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Uses of Cassia Fistula Linn as a Medicinal Plant

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ABSTRACT

There are many Cassia species worldwide which are used in herbal medicine systems. Cassia fistula is no exception... it is often used as a highly effective moderate laxative that is safe even for children. However, in large doses, the leaves and bark can cause vomiting, nausea, abdominal pain and cramps¹⁸. Cassia fistula is also employed as a remedy for tumors of the abdomen, glands, liver, stomach, and throat, for burns, cancer, constipation, convulsions, delirium, diarrhea, dysuria, epilepsy, gravel, hematuria, pimples, and glandular tumors. This plant is used by traditional medical practitioners for the treatment of various diseases. It is known as a rich source of tannins, flavonoids, and glycosides present in Cassia fistula might be medicinally important and/or nutritionally valuable. The plant is rich in carbohydrates, Linoleic, Oleic, and Stearic. The present review summarizes some important pharmacological studies on Cassia fistula and phytochemical investigations and isolated principles from them.

Keywords: Cassia Fistula, Herbal Medicine, Linoleic, Cancer, Constipation.

INTRODUCTION

The medicinal properties of plant species have made an outstanding contribution to the origin and evolution of many traditional herbal therapies. Many of the plants contain a variety of phytopharmaceuticals, which have found very important applications in the fields of agriculture, human and veterinary medicine¹. *Cassia fistula* L., (Fabaceae, Caesalpinioideae), a very common plant known for its medicinal properties is a semi-wild in nature. It is distributed in various regions including Asia, South Africa, China, West Indies and Brazil³. *Cassia fistula* is a deciduous, medium-sized tree up to 24 m in height and 1.8 m in girth, cultivated almost throughout India. It is one of the most important trees widely spread in the forest of India. It is usually occurring in deciduous forests throughout the greater part of India, ascending up to an altitude of 1,220 m in the sub-Himalayan areas and the outer Himalayas. It is common throughout Gangetic valley, particularly abundant in Central India and South India². It is planted as an ornamental tree in homesteads and along the roadside. Many of the biologically important compounds were isolated and identified from different parts of the plant. Medicinally it has been various pharmacological activities like antimicrobial, antifungal, antipyretic, analgesic, larvicidal, anti-inflammatory, antioxidant, anti-tumor, hepatoprotective, hypoglycemic activities, anti-diabetic activity, and laxative property⁴. In the traditional medicine, *Cassia fistula* is one of the most commonly used plants in Unani and Ayurvedic medicines, this plant has been described to be useful against skin diseases, liver troubles, tuberculous glands and its use in the treatment of haematemesis, pruritus, leucoderma and diabetes has been suggested^{6,7}. Traditionally, the plant is also used as an infusion, decoction, or powder, either alone or in combination with other medicinal plants. It constitutes an ayurvedic preparation "Dadrughan-vati" which is used for ringworm, leucoderma, etc. Chakramardha tailamu, a compound ayurvedic oil of this herb is beneficial in eczema, ringworm and other skin diseases^{8,9,10}. The whole plant is employed in the treatment of impetigo, ulcers, and helminthiasis and as a purgative. According to Ayurveda the leaves and seeds are acrid, laxative, antiperiodic, anthelmintic, ophthalmic, liver tonic, cardiogenic and expectorant⁸. The leaves and seeds are useful in leprosy, ringworm, flatulence, colic,

dyspepsia, constipation, cough, bronchitis, cardiac disorders. In India, *Cassia* species is used as a natural pesticide in organic farms. Roasted seeds of the *cassia* are substituted for coffee, like tephrosia seeds. *Cassia* powders are most popularly used in the pet-food industry^{11, 12}.

PLANT DESCRIPTION

Cassia fistula is a moderate sized deciduous plant 10 m tall, flowers yellow, leaves alternate, pinnate, 30-40 cm long, with 4-8 pairs of ovate leaflets, 7.5-15 cm long, and 2-5 cm broad. Fruits pendulous, cylindrical, brown, septate, 25-50 cm long, 1.5-3 cm in diameter, with 25-100 seeds. Seeds lenticular, light brown, lustrous⁶. It is a deciduous tree with greenish gray bark, compound leaves, leaflets are each 5-12 cm long pairs. A semi-wild tree known for its beautiful bunches of yellow flowers and also used in traditional medicine for several indications. A fruit is cylindrical pod and seeds many in black, sweet pulp separated by transverse partitions. The long pods which are green, when unripe, turn black on ripening after flowers shed¹³. The pulp is dark brown in color, sticky, sweet and mucilaginous, odor characteristic, and somewhat disagreeable¹⁴.

TAXONOMICAL CLASSIFICATION^{15,16}

Kingdom	<i>Plantae</i>
Subkingdom	<i>Tracheobinota</i>
Super Division	<i>Spermatophyta</i>
Division	<i>Mangoliophyta</i>
Class	<i>Magnoliopsida</i>
Sub Class	<i>Rosidae</i>
Order	<i>Fabales</i>
Family	<i>Fabaceae</i>
Genus	<i>Cassia</i>
Species	<i>Fistula</i>

VERNACULAR NAMES¹⁷

Bengali	<i>Bundaralati, Sonalu, Soondali, Sondal</i>
English	<i>Golden Shower</i>
Guajarati	<i>Garmala</i>
Hindi	<i>Sonhali, Amultus</i>
Kannad	<i>Kakkemara</i>
Marathi	<i>Bahava</i>
Tamil	<i>Shrakkonnai, Konai, Irjviruttam</i>
Telegu	<i>Kondrakayi, Raelachettu, Aragvadamu</i>
Sanskrit	<i>Nripadruma</i>
Arab	<i>Khayarsambhar</i>
Oriya	<i>Sunaari</i>
Punjabi	<i>Amaltaas, Kaniyaar, Girdnalee</i>
Urdu	<i>Amaltaas</i>

HERBAL MEDICINE USES

There are many *Cassia* species worldwide which are used in herbal medicine systems. *Cassia fistula* is no exception... it is often used as a highly effective moderate laxative that is safe even for children. However, in large doses, the leaves and bark can cause vomiting, nausea, abdominal pain and cramps¹⁸. *Cassia fistula* is also employed as a remedy for tumors of the abdomen, glands, liver, stomach, and throat, for burns, cancer, constipation, convulsions, delirium, diarrhea, dysuria, epilepsy, gravel, hematuria, pimples, and glandular tumors. In Ayurvedic medicine systems, the seeds are attributed with antibilious, aperitif, carminative properties while the root is used for adenopathy, burning sensations, leprosy, skin diseases, syphilis, and tubercular glands¹⁸. The intake of these seeds can cure skin diseases like ringworm, itch and psoriasis the leaves are employed there for erysipelas, malaria, rheumatism, and ulcers^{19, 20}.

GEOGRAPHICAL SOURCE

Cassia fistula L. (Caesalpinioideae) a very common plant known for its medicinal properties is a semi-wild Indian Laburnum known as a golden shower. The plant *Cassia fistula* is cultivated as an ornamental throughout India. *Cassia* species are annual under shrub grows all over the tropical countries (throughout India, Pakistan, Bangladesh and West-China) and grows well in the wasteland as a rainy season weed. In deciduous and mixed monsoon forests throughout greater parts of India, ascending to 1300 m in outer Himalaya⁸. In Maharashtra, it occurs as a scattered tree throughout the Deccan and Konkan^{21, 22}.

MORPHOLOGY

Aragvadha is a moderate sized tree. It attains a height of about 8 to 15 m when mature. It leaves are up to 5.1 to 12.2 cm long, par pinnate with a 4-8 pair of leaflets, coriaceous when fresh and paper on drying. Midrib is densely pubescent beneath^{23, 24}.

Leaves alternate, pinnate, 30-40 cm long, with 4-8 pairs of ovate leaflets, 7.5-15 cm long, 2-5 cm broad, entire, the petiolules 2-6 mm long.

Flowers of the *cassia fistula* are pale yellow in color usually in nearly sessile pairs in the axils of the leaves with five petals, upper one is very crowded. Flowers bright yellow in the terminal, drooping racemes, 30-60 cm long; calyx oblong, obtuse, pubescent; corolla with five subequal, obovate, shortly clawed petals, to 3.5 cm across; stamens 10, upper three with erect filaments to 0.7 cm long and with basified anthers²⁵.

A fruit is cylindrical pod and seeds many in black, sweet pulp separated by transverse partitions. The long pods which are green, when unripe, turn black on ripening after flowers shed 6. The pulp is dark brown in color, sticky, sweet and mucilaginous, odor characteristic, and somewhat disagreeable. The pod develops numerous transverse septa between the seeds. When fresh the β pods contain a black pulp which on drying adheres to the septa²⁵.

PHYTOCHEMISTRY

C. fistula extracts have been attributed to their primary and secondary metabolite composition. Primary metabolite analysis has essentially been focussed on the seed, pollen, fruit, leaf and pod. The composition of protein 12 %, carbohydrate 11.75%, lipid 12% and free amino acid 1.42%, respectively. The stem bark of *Cassia fistula* contains two flavonol glycosides, 5, 7, 3', 4'-tetrahydroxy-6, 8- dimethoxyflavone-3-O- α -arabinopyranoside, 5, 7, 4'-trihydroxy-6, 8, 3'- trimethoxyflavone-3-O- α -L-rhamnosyl (1 \rightarrow 2)-O- β -D-glucopyranoside and a xanthone glycoside, 1, 8-dihydroxy-3, 7- dimethoxyxanthone-4-O- α -L-rhamnosyl (1 \rightarrow 2)-O--D- β glucopyranoside²⁶. The fruit of *Cassia fistula* was a good source of Fe and Mn, and their concentrations were considerably higher than those in apple, apricot, peach, pear and

Orange and also revealed the presence of aspartic acid, glutamic acid and lysine constituted 15.3, 13.0 and 7.8%, respectively, of the total amino acids in the pulp^{27, 28}. The seeds yield a gum (7.65%) which is the most efficient suspending agent for calomel, kaolin and talc²⁹. Extraction of the dried and crushed seeds with petroleum ether (b.p.60-80°C) in a specially modified soxhlet apparatus gave 5.0% brownish yellow oil. Subsequently, Chrysophanic acid was also isolated from this oil²⁹. Mucilage (25.8%) was isolated from the seeds by extraction with hot water³⁰. The seeds constituted the same amino acids with 16.6, 19.5 and 6.6%, respectively while, isolated 5-Nonatetracontanone, 2-hentriacontanone, triacontane, 16 hentriacontane and beta- sitosterol from the hexane fraction of the fruits. fruit pulp contains sugar, gum, astringent matter, gluten, coloring matter and water proteins (19.94%) and carbohydrates (26.30%); arginine, leucine, methionine, phenylalanine, tryptophan, aspartic and glutamic acids; a new dimeric proanthocyanidin CFI isolated along with (-) epiafzelechin, (+) catechin, kaempferol, dihydrokaempferol and 1, 8-dihydroxy-3- methylanthraquinone²⁸. The neutral lipids were accounted for over 89.80% of the total weight of the lipid employed. Saturated and unsaturated fatty acids present in the oil were separated and varied from 23.79% to 28.20% and 63.28% to 66.71% respectively. The fatty acid composition of the oil was analyzed by Gas Liquid Chromatography (GLC). The major fatty acids found in the oil were linoleic acid (42.42%), oleic acid (29.62%), stearic acid (14.33%) and palmitic acid (11.41%). In addition to the above, caprylic acid (0.76%) and myristic acid (1.44%) were also present in minor amounts. Yueh-Hsiung Kuo *et al.* (2002), identified four new compounds from the seeds of *Cassia fistula*, 5-(2-hydroxy phenoxy methyl) furfural, (2*S*)-7-hydroxy- 5-hydroxymethyl-2-(22 -hydroxypropyl) chromone, benzyl 2- hydroxy-3,6- dimethoxybenzoate and benzyl 2- β -O-D-glucopyranosyl- 3,6-dimethoxybenzoate, together with four known compounds, 5 hydroxymethylfurfural, (2*S*)-7-hydroxy-2-(22 -hydroxypropyl)-5- methylchromone, and two oxyanthraquinones, chrysophanol and chrysophanein³¹.

PHARMACOLOGICAL STUDY

Anti-Fungal Activity

4-hydroxy benzoic acid hydrate obtained from the extracts of the flower of *Cassia fistula* (an ethnomedicinal plant) showed antifungal activity against richophyton mentagrophytes (MIC 0.5 mg/ml) and Epidermophyton floccosum (MIC 0.5 mg/ml)³¹.

Antibacterial activity

Three lectins from the *Cassia fistula* seeds possess antibacterial activities against various pathogenic bacteria.⁵⁴ The antibacterial activity of the aqueous and alcoholic extract of stem bark of *Cassia fistula* was highly effective³¹.

Anti-inflammatory activity

The extract of leaves of *Cassia fistula* was suggested for anti-inflammatory effects.⁵⁶ The anti-inflammatory and antioxidant activities of the *Cassia fistula* bark were found significant³².

Central Nervous System activities

The methanol extract of the seed *Cassia fistula* was tested for different pharmacological actions in mice. A depressant action of ME was also evident from the behavioral studies on mice. These results contribute with novel antiprotozoal compounds for future drug design studies³³.

Antiparasitic Activity

The fractionation through guided antileishmanial activity of the dichloromethane extract of *Cassia fistula* fruits (Leguminosae) led to the isolation of the active isoflavone biochanin A, identified by spectroscopic method³⁴.

Anti-itching activity

Vicharchika (eczema) is a chronic skin disease with no permanent cure in modern medicine. Raising serum IgE level is the commonest immunological marker for eczema. This study suggests of significant efficacy of Aragvadha on the patients of Vicharchika (eczema)³⁵.

Antipyretic activity

The pods of *Cassia fistula* was found to be devoid of antipyretic activity in experimental models. The pod's extracts showed a marked antipyretic effect by causing a reduction in yeast-induced fever. The extract caused a better hypothermal activity against yeast-induced pyrexia in rats. Subcutaneous injection of yeast induces pyrexia by increasing synthesis of prostaglandin and is used to screen³⁶.

Antitussive activity:

The methanolic extract of *Cassia fistula* was investigated for its effect on a cough model induced by sulfur dioxide gas in mice. It exhibited significant antitussive activity when compared with control in a dose-dependent manner³⁷.

Antioxidant Activity

Antioxidant activities of the aqueous (CFA) and methanolic extracts (CFM) of the *Cassia fistula*. Both extracts exhibited significant antioxidant activity in DPPH, Nitric oxide, and Hydroxyl radical induced in-vitro assay methods. Both extracts showed Dose-Dependent protective effect

Against lipid peroxidation and free radical generation in liver and kidney homogenates^{24, 25}. Antioxidant activity of *Cassia fistula* Linn) flowers in alloxan induced diabetic rats³⁸. Fruit

Pulp powder of *Cassia fistula* was investigated for its antioxidant activity both in vitro and in vivo³⁹.

Wound Healing

Infection is the major problem to treat the wound. Antibiotic resistance by the pathogenic microorganism renders drug ineffective. The alcohol extract of *C. fistula* leaves was analyzed for

Antibacterial effect against *Staphylococcus aureus* and *Pseudomonas aeruginosa*. *Cassia fistula* treated rats showed, better wound closure, improved tissue regeneration at the wound site, and supporting histopathological parameters pertaining to wound healing, and thus confirming the efficacy of *Cassia fistula* in the treatment of the infected wound⁴⁰.

Antiulcer activity

The ethanol leaf extract of *Cassia fistula* Linn was evaluated for antiulcer activity against pylorus ligation- induced gastric ulcer⁴¹.

Antileishmanial activity

Hexane extract from the fruits showed significant antileishmanial activity against the promastigote form of *Leishmania L. chagasi*⁴².

Anti-fertility

Cassia fistula reversibly suppresses fertility in male rats. Withdrawal of extract restored all the altered parameters, including organ weights, fertility, the circulatory level of hormones and tissue biochemistry, to control levels after 120 days. Oral administration of aqueous extract of seeds of *Cassia fistula* to mated female rats from day 1-5 of

pregnancy at the doses of 100 and 200 mg/kg body weight resulted in 57.14% and 71.43% prevention of pregnancy, respectively, whereas 100% pregnancy inhibition was noted at 500 mg/kg bw⁴³.

Antimicrobial activity

The leaves, stem bark and fruit pulp showed antibacterial activity. The fruit pulp was the most potent in this respect. The activity might be due to the presence of flavonoids. The solvent ether extract of the fruit pulp possess the maximum activity and when compared to chloramphenicol, the activity of 1 gm of this extract was found to be more than that seen with 100-g of chloramphenicol⁴⁴.

Antitumor activity

The effects of methanolic extract (ME) of *Cassia fistula* seed on the growth of Ehrlich ascites carcinoma (EAC) and on the life span of tumor-bearing mice were studied. ME treatment showed an increase of life span, and a decrease in the tumor volume and viable tumor cell count in the EAC tumor hosts. Cytological studies have revealed a reduction in the mitotic activity and the appearance of membrane blebbing and intracytoplasmic vacuoles in the treated tumor cells. Improvement in the hematological parameters following ME treatment, like hemoglobin content, red blood cell count and bone marrow cell count of the tumor bearing mice have also been observed. The results of the present study suggest that ME of *C. fistula* seed has an antitumor activity. Hematological studies have revealed that out of the three doses of ME, ME at the dose of 100 mg/kg has shown better results than at the doses of 200 and 300 mg/kg. The exact mechanism by which ME mediates its antitumor effect is still to be elucidated. Cytological changes indicate that ME might be having a direct tumoricidal effect on the tumor cells^{45, 46}.

Hepato- protective activity

Cassia fistula linn. has improved in the markers of hepatic toxicity and oxidative stress.⁴⁷ The hepatoprotective activity of *Cassia fistula* leaves has proved protective effect is analogous to that of a standard hepatoprotective agent⁴⁸.

Effect on chikungunya

The crude extract of *Cassia fistula* Linn. Served as a potential larvicidal, ovicidal and repellent agent against chikungunya vector mosquito⁴⁹.

Laxative activity

In-vitro effect of *Cassia fistula* infusion on isolated guinea-pig ileum study concluded that *C. fistula* pod infusion possesses significant dose-dependent laxative activity⁵⁰.

10. Effect on skin diseases

On the basis of the results of this study, it may be concluded that the *Cassia fistula* is having a significant effect in ameliorating the skin diseases due to pitta origin and is the safe drug of choice of purgation therapy⁵¹.

Larvicidal and ovicidal activity

The methanolic leaf extract of *Cassia fistula* was tested for larvicidal and ovicidal activity against *Culex quinquefasciatus* and *Anopheles stephensi*. The results show that the leaf extract of *C. fistula* is promising as a larvicidal and ovicidal agent against *C. quinquefasciatus* and *A. stephensi*⁵².

Hypolipidemic Activity

The effect of 50% ethanolic extract of *Cassia fistula* Linn. Legume was assessed on serum lipid metabolism in cholesterol-fed rats. The effect of 50% ethanolic extract of *Cassia fistula* legume was assessed on serum lipid metabolism in cholesterol-fed rats⁵³.

Antidiabetic Activity

The antidiabetic potential of the total alcoholic extract & its ethyl acetate fraction of the bark of *Cassia fistula* was studied in alloxan induced diabetic rats. The ethyl acetate fraction exhibited a Significant reduction in blood glucose levels than alcoholic extract. The activity was found comparable with standard drug glibenclamide . The mechanism of hypoglycemic and antidiabetic action of hydroalcoholic extract of *Cassia fistula* Linn in rats was reported. The ethanolic extract of *Cassia fistula* Linn Stem bark was investigated for their antihyperglycemic activity 18. Aqueous extract of *Cassia fistula* (Linn.) flowers (ACF) was screened for its antioxidant effect in alloxan induced diabetic rats. The seeds of *Cassia fistula* were investigated for their hypoglycemic activity. They were found to have marked hypoglycemic activity on normal albino rats but not on alloxan produced diabetic albino rats^{54,55}.

CONCLUSION

The extensive survey of literature revealed that *Cassia fistula* is an important medicinal and traditional plant with diverse chemical, pharmacognosy, and pharmacological spectrum. Before the introduction of modern medicines, disease treatment was entirely managed by herbal remedies. This plant is used by traditional medical practitioners for the treatment of various diseases. It is known as a rich source of tannins, flavonoids and glycosides present in *Cassia fistula* might be medicinally important and/or nutritionally valuable. The plant is rich in carbohydrates, Linoleic, Oleic, and Stearic. The present review summarizes some important pharmacological studies on *Cassia fistula* and phytochemical investigations and isolated principles from them.

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