

Pharmacological significance of Cassia fistula: A Review

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ABSTRACT: Medicinal plant species possess abundant and untapped reservoirs of chemical compounds with significant medicinal potential, rendering them important as sources of biomedicine. *Cassia fistula* L is a significant botanical species employed in several traditional medical practices, such as Ayurveda and Chinese Traditional Medicine. The tree is a deciduous species that is of medium size. It has elongated and rod-shaped fruits with pulp, and its vivid yellow blossoms have earned it the moniker 'Yellow Shower'. This study offers an updated account of the botanical characteristics and pharmacological attributes of the subject, encompassing its antioxidant, antibacterial, anti-inflammatory, antidiabetic, anticancer, hepatoprotective, and other capabilities. Pharmacological evaluations of medicinal plants offer vital insights. In this regard, *Cassia fistula* L has the potential to yield significant discoveries of bioactive natural compounds, which can aid in the development of innovative pharmaceutical products.

KEYWORDS: *Cassia fistula*, Amulthus, pharmacological activities, phytochemistry, Sennosides, traditional uses

I. INTRODUCTION

Indian traditional medicine includes Ayurveda, Siddha, Unani, and Homoeopathy traditions. Drug assessment relies on phytochemical, pharmacological, and analytical procedures including chromatography and microscopy. Evaluating the rich legacy of traditional medicine is crucial due to the growing global interest in adopting and researching traditional methods for various health care systems [1]. A plant that fits this description is *Cassia fistula*.

Cassia fistula L. (Fabaceae, Caesalpinioideae), a popular medicinal plant, is semi-wild. In Asia, South Africa, China, West Indies, and Brazil [2]. *Cassia fistula*, a deciduous,

medium-sized tree up to 24 m tall and 1.8 m wide, is grown across India. One of the most widespread trees in India, it grows in deciduous woods across the country and reaches 1,220 m in the sub and outer Himalayas. It is widespread throughout Gangeetic valley, especially in Central and South India [3]. It is a roadside and homestead decorative tree. From various plant components, several physiologically significant chemicals were extracted and identified. The present *Cassia fistula* review covers botanical characteristics, taxonomy, phytochemical ingredients, and pharmacological action [4].

TAXONOMY

Kingdom : Plantae
Subkingdom : Tracheobinota
Super Division : Spermatophyta
Division : Mangoliophyta
Class : Magnoliopsida
Sub Class : Rosidae
Order : Fabales
Family : Fabaceae
Genus : *Cassia*
Species : *fistula*

VERNACULAR NAMES

English : Golden shower, Indian laburnum
Sanskrit : Saraphala, Survanaka, Argwadha, Rajtaru
Urdu : Amaltas
Bengali : Amaltas, Sondal, Sonali

II. BOTANY

This deciduous tree has greenish gray bark, compound leaves, and leaflets measuring 5-12 cm in pairs. This semi-wild tree is famed for its lovely clusters and is utilized in traditional medicine for several purposes. There are 4-8 pairs of opposing, dark-green leaflets that shine above. The leaves are 23-40 cm long, with pubescent primary rachis and minute, linear-oblong, obtuse

stipules. Leaflets are ovate or ovate-oblong, acute, 5-12.5cm by 3.8-9.5cm, bright green above, paler and silvery below, densely pubescent midrib, cuneate base, numerous, close, conspicuous nerves, 6-10 mm long pubescent or glabrous petiolules. Bright golden flowers form elegant clusters. Flowers are 30-50 cm long in loose racemes, with thin, pubescent, and glabrous pedicels (3.8-5.7 cm). The calyx is 1 cm long, glabrous, and has oblong, obtuse segments. A golden corolla measuring 3.8 cm wide with antheriferous stamens. Fruits are cylindrical pods with numerous seeds and dark, delicious flesh split by transverse partitions. Green immature pods become black when ripe after flowering. The pods are 40-70 cm long, 20-27mm in diameter, smooth, and coarsely striated transversely, resembling small cracks. The rounded distal ends have a tiny point indicating the style position. The dorsal suture appears as one vascular thread, while the ventral suture has two tightly applied strands. The pod is separated internally by thin, buff-colored transverse dissepiments at 0.5cm intervals. Each compartment holds one flat, oval, reddish brown seed with a distinct raphe. The dark brown pulp is sticky, sweet, mucilaginous, and has a moderately unpleasant odor. The drug is found as thick, flat or curved chunks with smooth to rough exterior surfaces and warty patches, and a rough interior surface with parallel striations. It has a sweet and unique odor and astringent taste. The seeds are widely oval [5].

III. GEOGRAPHICAL SOURCE

The major constituents of the leaf oil were bornyl acetate (47.7%), pinocarvone (27.1%), camphor (9.3%) and terpinolene (5.4%), while the flower oil contained bornyl acetate (55.2%), pinocarvone (34.2%), camphor (2.8%) and terpinolene (2.0%) and the stem oil contained bornyl acetate (49.2%), pinocarvone (28%), camphor (9.5%) and terpinolene (6%) [17].

IV. TRADITIONAL USES

The root is a tonic, astringent, febrifuge, and powerful purgative [7-10]. The leaf extract inhibited *E. coli* mutagenicity [11]. Alcoholic root bark extract treats backward fever. The leaves are laxative and used as an emollient and poultice for chilblains, insect bites, swelling, rheumatism, and facial paralysis. Anti-periodic and laxative characteristics make leaves useful for jaundice, piles, rheumatism ulcers, skin eruptions, ring worms, and eczema. Oiled leaves and bark are

applied to pustules and insect bites. For chest, joint, migraine, and blood dysentery, use the roots. Root extract decreased blood sugar by 30% [12]. Leaves and flowers purge like pulp. For cough relief, roasted pod ashes combined with salt and honey are taken 3-4 times. Root helps fever, heart illness, retained excretions, and biliousness. Fruits are cathartic and snake bite remedies. Leaves juice treats skin problems. Flower and pod uses include purgative, febrifugal, biliousness, and astringent. The ethanolic 50% pod extract inhibits female albino rat fecundity. The heated pods are applied to cold-induced neck swellings. Fruits are used for asthma. For liver diseases, pulp is administered.

It is used in blood poisoning, anthrax, antidyseric, leprosy, and antidiabetic treatments to remove abdominal blockage. In albino rats, the floral extract suppresses ovarian function and stimulates uterine function. Fruits are used to treat diabetes, as an antipyretic, abortifacient, demulcent, and reduce inflammation and heat, as well as for chest, throat, liver, eye, and gripping issues.

Use leaf juice as a treatment for ringworm, alleviating irritation and dropsical edema. The fruit pulp around the seeds is somewhat purgative. It is also used for biliousness and diabetes. It can be used externally to treat flatulent colic and gouty or rheumatic joints. The pith is good for stomach, liver, or intestinal edema. The seeds contain emetic and cathartic effects, used for constipation. The seeds are mildly pleasant and have laxative, carminative, cooling, appetite-enhancing, and antipyretic properties. They aid in treating jaundice, bilirubin, skin diseases, and swelling throats. Dried seeds have hypoglycaemic action [13].

Amoebiasis uses seed powder. The fruit pulp treats constipation, colic, chlorosis, and urinary problems. The bark is utilized for the treatment of skin ailments, leprosy, jaundice, syphilis, and heart disorders due to its tonic and antidyseric effects. The root bark aqueous extract has anti-inflammatory properties. The root is utilized for heart problems, biliousness, rheumatic conditions, hemorrhages, wounds, ulcers, boils, and skin ailments. Using stem bark can treat amenorrhoea, chest discomfort, and swellings [13].

V. PHYTOCHEMISTRY

Antraquinone glycosides, sennosides A & B, rhein, glucoside, barbaroloin, aloin, formic acid, butyric acid, ethyl esters, oxalic acid, pectin, and tannin are found in the pod pulp. Free

galactomannan and amino acids come from seeds. Flowers produced ceryl alcohol, kaempferol, rhein, and fistulin, a bianthraquinone glycoside. Free rhein and glycosides-sennosides A & B obtained from leaves. Sugar, tannic materials, albuminous starch, calcium oxalate, and other substances are in the pulp crucial parts. Leaves and flowers include tannin, oxyanthraquinone, volatile oils and rhein. Pulp has sugar, gum, astringents, gluten, and coloring water and substance. Besides tannins, root bark includes phlobaphenes and oxyanthraquinone compounds. Rhein glucoside, fistulic acid, sennoside A & B are in the plant [14].

The pulp seed and shell analysis (dry basis) revealed moisture (60.4, 70.1, 34.2), protein (5.8, 15.9, 3.8), total N (0.93, 2.5, 0.6), ash (5.6, 4.5, 1.8%), and energy (fruit) (4.25kcal/g). The pulp has 31.3g sucrose, 26.2g fructose, 42.5% glucose, and (1809mg/100g dry basis) significant potassium content. The pods contain 5-nonatetracontanone and 2-hentriacontanone [15]. Fruit pulp contained proteins (19.94) and carbohydrates (26.30%); arginine, leucine, methionine, phenylalanine, tryptophan, aspartic, and glutamic acids were isolated; a new dimeric proanthocyanidin CFI was isolated along with (-) epiafzelechin, (+)catechin, kaempferol, dihydrokaempferol, and 1,8-dihydroxy-3-methylanthraquinone.

VI. 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) [16].

Antibacterial activity

Three lectins from the *Cassia fistula* seeds possess antibacterial activities against various pathogenic bacteria[16]. The antibacterial activity of the aqueous and alcoholic extract of stem bark of *Cassia fistula* was highly effective [17].

Anti-inflammatory activity

The extract of leaves of *Cassia fistula* was suggested for anti-inflammatory effects. The anti-inflammatory and antioxidant activities of the *Cassia fistula* bark were found significant [18].

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 studies[19].

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 method[20].

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) [21].

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 screen[22].

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 manner[23].

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. Antioxidant activity of *Cassia fistula* Linn flowers in alloxan induced diabetic rats. Fruit Pulp powder of *Cassia fistula* was investigated for its antioxidant activity both in vitro and in vivo [24, 25]

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 wound [26].

Antiulcer activity

The ethanol leaf extract of *Cassia fistula* Linn was evaluated for antiulcer activity against pylorus ligation- induced gastric ulcer[27].

Antileishmanial activity

Hexane extract from the fruits showed significant antileishmanial activity against the promastigote form of *Leishmania L. chagasi* [28].

Hepato- protective activity

Cassia fistula linn. has improved in the markers of hepatic toxicity and oxidative stress[29]. The hepatoprotective activity of *Cassia fistula* leaves has proved protective effect is analogous to that of a standard hepatoprotective agent[30].

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 activity[31].

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[32]. 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 [33, 34].

VII. CONCLUSION

Prior to the advent of contemporary pharmaceuticals, the treatment of diseases was exclusively reliant on herbal treatments. Approximately 80% of the global population living in the extensive rural regions of developing and underdeveloped nations continue to primarily depend on medicinal herbs. The plant is extensively utilized in the traditional medical practices of India and has been shown to have hepatoprotective, anti-inflammatory, antitussive, antifungal, wound-healing, and antibacterial effects. The presence of tannins, flavonoids, and glycosides in *Cassia fistula* makes it a great source of medicinal and nutritional compounds. The plant has a high concentration of carbohydrates, as well as Linoleic, Oleic, and Stearic acids. The leaf of *Cassia fistula* mostly includes oxalic acids, tannins, oxyanthraquinones, and anthraquinone derivatives. The fruit of *Cassia fistula* includes Rhein Glycosides Fistulic Acids, Sennosides A and B, Anthraquinones, and Flavanoid-3-ol-derivatives. The plant has been found to include Ceryl Alcohol, Kaempferol, Bianthraquinone Glycosides, Fistulin, Essential Oils, Volatile Components, Phytol (16.1%), 2-Hexadecanone (12%), Crystals, and 4-Hydroxy Benzoic Acids Hydrate. This study provides an overview of significant pharmacological research conducted on *Cassia fistula*, as well as the phytochemical investigations and isolated compounds derived from it. These findings have the potential to be further explored in order to discover new herbal medications.

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