

## Original Research Article

# Pharmacognosy of *Cassia angustifolia* Leaf Grown in Differently Treated Soils

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## ABSTRACT

### Keywords

*Cassia angustifolia*,  
Quantitative,  
Powder  
analysis,  
Stomata,  
Anatomy  
Pharmacognosy

*Cassia angustifolia* vahl, commonly known as Senna. In Tamil it is known as swarna patri is well known for its various medicinal properties in Indian systems of medicine. It is useful in habitual costiveness. It lowers bowels, increases peristaltic movements of the colon by its local action upon the intestinal wall. It is used as expectorant, wound dresser, antidysentric, carminative and laxative. Useful in loss of appetite, hepatomegaly, splenomegaly, indigestion, malaria, skin diseases, jaundice and anemia. Leaves are made into a paste, and applied to various skin diseases. The present work deals with the anatomy, quantitative microscopy, physical constants and fluorescence analysis of the plant leaves. Diagnostic characters of powder include unicellular covering trichomes, paracytic stomata. The powder analysis helps to check the adulteration of drugs. This would help therapeutic investigations and standardization of formulations containing leaf material of *C. angustifolia*. The aim of present study is to use stomatal characters as aid in taxonomy of medicinally useful *Cassia* plants. The study would help in the identification and authentication of these medicinal plants on the basis of stomatogenesis.

## Introduction

Pharmacognosy which is a science of the knowledge of medicinal plants is one of the important subjects in the overall curriculum of the pharmaceutical education in India and world. Pharmacognosy is an important link between pharmacology and study of Medicinal plants. Pharmacognosy is a vital link between Ayurvedic and Allopathic systems of medicines. It provides a system where in the active principals of crude drugs derived from natural origin can could be dispensed, formulated and manufactured in dosage forms acceptable to allopathic system of medicine (C.K.Kokate, A.P.Purohit, S, and B.Gokhale).In a nutshell

pharmacognosy forms an important bridge between the pharmaceuticals and basic sciences (Text book of pharmacognosy – Rosaline).

*Cassia* is a large genus of around 500 species of flowering plants in the family leguminosae (Lodha *et al.*, 2010). *Cassia* species are annual under shrub, the genus *Cassia* comprises of 580 species of herbs, shrubs and trees, which are widely distributed throughout the world of which only twenty species are indigenous to India (Anonymous 1950). Medicinally, *Cassia angustifolia* Vahl is an important plant

(Harnischfeger and stilze 1983) is systematically placed in to the division-Magnoliophyta, Class-Magnoliopsida Sub class-Rosidae, Order-Fabales, family-Caesalpinaceae.

### Taxonomical classification of Senna

Botanical Name: *Cassia anugstifolia*  
 Kingdom: Plantae  
 Sub Kingdom: Tracheobionata  
 Division: Magnoliophyta  
 Class: Mabnoliopsida  
 Subclass: Rosidae  
 Order: Fabales  
 Family: Caesalpinaceae  
 Genus: *Cassia*  
 Species: *angustifolia*

### Synonyms of *Cassia angustifolia*

Language	Names
English	Indian Senna, Tinnevelly Senna
Hindi	Sana ka pat
Sanskrit	Svarnapatri
Telugu	Nela tangedu
Malayalam	Sunnamukhi, Connamukki
Kannada	Nelavarika sonamukhi
Tamil	Nilavarai, Nelavakai

Senna is one of the most commonly used laxative drugs in the Eastern and Western countries for the treatment of constipation. Commercially available consists of the dried leaflets of Alexandria Senna (*Cassia acutifolia* Delile) or Tinnevelly Senna (*Cassia angustifolia* Vahl) belonging to plant family Leguminosae.(United states pharmacopoeia 2004; T.E. Wallis, Ed.2004) *Cassia angustifolia* is an ayurvedic herb more popularly known as Senna. It is also known as Swarnapatri in Sanskrit. Senna is an Arabian name but it is native to Sudan. It was brought into used by Arabian physicians for removing capillary congestion. It is a

small herb growing to a height of 2-3 feet. In India it is cultivated in Tamil Nadu, Andhra Pradesh and Karnataka. Its commercial cultivation has recently come up in Kutch (Gujarat) and Jodhpur (Rajasthan).It is mainly used as a blood purifier, laxative for relieving constipation and to treat skin diseases. It contains a powerful natural laxative called anthraquinone and is approved by the world health organization (WHO).Senna consists of the leaflets are golden brown in color after drying. *Cassia angustifolia* is one of the most widely used herbal laxatives (Dermarderosian, 2005). Cassia species are well known in folk medicine for their laxative and purgative uses. They are also used for treating skin diseases such as ring worm, scabies, eczema and wounds (Rastogi and Mehrotra).

### Materials and Methods

#### Collection of the plant material

*Cassia angustifolia* seeds were procured from the CIMAP, Hyderabad. The seeds were sown in earthen pots in Green house of Botanical Garden, Department of Botany, Osmania University, and Hyderabad. Plants were grown in three exposure, the black soil, heavy metals of cadmium 10ppm, Chromium 20ppm, Nickel 16ppm were introduced into the soil pots and in third set, Calcium hydroxide was also added along with heavy metals to the soil. Plants were exposed and studied 3 different conditions garden soil, Heavy metal added soil and other is heavy metals with 1%Ca(OH)<sub>2</sub> added soil. Addition of heavy metals was chromium-20ppm, at every concentration and condition triplicates were maintained and average value is considered. Earlier study was conducted with these 3 heavy metals to know at which concentration. Plant can tolerate and grow normally and with that study these 3 concentrations were

fixed. The collected Fresh leaves and leaves were shade dried for 10-12 days and finally pulverized into coarse powders. It was stored in well closed containers free from environment climatic changes till usage.

### **Chemical constituents**

The plant chemically contains Sennoside A, B, C and D (Hayashi *et al.*, 1980). Sennosides present in the leaf and pod of this plant, are diglucosides of sennidins. A number of sennosides have been reported (Tanaka *et al.*, 1982) from *Senna. Cassia angustifolia* is used for its purgative properties (Hennabelle 2009 and Verma *et al.*, 2010). Sennoside A and B together are responsible for upto 40 – 60% activity of crude Senna. The plant also contains rhein, aloe-emodin, chrysophanol, and their glycosides. (Newall CA, *et al.*, 1996; Bisset NG 1994). Additionally senna contains naphthalene glycosides (tinnevellin glycoside and 6-hydroxy musizin glycoside), flavonoid (kaempferol), phytosterols, myricyl alcohol, salicylic acid, chrysophenic acid, mucilage, resin and calcium oxalate (3, 4). In the fraction of the flavanoid family senna contains the yellow flavanol coloring matters kaempferol (3, 4, 5, 7-trihydroxyflavone), its glucoside (kaempferin) and isorhamnetin,  $\beta$ -sitosterol, calcium oxalate, mucilage, resin, saponins and polysaccharide hydrocolloids are also present.

### **Pharmacology of Senna**

Senna leaves and pods show laxative activity. Leaves contain glycosides, Sennoside A, B, C and D. Two naphthalene glycosides have been isolated from leaves and pods Anthraquinone gives the medicinal action of Senna. It appears that the aglycone portion is responsible for its action.

### **Pharmacological properties**

#### **Pharmodynamic properties**

Senna is an anthranoid type stimulating laxative. The laxative effect is due to the action of sennosides and their active metabolite, rhein-anthrone, in the colon. There are two different mechanism of action:

1. An influence on the motility of the large intestine: The laxative effect is realized by the inhibition of water and electrolyte absorption from the large intestine, which increases the volume and pressure of the intestinal contents. This will stimulate colon motility resulting in propulsive contractions.
2. An influence on secretion processes: Stimulation of active chloride secretion increases water and electrolyte content of the intestine. These changes in active electrolyte transport are dependent on calcium in serosal surface. The laxative action of Senna is partially via stimulation of colonic fluid and electrolyte secretion, and this secretion is mediated by stimulation of endogenous prostaglandin E<sub>2</sub> formation.

They also change colonic absorption and secretion to cause fluid accumulation. Enhanced permeability is the result of disruption of the tight junctions between the colonic epithelial cells (Soyuncu S *et al.*, 2008). Metabolism of anthranoid laxatives (deWitte P, Lemli 1990; deWitte P 1993) and Sennosides (Lemli J 1998; Hietala *et al.*, 1988; Lemli J.1996) have been reported.

#### **Antimicrobial activity of Senna**

The extracts of *Cassia angustifolia* showed anti-microbial activity. Different extracts (ethanol, methanol, and aqueous solutions) of *Cassia angustifolia* plant are extracting

out. Antimicrobial efficacy of various extracts was assessed by disc diffusion method against Gram positive bacteria-*Staphylococcus aureus*, Gram negative-*Escherichia coli*. The methanol extract shows more inhibition than ethanol and water extracts. *Staphylococcus aureus* shows more inhibition zone than *Escherichia coli*.

## Results and Discussion

Crude drugs are usually obtained from wild sources and are mostly collected by illiterate and unskilled people unaware of their botanical information, authentication and standardization parameters. This usually affects the safety of the final product. For safe and efficacious herbal medicine production, Appropriate control of starting material is extremely crucial. Pharmacognostical evaluation of different parameters is the vital etiquette for standardization of herbals (kumar *et al.*, 2014).

## Microscopic and histological techniques

### Transverse section of Leaflet

Shape of the leaf, thickness of the leaf lamina midrib and margins in sections view and their ratio, nature of the leaf has been considered as characters of taxonomic significance (Vijaya kumar 1983; Koteshwar Rao 1986). In the present study it is revealed that the following characters the leaf has shown isobilateral leaf, heterogenous mesophyll, palisade parenchyma, both the upper and lower epidermis possesses a prominent cuticle and sunken stomata. The epidermis is usually just one cell layer thick and forms when protoderm cells derived from the apical meristems differentiate. The shape of epidermal cells in present study observed that it is mostly pentagonal to

polygonal shaped epidermal cells on both the surfaces; epidermal cells are closely packed. In *Cassia angustifolia* plant leaves shown the Paracytic type of stomata. The Stomata surrounded by two kidney-shaped subsidiaries the conjoint walls of the subsidiaries are at poles of guard cells. Mesophyll is differentiated in to palisade & spongy tissue. In *Cassia angustifolia* leaf consists the lower epidermal cells are somewhat shorter than the upper ones and they possess slightly wavy walls. A transverse section through the midrib region shows a single arc shaped vascular bundle unsheathed by sclerenchymatous cells. The vascular bundle is collateral with xylem on the upper region

### Epidermis in surface

The epidermal cells were described to *Cassia angustifolia* have polygonal straight walls, The Anticlinal walls of the epidermal cells were described to be straight, on both surfaces of *Cassia angustifolia* leaf. In the present study the epidermal cells are more striated on the adaxial surfaces than the abaxial surface on leaf of *Cassia angustifolia*.

The arrangements of the epidermal cells are irregularly arranged, the outer walls of the epidermal cells is flat on both the adaxial and abaxial surfaces of leaf of *Cassia angustifolia*.

### Trichomes

Both the upper and lower epidermis possess trichomes and hairs. The hairs are non-glandular, unicellular, conical, often curved or with papillose walls (Dutta and Mukerji 1952). The trichomes are unicellular, uniseriate short conical warty hairs are present on *Senna* leaves. The base of trichome is broad and tapering end.

### Quantitative microscopy

Microscopic features not easily characterized by general microscopy were studied. This included Stomatal number, Stomatal index, palisade ratio, vein islet and vein termination numbers. They were evaluated according to the methods described by (Evans WC 2012).

### Leaf venation

The leaf veins consists of vascular bundles that help in the transport of mineral nutrients

and water from the roots to the leaf and the materials produced in the leaf to the rest of the plant. The pattern of leaf venation is important characteristic for the identification of plants. The purpose of the present study is to provide a detailed foliar venation characters in relation to taxonomy. In taxonomy also the disputes of keeping some species in particular genera's or families were shifted to the original positions and to related position from false keepings in the floras.

**Table.1** Different solvents of *Cassia* leaf powder showing different colors in normal light and UV light. (Mearz and paul 1950)

Plant extract	Ordinary light	U.V light	After 24 hours Ordinary Light	U.V light
Water	Chromo Gr.Ltp	Green stone	Banana Sun Beam	Green Stone
Alcohol	Chromo Gr.Ltp	swamp	Ever green	Privet
Acetone	Mt. Vernon green	mist	Burn swick gr.deep	Chrome green(deep)
Chloroform	Privet Fir	Rubient	Jungle green	Chrome green Deep
Petroleum ether	Green stone	Oriental Fuchsia	Teak wood pinecone	Bronze sheen
10% H <sub>2</sub> SO <sub>4</sub>	Cossak green	Quaker green	Guinea hen	Chrome green deep

**Fig.1** Different parts of *Cassia angustifolia* plant  
**Flowering Plants**

**Potted Plants**



**Dry leaves**



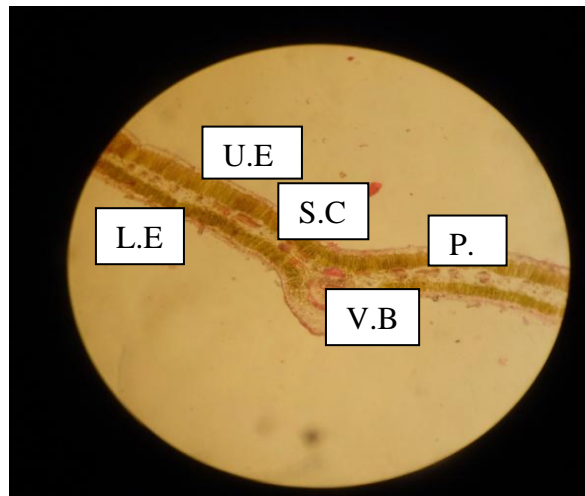
**Dry fruits**



**Fig.2** Powder microscopy of *C. angustifolia* showing a wavy epidermal cells, stomata, trichome, and mid rib Portion

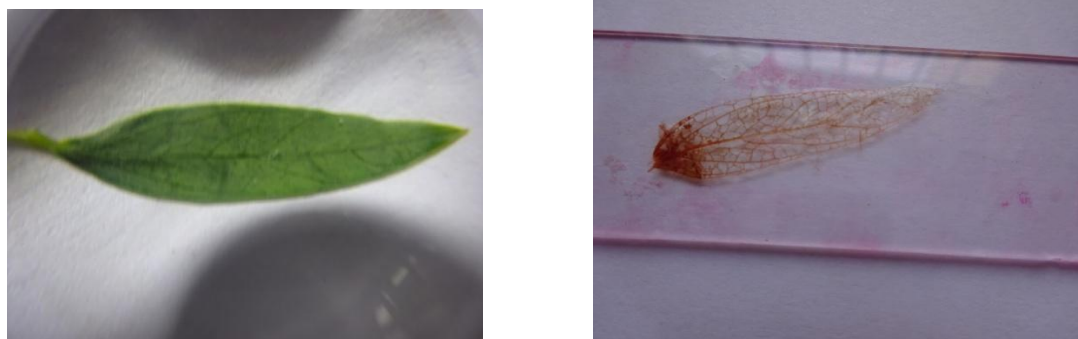


**Fig.2:** *Cassia angustifolia* leaf T.S

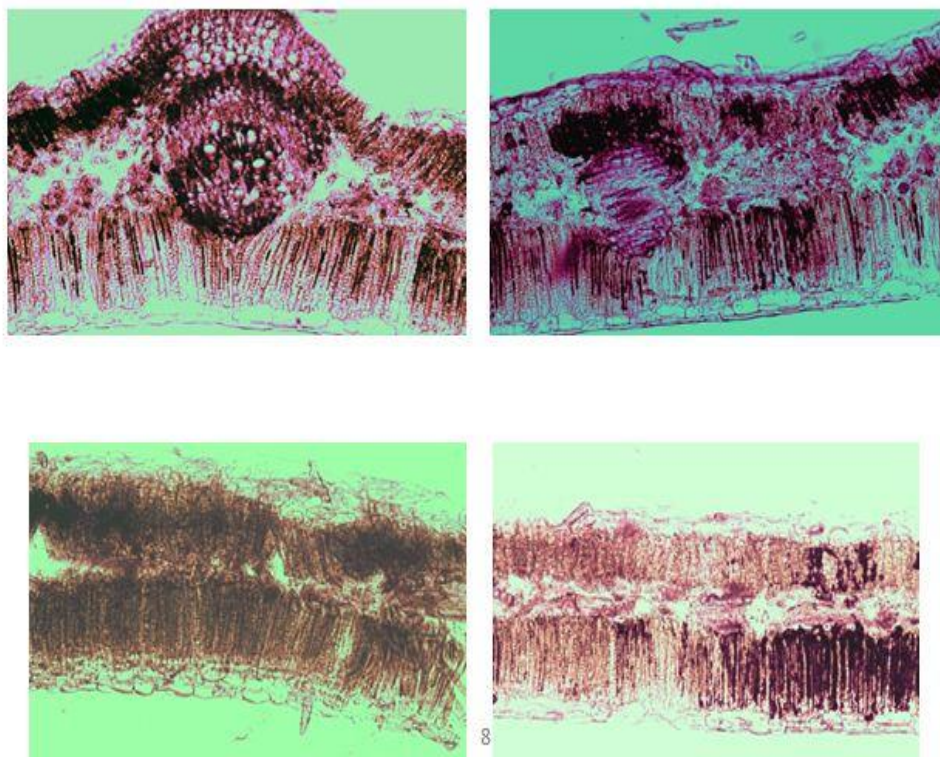


**Note:**  
U.E=Upper Epidermis,  
L.E=Lower Epidermis,  
P.T=Palisade Tissue,  
P=Phloem,  
S.C=Sclerenchyma,  
C.C=Collenchyma

**Fig.3** Leaf venation before and after venation



**Fig.4** Leaf lamina of *Cassia angustifolia*



Note: A= Leaf T.S of *Cassia angustifolia*, B= Leaf midrib portion of leaf T.S, C=Leaf lamina of *Cassia angustifolia* trichome are upper and lower epidermis.

**Fig.4** Different solvents of *Cassia* leaf powder showing different Colors in normal light and UV light



**Normal light**



**UV Light**

### Powder analysis

The powder of the leaves of *Cassia angustifolia* dissolved in different solvents

and the extractions were tested in under Ordinary Light and Ultra violet light and the residue were also observed immediately and also after 24 hours were verified by a

comparison with a color catalogue of Maerz and Paul (1950). In *Cassia angustifolia* exhibit different identical color in different solvents which helps in identifying the taxa even it's in powder form and also helps in checking the adulteration and the drug preparation.

### Phytochemical screening

The presence of secondary metabolites such as tannins, alkaloids, glycosides, terpenoids and phytosterols were determined according to standard methods. These secondary metabolites may be responsible for its pharmacological activities such as anti-epileptic (Sundara RL *et al.*, 2012), hepatoprotective activity against paracetamol induced liver damage in rats (Sastry AVS, *et al.*, 2011) anti-inflammatory effects of the seeds (Basha SI, 2011), antibacterial (EL-Kamali HH, EL-Amir MY 2010) and antifungal (Vipul SD, Anjana KV.2011) properties.

In conclusion, the present studies have established organoleptic, macro morphological, microscopic and physicochemical properties which may be useful in the identification of *Cassia angustifolia*. In present study shown the pentagonal to polygonal shaped epidermal cells on both the surfaces; epidermal cells are closely packed. In *Cassia angustifolia* plant leaves shown the parasitic type of stomata. The present study reveals that the foliar epidermal characters are important in taxonomic identification and species relationships in the members of the Senna examined. A greater number of information on taxa will be helpful to understand the taxonomic value of stomata type and distribution. Foliar anatomical characters such as stomata and trichomes have been found instrumental in solving taxonomic problems. In Powder analysis In *Cassia*

*angustifolia* exhibit different identical color in different solvents which helps in identifying the taxa even it's in powder form and also helps in checking the adulteration and the drug preparation. Senna play a vital role as their economic value is beyond dispute. Senna is rich source of Sennosides, glycosides and other nutrients and can provide a solution to the problem of malnutrition and other diseases to a great extent. The efficacy of Senna preparation has been evaluated in clinical trial in the treatment of constipation and for bowel cleansing before radiological investigations or colonoscopy.

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