

Medicinal Value of Plant Cassia Fistula Linn: Golden Shower Tree

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Abstract: The fabaceae family includes the Cassia fistula plant, commonly referred to as the Golden Shower, Indiana Laburnum, or Raja vriksha. It originated in East Africa, South Africa, India, the Amazon, and Sri Lanka, and it has since moved to Mexico, China, Mauritius, Mexico, China, and the West Indies. Cassia fistula is used by people to decorate and provide shade for houses as well as for 'Vishukkani' celebrations on Vishu, the first day of the zodiac cycle. It is recognized in medicine for a number of advantages, including liver protection, antifungal, antioxidant, antibacterial, and anti-inflammatory qualities. Gout, fatty liver, bronchitis, jaundice, and skin disorders are among the ailments it is used to treat. Regarding Ayurvedic medicine, It's regarded as a "disease killer" that harmonizes the doshas in the body. (1) The leaves are treated externally for a variety of ailments, including rheumatism and bug stings, and they have laxative properties. Acids, anthraquinones, and glycosides are among the substances found in cassia fistula. Compared to other fruits, its fruit is high in iron and manganese and contains amino acids such as lysine, glutamic acid, and aspartic acid. It is well-known for its therapeutic benefits, which include preventing ulcers, managing diabetes, combating cancer, and suppressing coughs. It also has antifungal characteristics. (2)

Keywords: Golden Shower, Cassia fistula, antibacterial, disease killer

I. INTRODUCTION

80% of plants are used on a daily basis for medicinal purposes worldwide. Medicinal plants are becoming more common since conventional natural therapies are being acknowledged in the medical field. The Atharva Veda, written circa 1200 BC, discussed a wide variety of therapeutic plants. Eighty percent of the population in less developed nations uses plant-based medications (Konar et al., 2022; Duraipandiyam and Ignacimuthu, 2007). In West Bengal, the golden shower tree is also referred to as Bandar lathi or Sondal. It can aid in the healing of ulcers and is used as a tonic (Ali, 2014; Biswas and Ghosh, 1973). Plants are used as medicine by tribes in isolated forests (Mondal, 2022). This tree is used to cure skin conditions such as ringworm. It treats nasal infections in Indian cultures. The leaves are used in India to treat inflammation. The fruit can lessen fever and inflammation; the blooms have purgative properties; and more. It helps with rheumatism, liver, heart, and chest issues (Duraipandiyam and Ignacimuthu, 2007). The entire plant has purgative properties and can be used to treat worms, ulcers, and impetigo. According to Singh and Yadav (2013), the leaves and seeds have the ability to strengthen the liver and heart, relieve constipation, and tighten. Leprosy, ringworm, gas, colic, indigestion, coughs, bronchitis, and heart problems are among the other conditions they can treat (Pawar and Killedar, 2017). (3)

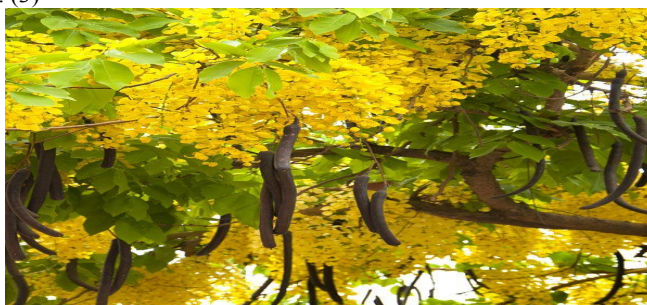


Fig no. 1 cassia fistula plant (4)

General information :

Scientific Name: *Cassia fistula*
 Pronunciation: KASS-ee-uh FIST-yoo-luh
 Common Name(s): Golden-Shower
 Family: Leguminosae
 USDA Hardiness Zones: 10B through 11
 Origin: Not native to North America
 Uses: Good for large parking lot islands (> 200 square feet in size), wide tree lawns (>6 feet wide), shade trees, specimens, and residential street trees
 Availability: Somewhat available; you might need to look outside the local region to find the tree.

Description:

Height: 30 to 40 feet
 Spread: 30 to 40 feet
 Crown Uniformity: Irregular outline or silhouette
 Crown Shape: Oval, upright, vase shape
 Crown Density: Moderate
 Growth Rate: Fast
 Texture: Medium (5)

Vernacular names : (6)

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

Table no : 01(vernacular names of *C. fistula*)

A bioanalytical guide to cassia fistula :

C. fistula is a species of tree that is often referred to as the Indian laburnum or golden shower. At almost 24 meters tall and 1.8 meters broad, the tree is of medium size. It is present throughout India. The tree has greenish-gray bark and sheds its leaves during specific seasons. It is known as the "golden shower tree" because of its clusters of golden yellow blooms that drop down like a shower and its leaves, which are composed of tiny leaflets that are typically in pairs.

Botanical information of Cassia fistula

- Kingdom: Plantae
- Subkingdom: Tracheobinota
- Super division: Spermatophyta
- Division: Magnoliophyta
- Class: Magnoliopsida
- Sub class: Rosidae

- Order : Fabales
- Family : Fabaceae
- Genus : Cassia
- Species : Fistula. (7)

II. GEOGRAPHIC DISTRIBUTION

C. fistula, also known as the golden shower tree, is the national tree and flower of Thailand, and the state flower of Kerala in India. In India, it's called Amaltas in Hindi, Kakke in Kannada, Konrai in Tamil, Sonali or Amultas in Bengali, and Aaragvadh or Raajavriksha in Sanskrit. The Indian postal service even issued stamps to honor this tree. It's originally from South-East Asia but has spread to many tropical regions. It can grow in various types of forests, from tropical to subtropical, and from sea level up to 1300 meters in altitude. It likes places with rainfall between 480 and 2720 mm per year and temperatures between 18 and 29°C. It can grow in different types of soil but prefers calcareous and volcanic soils. It can handle some shade, is resistant to drought, but can't handle frost. It's not a nitrogen-fixing tree. (8)

Ecology:

This is a tree of deciduous forests ranging from tropical thorn to moist through subtropical thorn to moist forest zones. Indian laburnum is reported to tolerate precipitation of 480-2720 mm, annual temperature of 18-28.5 deg C, and pH of 5.5-8.7. The tree can withstand moderate amount of shade, is drought resistant, but not frost hardy.

Biophysical limits

Altitude:

Mean annual temperature: 18-29 deg C

Mean annual rainfall: 480-2720 mm

Soil type: The tree prefers soils of pH 5.5-8.7

Documented species distribution :

Native: India

Exotic: Australia, Egypt, Ghana, Mexico, Pakistan, Zimbabwe

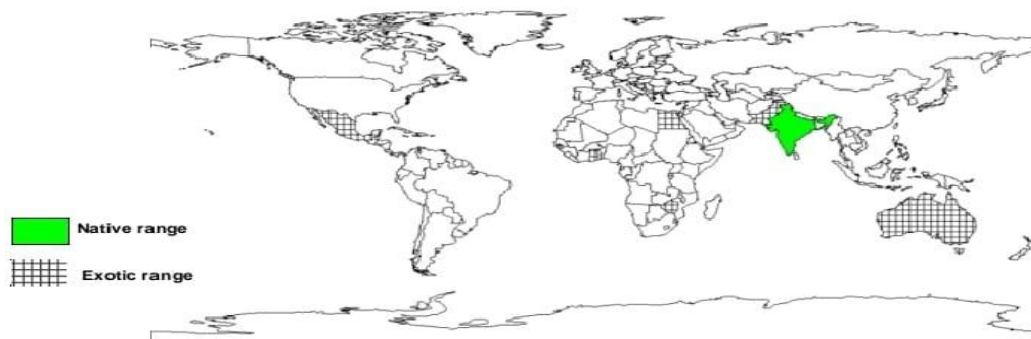


Fig no ;02 (documented species distribution)

The map above shows countries where the species has been planted. It does neither suggest that the species can be planted in every ecological zone within that country, nor that the species can not be planted in other countries than those depicted. Since some tree species are invasive, you need to follow biosafety procedures that apply to your planting site

Morphology:

This tree is deciduous, meaning it loses its leaves seasonally. It has greenish-grey bark and compound leaves made up of smaller leaflets, which are about 5-12 cm long. The tree is known for its beautiful bunches of yellow flowers and is used in traditional medicine for various purposes. Its fruit is a cylindrical pod with many black seeds surrounded by

sweet pulp. The pods start green but turn black as they ripen after the flowers fall off. The pulp inside is dark brown, sticky, sweet, and somewhat disagreeable smelling.

The tree grows to about 6-9 meters high with a straight trunk and spreading branches. The leaves are large, with small hairs on the main stem and tiny, linear-oblong stipules. The leaflets are bright green on top and paler underneath when young, becoming silvery-pubescent. The flowers form in loose clusters on long stalks, with yellow petals and many stamens. The pods hang down, are cylindrical, smooth, and shiny, turning brown-black when ripe. They contain numerous flat seeds with a reddish-brown color and a whitish embryo inside.

Microscopy :

The leaflets of *C. fistula* had stomata on both upper and lower surfaces. These stomata had protective rims around them. Different types of stomata were found in different parts of the plant, including paracytic, anisocytic, tetracytic, and staurocytic. The density of stomata on the upper surface of cotyledons was slightly higher than on the lower surface. On the leaflet's lower surface, the average density of stomata was around 176.94 per square millimeter, which was about 33.3% lower than on the upper surface. (9)

Microscopical evaluation

Microscopic examination is crucial for identifying adulterants. When we looked at a slice of *C. fistula* leaves, we saw specific features that help us identify the plant correctly. In the slice, we noticed a structure with straight-walled, tightly packed cells on the upper and lower sides, forming a dorsi-ventral pattern. Some of these cells were modified into small, non-glandular hairs. Inside the leaf, there were elongated cells in a single layer, followed by a few layers of loosely arranged cells.



Fig no : 03 Arrangement of leaflets and leaflet of *C. fistula* (10)

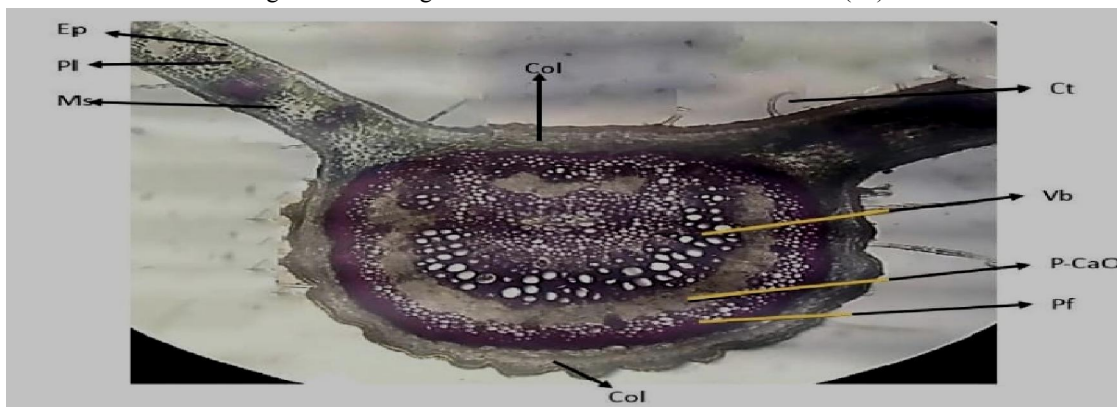


Fig no 04 : Transverse section of *Cassia fistula* leaflet; lignified cells. Ct: covering trichome; Col: collenchyma; Ep: epidermis; Ms: mesophyll; Pl: palisade cells; P-CaO: parenchyma with calcium oxalate; Pf: pericyclic fiber; Vb: vascular bundle (10)

Culture :

Cassia fistula is like a special plant in Thailand. It's both their national tree and flower. The yellow flowers are important because they represent Thai royalty. In Thailand, there was even a big festival named after this tree. In India, the Indian laburnum is a big deal, especially in Kerala during the Vishu festival. They even put it on a stamp! In Sri Lanka, they grow it a lot in Buddhist temples. In Laos, they use its flowers during their New Year celebrations to bring happiness and luck. And in Taiwan, it's the school tree at National Taiwan Normal University because its seed pods look like old-timey teacher's whips. (11)

Physicochemical analysis :

The cassia fistula leaflets and powder used for physicochemical analysis. The parameters like loss on drying, foreign matter, extractive values were studied as per Kalaskarr [5]. In addition, the swelling index, foaming index, pH of extract and total fiber content were studied as per WHO guidelines [6]. (WHO, 1998). (10)



Fig no : 05

III. CULTIVATION AND COLLECTION

Materials and method

Collection of drug:

Fully ripened pods of Aragvadha having average length and diameter of 52–53 and 7– 7.5 cm respectively, externally deep brownish black color with average weight of 120–125 g were collected in the month of NovemberDecember (Shishira Rutu) from university campus, was authenticated as Cassia fistula L. (Caesalpinaceae) by comparing its characters from authenticated book and flora .

Method :

Procured samples were observed for its morphological and organoleptic characters like size, shape, color, smell, etc. Its dimensions were measured.

Division:

The collected pods were equally divided into three groups. One group of the pods were non buried and fruit pulp obtained from it was labeled as sample A. Remaining two groups of pods were buried in the two pits specially designed for the study.

Pit size:

Two pits labeled as pit no. 1 and pit no. 2 in size of 24” length, 12” breadth and 15” depth were dug in the botanical garden of the university, in an open area.

Putting in the pits:

Equal number of pods were buried in each of the pit with sand collected from river bed and kept for 7 and 14 days (12).

Collection of fruit pulp:

After 7 days, the pods from pit no. 1 were taken out and dried in sunlight for 2 h. Then pods were broken and pulp was removed manually. These pulps were divided equally into two parts – one part (sample B) was taken for the organoleptic and analytical study, and the second part (sample C) was kept in an airtight glass container for 30 days and then taken for organoleptic and analytical study. Similar procedure was carried out after 14 days for collection of fruit pulp buried in pit no. 2 and collected samples were labeled as sample D and sample E respectively



Fig no. 06 a) Flower, b) seed , c) Plant (13)

The seeds were collected from Prem Nursery and planted in small polybags in April. The germination time was recorded after planting. Every two months, data on root and stem length, number of nodes and internodes, circumference, basal area, and leaf area were recorded by uprooting and washing the plants. The roots, stems, and leaves were separated for biomass estimation, dried, and weighed. Soil analysis included separating sand, silt, and clay particles, determining organic matter content, nitrogen content using the Kjeldahl method, and estimating potassium using a flame photometer. Soil samples were prepared by drying, grinding, sieving, mixing, and partitioning. The variation in soil types significantly affected the overall plant length, with the 80:20 soil ratio resulting in the highest whole length of 103 cm. Root length was better in the 80:20 soil ratio compared to others, especially in the rainy season. Stem length varied significantly among seasons, with maximum growth in the rainy season. The 80:20 soil ratio also produced the highest stem length

Adulteration :

Adulteration and substitution of Cassia fistula, or the golden shower tree, in herbal products are big concerns. Adulterants can vary, like adding other plant materials to increase bulk, using inert substances like starch or sand to add weight without any value, or adding harmful chemicals like lead chromate or sulfur dioxide to enhance color or preserve the fruit, which can be dangerous to health. Substitution involves replacing Cassia fistula with cheaper or more available plants, either intentionally to save money or due to poor quality control. To tackle this problem, strict quality control measures, proper sourcing, and testing of raw materials are necessary. Regulatory authorities also need to enforce standards and punish those who break the rules to ensure products are safe and genuine.

PHYTOCHEMICALS PRESENT IN C. FISTULA.

Plant organ	Phytochemical present
Leaves	Anthraquinones like rhein, chrysophanol and physcion, butyric & formic acids, pectin, tannin, sennosides A & B, oxalic acid, physcion, lignans e.g., Syringaresinol, flavonoids e.g., Quercetin-O-hexoside, Proanthocyanidin B dimer, Apigenin-6,8-di-C- Glycoside, Myricetin hexoside, Apigenin-C-hexoside-Opentoside Phenolic acids e.g., Coumaric acid derivative and 3,4-di-O-caffeoylquinic acid, chrysophanol biflavonoids and triflavonoids, Physcion B2 (+-) epiafzelechin.
Flowers	Alkaloids, rhein, leucopelargonidin tetramer, fistulin, kaempferol, heptacosanoic acids, hentriacontanoic, triacontanoic, Nonacosanoic, and Gibberellic acid
Bark	Oxyanthraquinone, and flavonol glycosides, Dihydroxyanthraquinone, Leucocyanidin, Fistucacidin (3,4,7,8,4' -pentahydroxyflavon), and Lupeol.
Pods	Fistulic acid, and flavone-3-O-arabinopyranoside, 3-formyl-1-hydroxy-8-methoxyanthraquinone, Catechins
Fruits	1,8-dihydroxy-3-anthraquinolone derivative, Rhein, fistulin, oxyanthraquinone, tannin, ceryl alcohol, Glycosides-Sennosides A & B, volatile oil (essential oils), Chrysophanol, resinous and waxy derivatives
Seeds	Anthraquinone derivatives, carbohydrates, proteins, amino acids, resinous and waxy derivatives, volatile oil, sterculic and malvalic acids, (2' S)-7-hydroxy-2-(2' - hydroxypropyl)-5-methylchromone, 5-hydroxymethylfurfural, Benzyl-2β-O-D-glucopyranosyl-3,6-dimethoxybenzoate, Benzyl-2-hydroxy-3,6- dimethoxybenzoate and 5-(2-hydroxyphenoxymethyl) furfural (14)

Table no : 02 Cassia fistula Phytoconstituents

USES :

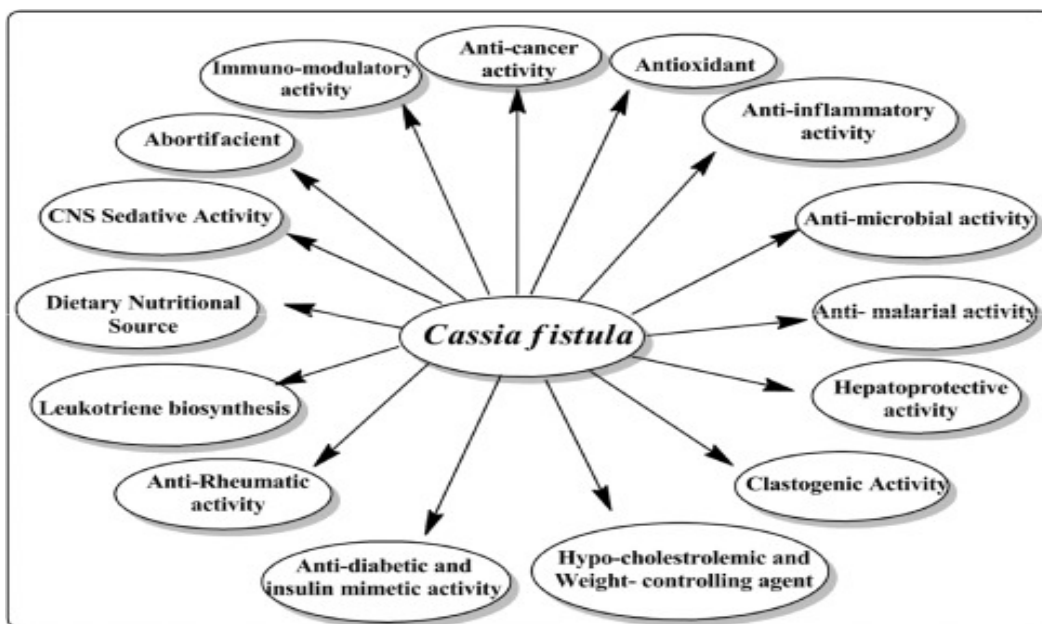


Fig no: 07 Uses of C. fistula (15)

Traditional uses :

The root of Cassia fistula is used as a tonic, astringent, fever reducer, and strong laxative. Extracts from the leaves have been shown to reduce mutations in E. coli bacteria. Root bark extract mixed with alcohol can be used for fever. The

leaves are laxative and can be used externally for various issues like chilblains, insect bites, swelling, rheumatism, and facial paralysis. They also have properties that help with jaundice, piles, ulcers, and skin conditions like eczema and ringworms. The roots are used for chest pain, joint pain, migraines, and dysentery. Root extract has been shown to lower blood sugar levels by up to 30%. Both leaves and flowers have laxative properties, like fruit pulp. Ashes from burnt pods mixed with a little salt can be taken with honey to relieve coughs. The root is useful for fever, heart problems, digestive issues, and bile disorders. The fruit can act as a laxative and is used for snake bites. Leaf juice is used for skin diseases, while the pulp is used for liver disorders. The plant is also used as a pain reliever, fever reducer, and treatment for malaria, blood poisoning, anthrax, dysentery, leprosy, diabetes, and abdominal obstruction.

The juice from Cassia fistula leaves can be used to treat ringworm, soothe irritation, and reduce swelling from fluid buildup. The pulp around the seeds acts as a mild laxative and is used for digestive issues like biliousness and diabetes. Externally, it can help with gas-related colic and joint pain from conditions like gout or rheumatism. Dried seeds have been shown to lower blood sugar levels, and seed powder is used for amoebiasis. The fruit pulp is used for constipation, colic, anemia, and urinary problems. The bark has tonic and anti-diarrheal properties and is used for skin issues, leprosy, jaundice, syphilis, and heart problems. The root bark extract has anti-inflammatory properties. The root is used for heart conditions, digestive issues, rheumatism, bleeding, wounds, ulcers, boils, and various skin problems.

Pharmacological activities

Different parts of the Cassia fistula plant have many medicinal benefits. It's been found to have effects like lowering blood sugar, acting as an antioxidant, and showing potential against tumors. It's important in traditional medicine for treating skin infections, inflammation, ulcers, rheumatism, jaundice, and loss of appetite. The root can act as a purgative, meaning it helps with bowel movements, and it's used for heart problems, fever, biliousness (a digestive disorder), nausea, and fluid retention.

Antibacterial Activity : This study looked at how lectins from Cassia fistula seeds can fight bacteria. They tested three types of lectins (CSL-1, CSL-2, CSL-3) against 14 different harmful bacteria. They found that CSL-3 was especially effective against many bacteria, including *Bacillus megaterium*, *streptococcus*, β -hemolyticus, and *Shigella boydii*. However, CSL-2 was found to be highly toxic to brine shrimps, even in small amounts. Another study in Iran looked at how methanolic and ethanolic extracts from Cassia fistula can fight bacteria. They tested these extracts against three types of Gram-positive bacteria and five types of Gram-negative bacteria. They found that the extracts were particularly effective against *E. coli* and *K. pneumoniae*. (16)

Antifungal Activity : A study examined the potential antifungal properties of Cassia fistula flowers. Tested against *Trichophyton mentagrophytes*, *Trichophyton simli*, *Trichophyton subrum*, and *Epidermophyton floccosum*, they employed an ethyl acetate extract. They discovered that the growth of these fungi might be inhibited by a substance named Rhein that was extracted from the flower. Rhein reported MIC values of 12.5 $\mu\text{g/ml}$, 62.5 $\mu\text{g/ml}$, and 31.25 $\mu\text{g/ml}$ for the various fungi. The amount required to stop the growth varied. (16)

Antibacterial And Antifungal Activities : Researchers tested Cassia fistula flowers to see if they could fight bacteria and fungi. They used different extracts and found that they worked against some bacteria and fungi. Among bacteria, they worked well against certain types (Gram-positive), but only against *Pseudomonas aeruginosa* among Gram-negative bacteria. Against fungi, they were effective against *Trichophyton mentagrophytes* and *Epidermophyton floccosum*. They discovered that a compound called 4-hydroxy benzoic acid hydrate, identified using X-ray crystallography, was responsible for this effect. (16)

Antipyretic Activity : This study looked at whether extracts from Cassia fistula pods could reduce fever in rats. They found that the extracts did indeed lower fever, and the effect was stronger than in rats not given the extracts. This might be because of substances like glycosides, amino acids, flavonoids, and steroids found in the extracts, either alone or working together.

Anti-Inflammatory Activity: This study checked if extracts from Cassia fistula pods could lower fever in rats. They discovered that the extracts did reduce fever, and the effect was stronger than in rats without the extracts. This could be because of substances like glycosides, amino acids, flavonoids, and steroids found in the extracts, either alone or working together. (16)

Analgesic Activity : This study tested whether a methanolic extract from Cassia fistula pods could reduce pain in rats and mice. They used methods like tail clip and hot plate to measure pain levels. The results showed that at

concentrations of 250 mg/kg and 500 mg/kg, the extract significantly reduced pain ($P < 0.01$). This suggests that the extract from Cassia fistula pods has potential as a pain reliever. (16)

Antidiabetic Activity : A study looked at whether extracts from the bark of Cassia fistula could help with diabetes. They tested ethyl acetate and alcoholic extracts on rats with diabetes caused by alloxan. The extracts effectively lowered blood sugar levels and improved lipid levels in the blood. When compared to a diabetes medication called glibenclamide, the ethyl acetate fraction was found to be more effective. This was likely because of the presence of flavonoids in the extract. (16)

Antiulcer Activity : A study looked at whether the ethanolic leaf extract (ELE) from Cassia fistula could help with gastric ulcers in rats. They induced gastric ulcers in different groups of rats and then gave them different doses of ELE (200, 500, and 750 mg/kg) along with Ranitidine (a medication used for ulcers). After 4 hours, they examined the gastric juice to see the pH, free acidity, gastric volume, and acidity. They found that the ELE helped protect the stomach lining, possibly due to its strong mucosal defense. (16)

Anticancer Activity: In this study, researchers tested methanolic extracts from Cassia fistula on human prostate cancer cells and found that they have anticancer properties. In the MTT assay, treating the cancer cells with 30 μ g of the extract resulted in only 5.06% cell viability. They identified linoleic acid and citronellal using GC-MS. They confirmed the anticancer activity using the acridine orange test. Overall, the treated cancer cells showed increased activity of caspase and fragmentation in genomic DNA, which are indicators of cell death. (16)

ADVERSE EFFECT :

Several studies have tested the safety of various plants using animal models. One important study compared the toxicity of an infusion made from Cassia fistula pods to a senokot tablet. They found that the infusion had very low toxicity, with an LD50 (lethal dose for 50% of the test population) of 6600 mg/kg. Additionally, there were no harmful effects observed in the organs when examined under a microscope. Another study looked at the acute toxicity of extracts from Terminalia indica and Cassia fistula and found no signs of toxicity at a dose of 2000 mg/p.o. (7)

MARKETED FORMULATIONS :

Ayurvedic Preparations

It is one of the ingredients, of the preparation known as Constivac (Lupin Herbal) a bowel regulator, relieves constipation. It is also one of the ingredients of the preparations known as Pilex, Purian (Himalaya Drug Company) for piles and detoxifier respectively. (17)

Cassia fistula pulp powder (bixa botanical)200gm (price :270/-)

Amaltas cassia fistula tablets dietary supplements (merlion naturals) 120tablets (Price : 249/-)

Cassia oil (sheer essence) 15ml (price: 200/-)

Cetragen ointment (dermatological)350ml (price : 120/-)

Cassia fistula (terravita) 100 capsules (Price : 24.87USD to Indian rupee 206161)

HOMEMADE PREPARATIONS :

Cassia oil for hair – Since this oil possesses astringent properties, it is useful for skin and hair. It **strengthens hair roots and promotes hair growth.**

Clear the air ways

Mehendi formulation

Cough syrup

IV. CONCLUSION

Before modern medicine became widespread, people relied mainly on herbal remedies to treat various illnesses. Even today, around 80% of people in rural areas of underdeveloped and developing countries still use medicinal plants and their products. Cassia fistula is one such plant used widely in India and other countries for its potential to heal wounds, act as an antioxidant, and protect the liver. Studies have shown that Cassia fistula has many medicinal properties, including anti-inflammatory, liver protection, cough suppression, antibacterial, and antifungal effects. It contains

important compounds like glycosides, tannins, and flavonoids, which are beneficial for health. While research has shown promising results, more studies are needed to fully understand the effectiveness of different extracts from *Cassia fistula*. This information can guide further exploration and discovery of new natural compounds for medicinal use.

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