present in the extracts [4]. An aqueous extract of raw ginger administered daily (500 mg/kg, intraperitoneally) over 7 weeks to streptozotocin (STZ)-induced diabetic rats indicated that raw ginger possesses hypoglycaemic, hypocholesterolaemic and hypolipidaemic potential [5]. A double-blind, placebo-controlled, randomized clinical trial conducted on type 2 diabetes patients when supplemented with 3 g/day of ginger for 12 weeks showed positive glucose homeostasis and antioxidant capacity [6]. A double-blind placebo-controlled trial with patients suffering with type 2 diabetes received 2000 mg per day of ginger over a course of 10 weeks showed reduced serum levels of fasting blood glucose and hemoglobin A1C [7].

Taken together, the rich pharmaceutical diversity and the potential anti-diabetic properties of ginger, urges the need to set pharmacopeial standards for authentication and identification of such medicinally important plant. Thus, this paper discusses various pharmacognostic approach including physio-chemical, microscopic and preliminary phytochemical parameters of *Zingiber officinale*

### Materials and Methods

**Voucher specimen:** The plant materials were collected and Identity was confirmed with the voucher specimen using [8] and deposited in raw drug repository with number Zin off/RP/VVPL/10/02/20. Physico-chemical values such as the percentage of total ash, acid-insoluble ash, and water and alcohol-soluble extractives were calculated as per the Ayurvedic Pharmacopeia of India [9]. Preliminary phytochemical tests were performed according to [10]. TLC

fingerprinting profile carried as per [11]. For the Anatomical studies, transverse sections (TS) and powder microscopy studies were prepared and stained [12, 13]. A standard, Limit for total microbial count was provided by WHO Guidelines [14].

## Results and Discussions

### Pharmacognostic evaluation

**Table 1:** Pharmacognosy features

Physicochemical Constants			Organoleptic Characters	
Parametrs	Values	Limit	Parametrs	Values
TA	5.1%	NMT 6%	Taste	Sweetish
AIA	0.4%	NMT 1.5%	Color	Creamy white
ASE	65.4	NLT 3%	Odour	Strong
WSE	55.8	NLT 10%	Texture	Fibrous

TA - Total Ash; AIA - Acid Insoluble Ash; ASE - Alcohol Soluble Extractive; WSE - Water Soluble Extractive, NMT- Not More Than, NLT- Not Less Than Limit as prescribed by Ayurvedic Pharmacopeia of India

All of the parameters of these studies for the sample were found to be under the range of limits as prescribed by Ayurvedic Pharmacopeia of India (table 1)

### Preliminary Phytochemical Analysis

**Table 2:** Preliminary Phytochemical Analysis

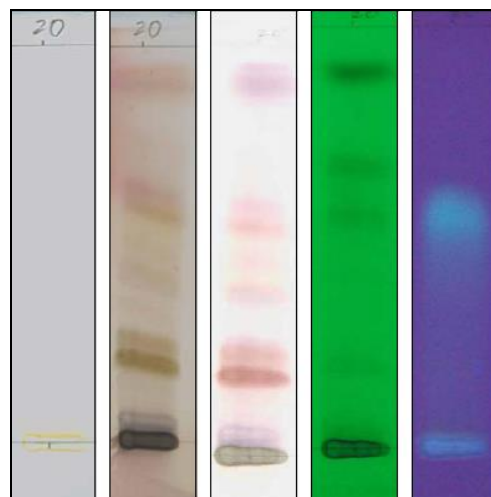
Sl.No	Secondary Metabolite	Result	Inference
1	Alkaloid: Mayer's Test	-	No creamy white precipitate
2	Phenol: Ferric chloride Test	+	Intense coloration
3	Tannins: Lead Acetate test	+	White Precipitate
4	Steroids: Salkowski test	+	Red coloration at the junction
5	Flavonoid: Flavanoid Test	+	Colour change
6	Saponins: Foam test	-	No Foam Formation

The methanoic extract of the plant showed the presence of secondary metabolites such as, steroids, flavonoids, tannins and phenols but showed negative result for the presence of; alkaloids, saponins (table 2).

### TLC Profile

**Table 3:** TLC Profile

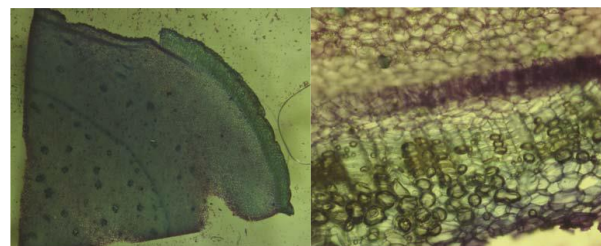
TLC Finger Printing Profile								
Under Visible Light								
Rf Values	-	-	-	-	-	-	-	-
Sprayed with 10% H <sub>2</sub> SO <sub>4</sub>								
Rf Values	0.05	0.2	0.24	0.4	0.58	0.9	0.94	-
Sprayed with Anisaldehyde								
Rf Values	0.04	0.19	0.24	0.39	0.55	0.89	-	-
Under Short UV (254 nm)								
Rf Values	0.2	0.55	0.67	0.89	-	-	-	-
Under Long UV (366 nm)								
Rf Values	0.57	-	-	-	-	-	-	-



**Fig 1:** TLC Chromatograms

*Zingiber officinale* showed no band under visible light, 7 bands when sprayed with 10% H<sub>2</sub>SO<sub>4</sub> and 6 bands when sprayed with Anisaldehyde. Further, 4 and 1 bands under short and long UV light respectively. The results are qualitative TLC finger print profile of plant under study (table 3, fig 1)

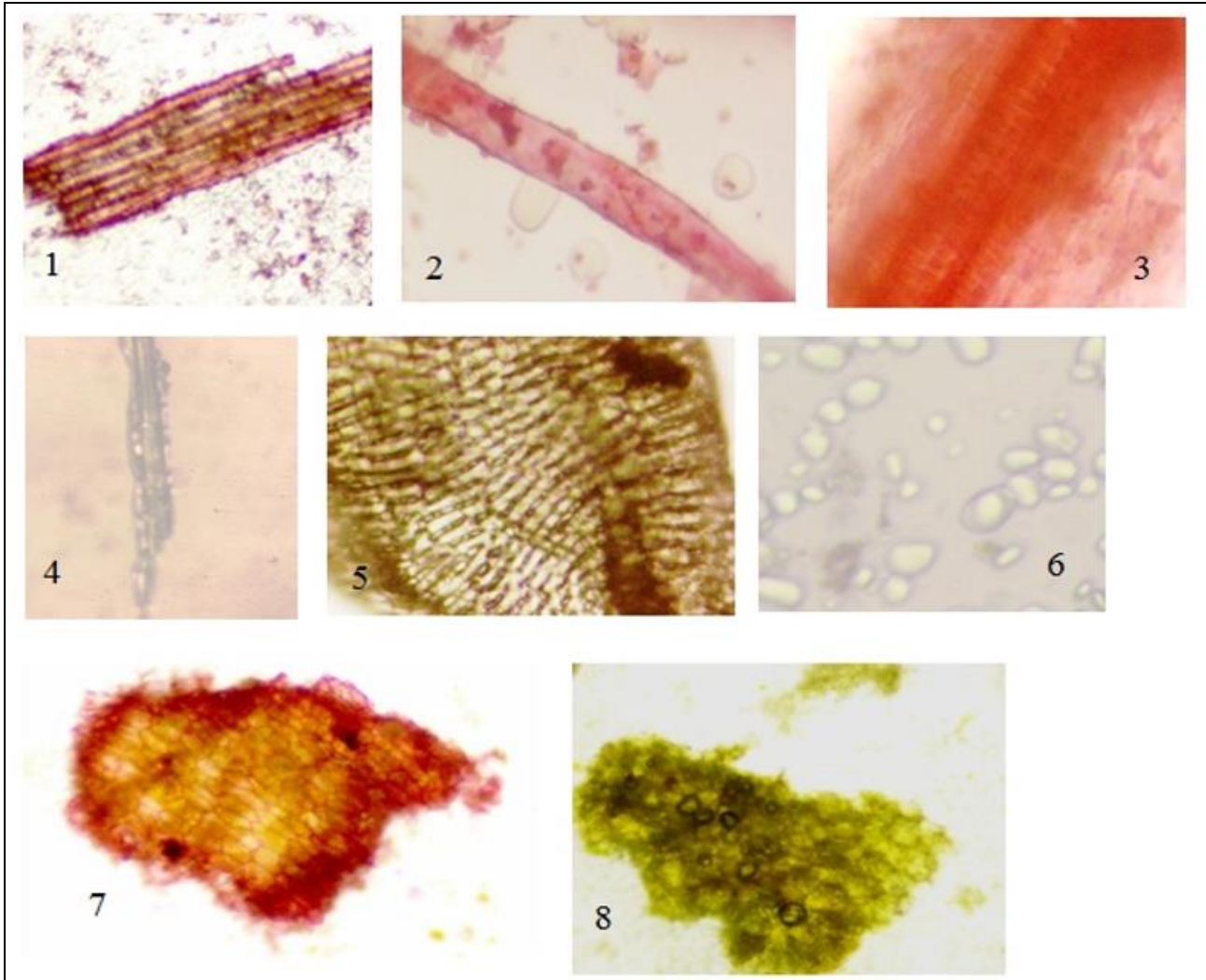
### Anatomical Characters



**Fig 2:** Anatomical Characters of *Zingiber officinale*

Shows a few layered irregularly arranged, tangentially elongated brown cells of cork and 6-7 rows of thick walled readily arranged cells of inner cork, Secondary cortex consists of hexagonal to polygonal isodimetric thin walled parenchymatous cells containing numerous circular to oval starch grains with striations and hilum at one end with clear concentric striations, Idioblasts containing large yellowish to brownish globules oleo resin walls of oil cells suberised, numerous closed conjoint, collateral cortical, fibro vascular bundle, scattered throughout cortical zone greater number occurring in inner cortical region, larger bundles consists of vessels small cells of sieve tubes, polygonal cells of parenchyma and group of fibers vessels showing reticulate scalariform and spiral thickening fiber septet with a few oblique pores on their walls, Endodermis single layered enclosing central steel, which consists of thin walled polygonal isodimetric cells of parenchyma filled with abundant starch grains, oleoresin cells similar to those present in cortex (fig 2).

### Powder Characters



**Fig 3:** Powder characteristics of *Zingiber officinale*

- 1: Part of a group of fibers
- 2: Fibers with dentate walls,
- 3: A small reticulately thickened
- 4: Tracheids
- 5: Part of a larger reticulately thickened vessel
- 6: Starch granules showing septa
- 7: Parenchymatic Cells vessel with associated fibers
- 8: Parenchymatic cells with oleoresin cells

Powder microscopy helps in identification of various broken parts of the sample which are unique and plays a significant role in authentication of crude sample (fig 3)

#### Microbial Limit Test

Total Aerobic Bacterial Count (TABC):  $2.4 \times 10^3$   
 Total Yeast and Mould Count (TYMC):  $0.9 \times 10^3$   
 (Microbial contamination limit for raw herbs - TABC:  $<10^7$ , TYMC:  $<10^5$ )

All the values were within the limits as prescribed by WHO guidelines and Indian herbal pharmacopeia

#### Conclusion

Assessing quality, safety along with authentication and identification of medicinal plant are one of the fundamental steps which can be done with the help of pharmacognostic and preliminary phytochemical approach. The sample

exhibited Physico-chemical characteristics in accordance with Ayurvedic Pharmacopoeia of India. Anatomical Characters and powder microscopic studies are distinctive. Further, phytochemical analysis of the plant revealed the presence of flavonoids, tannins, Steroids and phenols. The TLC profile can be used as its finger print profile. Microbial limit test was performed and it was found that all the parameters of the study were found to be well within the range as prescribed by Indian Herbal Pharmacopeia and WHO Guidelines.

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