



Study of Aragvadha (*Cassia fistula* Linn.) with special reference to phyto-pharmacological properties: An overview

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Received: 29.11.2018

Revised: 28.03.2019

Accepted: 14.05.2019

Abstract

Cassia fistula Linn. is a plant of family fabaceae. It is commonly known as golden shower, Indian laburnum, and *rajvriksha*. It has been popular as a common drug of choice for *Ayurveda* experts from ancient time due to its various therapeutic properties like laxative, hepato-protective, antibacterial, analgesic, antipyretic, anti-inflammatory, hypoglycemic, anticolic, antifertility, etc. and it useful in the management of many diseases like *kushtha* (skindiseases), *jwara* (febrile conditions), *hridyaroga* (cardiac problems), *visarpa* (herpes), *vatarakta* (gout), *madhumeha* (diabetesmellitus), *arsha* (piles), *bhagandar* (fistula in ano) etc. It is found in over all India and other adjacent countries, especially in Himalayan tract and outer Himalaya region. Its extract mainly contains Anthraquinone, fisulic acid, resins, flavinoids, rhein glycoside. Beside references from *Ayurvedic* classical texts, this article described researches which carried out on this plant for its clinical and pharmacological evaluation.

Key words: *Cassia fistula* Linn, anti-inflammatory, *Ayurvedic* formulations, Anthraquinone, *madhumeha*.

Introduction

Ayurveda is the collection of precious knowledge about health which was scripted by Indian *Acharya* thousands of years ago. It describes the use of many medicinal plants and their preparations for mitigation of diseases far before anyone else in world. It is estimated that more than 25% of the modern medicines are directly or indirectly derived from plants. Indian medicinal plants are considered as a vast source of several pharmacologically compounds that is commonly used as home remedies. *C. fistula* Linn. (*Aragvadha*) is a mediumsizedtree and its different parts are used in *ayurvedic* medicine as well as in home remedies (Narhari, 2003). It has been popular as a common drug of choice for *Ayurvedic* physicians from ancient time. *C. fistula* Linn. is used as a component in many *Ayurvedic* formulations such as *aragvadhaghrita*, *panchagavyaghrita*, *mahakalyanakaguda*, *siddharthakasnana*, etc. Aim of this article is to provide a comprehensive

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review on the phytochemical and pharmacological aspects of *Cassia fistula* Linn (Gupta, 2010).

Synonyms

Ayurvedic - *Dirghaphala*, *Vyadhiha*, *Chaturangula*, *Aarveta*, *Karni*, *Karnikar*, *Rechan*, *Naradhip*, *Shampak*, *Rajvriksha*, *Apdhatak*, *Kalpadru*, *Swarandrum*, *Kritamalak*, *Vyadhighat*, *Suvarnak*, *Swaranang*, *Swarnaphala*, *Dhanbahera*, *Manthan*, *Nripadrum*, *Hempushpa*, *Rajtaru*, *Kandughana*, *Swarnapuspa*, *Kusthasudan*.

English name: Indian laburnum, purging fistula, riding pipe, goldenshower, drumstick, purging cassia, pudding pipe tree.

Properties

Ayurvedic Properties of *C. fistula* Linn. are:

Rasa – *Madhur*, *Tikta*

Guna – *Guru*, *Sheetal*

Virya – *Sheet*

Vipaka – *Madhur*

Morphological description

a) **Macroscopic:** It is a flowering plant of fabaceae family and commonly known as golden rain tree, *cana fistula*, and other names. The species is native to the Indian subcontinent and adjacent regions of South-east Asia. It is the state flower of Kerala and a very important ornamental plant of India. It is a



national tree of Thailand and the National flower of Thailand. It is a small to medium-sized tree that typically grows upto 30-40 feet tall in height. It has greenish Grey smooth bark when young and rough when old it exfoliates in hard black scales. It is well known for producing five-petaled, bright yellow flower in 8-18 inches pendulous terminal racemes which covers the tree with profuse bloom in May-July. It have even pinnate compound leaves which upto 12-16 inches long and 4-8 pairs of ovate-lanceolate leaflets found in a leaf. Leaves usually drop in April as an overture to flowering which occurs from May to early July.

Tree is often considered to be semi- deciduous or semi-evergreen because of this brief loss of leaves. A second less significant bloom occur in month of September. Following flowers there is a 30 to 60 cm long, cylindrical, pendulous, almost straight, smooth, shining, dark brown, indehiscent pod with plentiful (40-100) horizontal seeds immersed in a dark coloured sweetish pulp. Firstly pods are green but on maturity they turn in black colour remaining on the tree until the following year. Sticky brown pulp inside the pods has been used in herbal medicines. Seeds are generally ovate, thick, smooth and dark brown or black in colour (Kirtikar and Basu, 2006).

Microscopic:

Root: Outer region of cork consisting of 30-40 rows of slightly thick walled tangentially elongated cells, mostly filled with brownish tannin. Centre of the root is occupied by the wood which is composed of vessels, xylem fibers, wood rays and xylem parenchyma (Rajagopal *et al.*, 2013).

Stem: Outermost layer of cork consisting of 18-24 rows of slightly thick walled tangentially elongated cells, filled with brownish tannin. Vessels are pitted with simple perforations, fibers highly thick walled, xylem parenchyma filled with simple and compound starch grains (Bahorun *et al.*, 2005).

Leaf: An upper and lower epidermis, chlorenchyma and a ring of pericyclic fibers enclosing a peculiarity arranged vascular bundle and small central pith, which is irregular shaped.

Fruit: The macerated material of fruit shows vascular elements composed of tracheids, small ray cells with simple pits on walls, fibers, stone cells of varying shapes and parenchymatous cells of fruit pulp filled with a brownish black content.

Table 1. Taxonomic Classification (Danish *et al.*, 2011)

Kingdom	Plantae - Plants
Subkingdom	Tracheobionta - Vascular plants
Division	Mangoliophyta – Flowering plants
Class	Magnoliopsida- Dicotyledons
Sub class	Rosidae
Order	Fabales
Family	Fabaceae (caesalpiniaceae) – Pea family
Genus	Cassia L. - Cassia
Species	<i>C. Fistula</i> Linn. – Golden shower

Table 2. Showing chemical constituent of *Aragvadha* (Chopra *et al.*, 2006 and Lee *et al.*, 2001).

Part	Chemical constituents
Bark and heart wood	Barbaloin and rhein, fistucacidin
Leaves	Rhein and its glycoside sennosides A and B
Stem bark	Lupeol, B-sitosterol, hexacosanol tannin
Pod	Rhein, glycoside, fistulicacid, Ceryl alcohol, anthraquinone and tannin,
Flowers	Ceryl alcohol, fistulin, rhein dianthroquinone glucoside
Fruit pulp	Proteins, carbohydrates, arginine, leucine, methionine, phenylalanine
Seeds	Galactomannam composed of D-galactose and D – mannose
Plant	Seven bioflavonoid and two tri flavonoids

Pharmacological behavior of *Cassia fistula*:

Antimicrobial activity

The methanol extract of *C. fistula* seeds was investigated for potential antimicrobial activity against different medically important bacterial, yeast and fungal strains using the disk diffusion technique. The extract had great *in vitro* potential of antimicrobial activities against all the tested microbial strains like *E. coli*, *P. aeruginosa*, *S. aureus*, *S. pyogenes* and the fungi *C. albicans* and *A. niger*.

Antifungal activity

Extracts of *C. fistula* leaves with acetone diethyl ether and methanol shows antifungal activity against *Candida albicans*. Study result show that *C. fistula* seed extract had completely inhibited the growth of *C. albicans* and also exhibited prolonged anti-yeast activity. Ethyl acetate extract of *Cassia fistula* flower shows antifungal activity against the



growth of many fungi such as Trichophytonmentagrophytes, Trichophytonsimii, Trichophyton rubrum and Epidermophyton floccosum due to the presence of Rhein (Bhalodia *et al.*, 2012; Phongpaichit *et al.*, 2004; Duraipandiyana and Ignacimuthu, 2007).

Antiviral activity

Ethanol extract of pod and stem bark of *C. fistula* were found active against Ranikhet disease virus and Vaccinia virus, Ethanol extract of fruit reported active against Foot and Mouth Disease virus. In aqueous hot extract of pods and leaves of *C. fistula* were examine against infectious boiverhinotracheitis virus. Result of this study suggest that pod hot aqueous extract of *C. fistula* shows dose dependent anti IBR virus activity (Shankar and Mathew, 2012).

Antibacterial activity

Extraction of *C. fistula* leaves was carried out using solvents viz. petroleum ether, chloroform, ethanol, methanol and water. Although all five extracts showed promising antibacterial activity against test bacterial species like *E. coli*, *K. aerogenes*, *Protious vulgaris*, and *P. aerogense* bacteria but maximum activity was observed in ethanol extract. These entire findings exhibit that the leaf extracts have broad-spectrum activity and suggest its possible use in treatment of infectious diseases (Shankar and Mathew, 2012; Vasudevan *et al.*, 2009; Panda and Padhi, 2011).

Anti-inflammatory activity

The extract of leaves of *C. fistula* was suggested for anti-inflammatory effects. Extracts showed Dose-Dependent protective effect against lipid peroxidation and free radical generation in liver and kidney homogenates which shows that *C. fistula* bark extracts possess significant anti-inflammatory properties (Bhakta *et al.*, 1999; Ilavarasan *et al.*, 2005). Effect and the results were compared with standard drugs (diclofenac and indomethacin).

Hepato- protective activity

Bhakta *et al.* (1999), investigated the Hepatoprotective activity of the n-heptane extract of *Cassia fistula* leaves was investigated by inducing hepatotoxicity with paracetamol in rats. The extract at a dose of 400 mg/kg body wt. exhibited orally, significant protective effect by lowering the serum levels of transaminases (SGOT and SGPT), bilirubin and alkaline phosphatase (ALP). The hepato protective activity of *C. fistula*

leaves has proved protective effect analogous to that of a standard hepato protective agent (Kannampalli *et al.*, 2007 and Bhakta *et al.*, 1999).

Antipyretic activity

Bhakta *et al.* (2001), examined the significant activity of methanol extract of buds of *C. fistula* for its anti-pyretic action on normal body temperature and yeast-induced pyrexia in rats in both the models at doses of 200 and 400 mg/kg. At a dose level of 200 mg/kg, the extract caused significant lowering of normal body temperature up to 3 hr. at 400 mg/kg dose it caused significant lowering of body temperature up to 6 hr. The results obtained are comparable to those for paracetamol, a standard antipyretic agent. The results suggest that there exists a potential benefit in utilizing *C. fistula* Linn. in treating conditions associated with fever.

Wound healing activity

The methanolic extract of *C. fistula* leaves was examined for its wound healing property in the form of an ointment in two types of wound models in rats, excision wound model and incision wound model. The ointment of the leaf extract of two different concentrations (5 and 10% w/w ointment of leaves extract in simple ointment base) responded significantly in both models of wounds tested. The results were also comparable to standard drug, nitrofurazone, in terms of wound contraction ability, epithelization period, tensile strength and regeneration of tissue at wound area. *C. fistula* treated rats showed better wound closure, improved tissue regeneration at the wound site and supporting histopathological parameters pertaining to wound healing (Bhakta *et al.*, 1997 and Senthil *et al.*, 2006).

Effect on chikungunya: The crude extract of *C. fistula* Linn. served as a potential larvicidal, ovicidal and repellent agent against chikungunya vector mosquito (Govindarajan, 2009).

Anti-tussive activity: The methanol extract of leaves of *C. fistula* has exhibited significant anti-tussive agent (Bhakta *et al.*, 1998).

Effect on fistula in-ano : Role of *Aragvadhadisutra* in the management of fistula in ano is found effective (Kumar, 2000).

Laxative activity: The pods and leaves contain anthraquinone glycosides and anthraquinone glycoside which act as a laxative which has been used in traditional medicine for a long time. In-vitro effect of *C. fistula* infusion on isolated guinea-pig



ileum study concluded that *C. fistula* pod in fusion possess significant dose dependent laxative activity (Akanmu *et al.*, 2004).

Effect on skin diseases

On the basis of the results of this study it may be concluded that, the *C. fistula* is having significant effect on skin diseases due to pitta origin and is safe drug of choice of purgation therapy (Kumar and Chaudhary, 2013).

Antitumor activity: The study of methanolic extract of *C. fistula* seeds prevents the growth of Ehrlich ascites carcinoma. Reports show the increased life span, viable tumor cell count and decreased in the tumor volume. Improvement in the hematological parameters like hemoglobin content, red blood cell count and bone marrow cell count of the tumor bearing mice have also been observed. Cytological studies revealed a reduction in the mitotic activity, and the appearance of membrane blabbing and in tracytoplasmic vacuoles in the treated tumor cells (Shankar and Mathew, 2012).

Antiparasitic activity: Dichloromethane extract of *C. fistula* fruits showed 50% effective concentration of 18.96 µg/ml against promastigotes of *Leishmania L. chagasi*. The Cytotoxicity of this substance against peritoneal macrophages resulted in an EC50 value of 42.58 µg/ml. A more or less similar study has been done by using Hexane extract of *C. fistula* fruit that shows significant anti-leishmanial activity against the promastigote form of *Leishmania L. Chagasi* (Sartorelli *et al.*, 2009).

Antifertility activity: This is observed that Oral administration of aqua sextret of seed of *C. fistula* to mated female rats from day 1-5 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 body weight. This suggests a mild estrogenic activity of the extract (Vijay *et al.*, 1999; Rajesh and Jain, 2009).

Antidiabetic activity: Diabetes mellitus is the most common and serious metabolic disorder among people all over the world. Methanol extract of *C. fistula* stem bark reduced the blood glucose levels in Streptozotocin-induced diabetic rats. Oral administration of Catechin a natural phenol plant secondary metabolite markedly increases tissue glycogen, restored the altered Glucokinase, glucose-6 Phosphatase, Glycogen Synthase and

Glycogen Phosphorylase. Above study suggest that Catechin possesses hypo-glycemic, Glucose oxidizing and insulin mimetic activities and hence it could be used as a drug for treating diabetes (Malpani *et al.*, 2010; Pitchai and Manikkam, 2012; Agnihotri and Singh, 2013; Daisy and Saipriya, 2012; Jarald *et al.*, 2013; Einstein *et al.*, 2013; Nirmala *et al.*, 2008).

Conclusion

A numbers of modern drugs has been isolated from the plants as plant are the natural pool of therapeutic drug free from the side effects caused by any other non-herbal product. In ancient time almost all diseases treatment managed by plant products. *C. fistula* is an important and potential medicinal plant. The offered literature is about the substantial evidences on the anti-bacterial activities of its pod and seed extracts *C. fistula* Linn. has been used since ancient time in Ayurvedic system of medicine. It is known as a rich source of tannins, flavanoids and glycosides present in *C. fistula* Linn. might be medicinally important and/or nutritionally valuable. It possesses therapeutic potential in diseases like kushtha (skin diseases), hridroga (cardiac problems), vatarakta (gout), raktapitta (blood disorders), madhumeha (diabetes mellitus), visarpa (herpes), and jvara (febrile conditions), etc. Though there are certain properties which are still to be screened out, almost all these utility have been revalidated through relevant experimental models in recent past. Various parts of plant are found hypoglycemic, laxative, antibacterial, antipyretic, anti-inflammatory, smooth muscle stimulant, hepatoprotective, analgesic, anticancer, abortifacient, anti-colic, anti-fertility, estrogenic, anti-inflammatory, anti-tussive, antifungal and also used to check wounds healing and antibacterial properties etc. shows us diverse veracity of the plant.

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Study of Aragvadha (*Cassia fistula linn.*) with special reference to Phyto-Pharmacological properties

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