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GOLDEN SHOWER TREE: EMERGING MEDICINAL PROPERTIES COMPOSED OF PHYTOCHEMISTRY

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Keywords:

Cassia fistula, Phytochemistry, Pharmacology, Anticancer, Antipyretic *etc*

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ABSTRACT: The motive behind this analysis is to grant a layout to the very familiar plant to everyone as the "Golden shower *Indian laburnum* " is affiliated with the Fabaceae family which is employed as a medicinal plant that possesses pharmacological activities in the healthcare system. Pharmacologically, it is very noteworthy in curing various infirmities and performs as an anti-inflammatory, carminative, analgesic, laxative, anti-bacterial, antifungal, anti-diabetic, antioxidant, hepatoprotective, antifertility, wound healing, antiulcer, anti-tumor, antifertility, antipyretic and anti-cancer, *etc*. Leaves, flowers, roots, fruit, wood, pulp, pods, seeds, trunk, *etc*., are different parts of *Cassia fistula* Linn. The plant has been approved for medications for Jaundice, Gout, Fatty Liver, Liver Disorder, Bronchitis, Fever, Skin disease, Migraine, Joint pain, Cancer, Tumour and so on. The *Cassia fistula* Linn. has also been suggested to possess, anti-diabetic, abortifacient, hepatomegaly, rheumatic disorder, pruritus, leprosy and diuretics. It also has blood purifier activity. *Cassia fistula* plants are found all over India. This plant's fruits, flowers, stem bark, and leaves contain a wide range of biologically active chemicals constituents including anthraquinones, flavonoids, flavon-3-ol derivatives, alkaloids, glycosides, lipids, tannin, saponin, terpenoids, reducing sugar and steroids, all of which have different therapeutic characteristics. Thanks to its pleasing and attractive yellow-colored flower it is employed as an ornamental tree. In light of the drug's medical relevance, the current research attempts to examine the literature on traditional usage, phytochemistry, and pharmacological qualities of several portions of the *Cassia fistula* plant. The main goal of this article is to highlight the most recent review of therapeutic activity against various diseases that have been scientifically proven.

INTRODUCTION: *Cassia fistula* Linn. also referred to as the golden shower tree (Bengali name: Sonali or Bandor lathi), belongs to the Caesalpiniaceae, is widely used for its medicinal properties, its main property is that of a light laxative suitable for youngsters and pregnant women. It's also purgative thanks to the wax aloin and a tonic [1] and has been reported to treat many other intestinal disorders like healing ulcers [2]. It is cultivated as a decorative tree for its appealing yellow blossoms in pendant racemes in lots of locations in India [3]. The tree infrequently grows in woodlands and along roadsides, but when it blooms, it is stunning [4].

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Many physiologically significant chemicals have been extracted and identified from various regions of plant [3, 5]. Antimicrobial, antifungal, antipyretic, analgesic, larvicidal, anti-inflammatory, antioxidant, anti-tumor, hepato-protective and hypoglycemic properties are some pharmacological

activities [6]. *Cassia fistula* is a blossoming plant belonging to the subfamily Caesalpiniaceae of the leguminous household (Fabaceae), commonly recognized as Amaltas. Out of the four hundred species, it comprises the genus Cassia [7-8]. According to the World Health Organization, more than 70% of the world's population must rely on traditional Medicine to meet their primary health needs. Traditional Medicine is used by 80% of the population in developing nations for fundamental medical problems [9, 10]. Plant drugs and herbal formulations are frequently considered less toxic and free from side effects than synthetic ones [11].

TABLE 1: *CASSIA FISTULA* ITS TAXONOMY & CLASSIFICATION

S. no.	Taxonomic Category	Scientific Name
1.	Kingdom	Plantae
2.	Subkingdom	Tracheobinota
3.	Super Division	Spermatophyta
4.	Division	Mangoliophyta
5.	Class	Magnoliopsida
6.	Sub Class	Rosidae
7.	Order	Fabales
8.	Family	Fabacae
9.	Genus	Cassia
10.	Species	fistula

TABLE 2: *CASSIA FISTULA* THE VERNACULAR NAME WITH ITS STATE ORIGIN

S. no.	State / Language name	Vernacular Name
1.	Telagu	Kondrakayi, Raelachettu, Aragvadhamu, Koelapenna
2.	Arab	Khayarsambhar
3.	Oriya	Sunaari
4.	Punjab	Amaltaas, Kaniyaar, Girdnalee
5.	Bengali	Bundaralati, Sonalu, Soondali, Sondal
6.	English	Indian Laburnum, Purging, Cassia fistula, Golden Shower.
7.	Gujarati	Garmala
8.	Hindi	Sonhali, Amultus
9.	Kannad	Kakkemara
10.	Marathi	Bahava
11.	Tamil	Shrakkonnai, Konai, Irjviruttam [7, 13, 14]
12.	Malayalam	Konna [15]

Distribution: Usually referred to as Golden Shower (English), Amaltas (Hindi), purging cassia, *India laburnum*, and pudding pipe tree are some of the common names for *Cassia fistula* L. (family Leguminosae) (English). It's a type of evanescent tree. Thanks to its lovely yellow-colored blossoms, it is utilized as an ornamental tree [13]. The tree is one of the foremost widespread within the forest in India, usually occurring in deciduous forests throughout the more significant part of India, ascending to an altitude of 1,220 m within the sub-Himalayan tract and, therefore, the outer Himalayas. It's common throughout the Gangetic valley, particularly abundant in Central India and South India [16]. The tree is found all over India [17, 18, 3, 19, 20 21, 22].

It can be found throughout the Himalayas, from Punjab to Sri Lanka 21 and central and eastern Himalayas [23]. In Maharashtra, it is scattered throughout Deccan and Konkan [24]. It's cultivated as a decorative throughout India [25]. It's also distributed in several parts of the planet like Asia, Brazil, Mexico, East Africa, South Africa [26, 22], Burma [21] and the West Indies [27, 28].

Botanical Description: It's a deciduous tree with greenish-grey bark, compound leaves, and 5-12 cm long leaflets in pairs. A semi-wild tree with lovely bunches is also used in traditional Medicine for various ailments [29]. Its leaves are paripinnate with 4-8 pairs of leaflets, up to 5.1 to 12.2 cm long, coriaceous while fresh and papery when dried. Underneath the midrib was highly pubescent.

In axillary loose pendulous racemes, Aragvadha flowers are bright yellow [06]. *C. fistula* Linn is a 6-9m tall tree. The trunk is straight, and the bark is smooth. When the trunk is young, the bark is pale grey, but it turns dark brown as it ages. The leaves are 23-40cm long, and the branches are slender and dispersed.

The flowers are lax racemes 30-50 cm long, with pedicels 38-5.7 cm long, slender, "glabrous or pubescent, the calyx is 1 cm long, divided to the base, pubescent, segment oblong and obtuse," and pedicels 38-5.7 cm long, slender, "glabrous or pubescent, the calyx is 1 cm long, divided to the base, pubescent, segment oblong. The yellow corolla is 3.8cm wide [29]. It can grow on poor, shallow soil, also as on trap, granite, and stone soil nearly everywhere over the globe [30]. The pulp features a sweetish taste ; therefore, the number of seeds is 25- 100 in each pod. The stem is smooth and greenish to pale grey in colour when young, but older stems are dark brown to grayish-white with a rough surface.

The basis is reddish-brown and rough externally with numerous horizontal lenticels [31]. The pulp is employed as a drug [32].

Synergistic Effect: The plant's *Solanum xanthocarpum* and *Cassia fistula* have a synergistic relationship [33]. They have anti-inflammatory properties even at relatively low doses of drugs. Cassia fistula, also known as Amoxy-cassia, was traditionally used to boost the host's immune [34]. Fluconazole and *Cassia fistula* has a synergistic effect [35].

Ethnobotanical Description:

Tree: *Cassia fistula* L. is a medium-sized, erect tree that is glabrous throughout [23]. The tree is 6-9 m [18] tall, with a girth of 0.9-1.2 m [3]. The tree is deciduous, can be found in forests on rare occasions, and is commonly planted along roadsides [4].

Trunk: When young, the trunk is straight, rigid, smooth, and pale grey; as it ages, it becomes rough and dark brown [18]. It is made up of a hard reddish hefty wood [22].

The drug is found in thick flat, or curved pieces with a smooth to the rough exterior surface with warty patches; greenish-grey to red; inner surface rough, reddish with parallel striations; fracture, laminate; odor, sweet and distinctive; taste, astringent [36].

Bark: When young, the tree's bark is smooth greenish-grey, but as it ages, it becomes rough, flaking in hard scales [17] and dark brown [37].

Leaves: Leaves are 20-40 cm long [37], with a pubescent primary rhachis and stipules that are minute, linear-oblong, obtuse, and pubescent [18], 4- to 8-paired [37] and consisting of big leaflets [38].

Pulp: The pulp is either black [3, 21] or a dark-colored sweetish tint [17, 18].

Seeds: The seeds are small, smooth, yellowish-grey [3] and roughly ovoid, horizontally embedded in a black sweetish flesh [17]. Seeds are around 8 mm long, somewhat less wide and 5 mm thick [18].

Habitat: Plants can endure precipitation of up to 480-2720 mm and temperatures of 18—28.5 °C at a pH of 5.5-8.7. It can withstand periods of drought.

Flower: The flower is golden yellow, racemes pendulous, glamorous (smooth), adolescent and 4-7 in diameter. The calyx is long (it is split into the base), with blooming and oblong segments. Yellow is the colour of the corolla (petals).

Root: The root is a brownish-red colour. It is rough on the outside and contains lenticels in a horizontal pattern. The outer bark can be readily rubbed away to reveal the lighter pink inner bark. Porosity, which is uneven and yellow, is a property of the wood.

Stem: The external layer of the stem is compact with 0.2-inch thickness, smooth, greenish to pale grey wood displays porosity, and is off-white in colour in the early stage.

Wood: Three types of wood can be discussed. Sapwood, heartwood, and lumber are the three types of wood. Timber is lustrous, robust, brittle, and small in size and is employed in agricultural equipment and cart construction. It can divide.

Heartwood can range in color from yellowish red to brick red to brownish red, with darker streaks. Annual rings have a distinct appearance. Sapwood is a light, dirty white color [21, 39].

Fruit: It's a leguminous plant with a strong odor and numerous seeds embedded in it. It starts as a green pod that turns black as it ripens. The ripening of pods occurs as flowers shed.

The hue of the mucilaginous pulp is dark brown. The hue ranges from grey to crimson, with reddish markings and a distinct flavor. The pods are long and slender. The pods are separated into parts on the inside. One seed is contained in each segment. Each seed is immersed in delicious black pulp transversally. The embryos are oval, large and thick, yellow-colored embryos and are lodged in the white endosperm [39]. 5 [37], subequal, veined, obovate, short-clawed [18, 21] and 3/4-1 inch deep petals [23]. The corolla measures about 3.8 cm in diameter [37, 18]. The calyx is glabrous, caduceus [23], hairy and divided at the base, with oblong and obtuse segments [18].

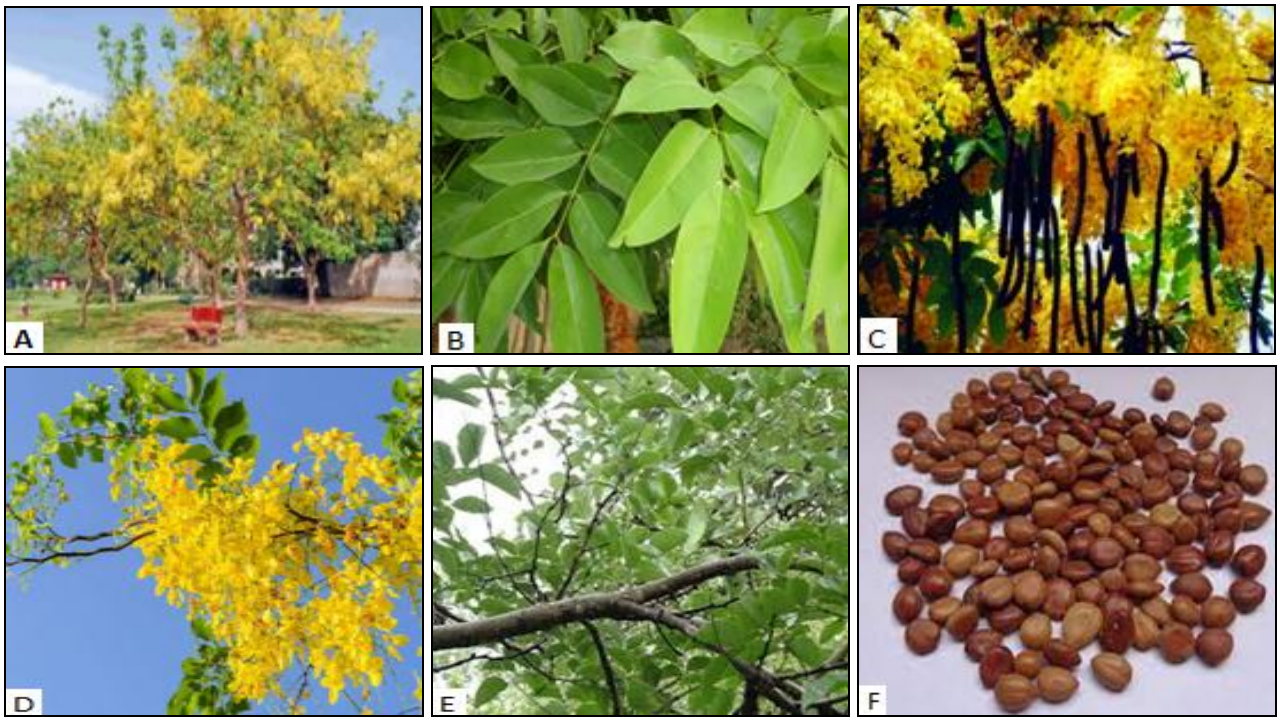

FIG. 1: THE PICTURE DEPICTS THE PLANT, ITS PARTS - (A) WHOLE PLANT (B) LEAF (C) FRUIT (D) FLOWER (E) STEM (F) SEEDS

Phytochemistry: Various researchers have looked into the following chemical compounds in *Cassia fistula*.

Whole Plant: It contains Citronellol, linolic acid, anthraquinone, alloin wax, phenolic compounds, free sugar, galactomannan, free amino acids, saponin, gum cardiac glycosides, alkaloids, glycosides, kaempferol, emodin II, iron, calcium, phosphate, resins, tannins, steroids, terpenoids, rhein, sennoside A and B1 Flavan 3-ol derivatives [40, 41]. Root: The root has been analyzed to have rhonthocyanadin. Flavan 3-ol derivatives, flavonoids, 7-methylphysicon, betulinic acid, Bsitosterol, rhamnetein, 3-Ogentiobioside. Root bark contains phlobaphenes and oxyanthroquinone [42, 43].

Seeds: Seeds broadly ovate, 8mm. long, slightly less in width, and 5mm thick [7] S Verma. Pharmacological review on golden shower tree Linn (AMALTAS). Galactomannan, amino acid-free sugar [7], iron, anthroquinon, gum, alkaloids, glucosoidssaponins, phosphate, sodium, Resin [45], terpeoids, dianthroquinone, sennoside A, Sennoside B, fistulic acid, ceryl, alcohol, kaempferol, bianthroquinone, tannins, fatty acids isoflavonoids, flavonoids, glycosides, anthraquinones, steroids, terpnoidsand phenolic compounds, glycerides with linoleic, oleic, stearic and hexadecanoic acid, globulin, albumin, cephalin, lecithin, phospholipids, carbohydrates, lecitins are sugar-binding proteins that agglutinate cells, proteins [47], proanthrocyanadins, Terpenoids, and steroids, with typical sterols such asstigmasterol, β-sitosterol, campesterol, fucosterol, lathosterol and ergosta-4,22- dien-3-one. Other typical compounds were 5-(4,8-dimethylnonyl)-5-methyldihydro-2 (3H)- furanone, tetramethyl-hexadeca-1,6,10,14-tetraen-3-ol, 3-(6-hydroxy-3,7-dimethyl-octa-2,7-dienyl)-4-methoxy-phenol and 2,5-furandione,3-dodecenyl, which were present within the seed oil [7, 42, 48, 49, 50]. The seed oil contains fcyclopropenoidd fatty acids, vernolic, malvalic and stetculic acids [3]. Seeds are rich in glycerides with linoleic, oleic, stearic, and palmitic acids as major fatty acids alongside minor traces of caprylic and myristic acids and carbohydrates like galactomannan [51] crysophanol, chrysophanein, oxyanthroquinone [51, 14]. Seeds broadly ovate [52]. Seeds contain Napins (protein) that have antifungal activity [53].

Bark: Two flavonol glycosides, 5, 7, 3', 4'-tetrahydroxy-6, 8- dimethoxyflavone-3-O-α arbinopyranoside, 5, 7, 4'- trihydroxy-6,8,3'-trimethoxyflavone-3-O-α-L-rhamnosyl (1→2)-O-β-D-glucopyranoside and a xanthone glycoside,

Flavanoids, hexacosanol, B–sitosterol, lupeol, L1(Hexane), L2($CHCL_3$), L_3CHCL_3, L4, tannins contain phlobaphenes, oxyanthraquinone, 1,8-dihydroxy-3, 7- dimethoxyxanthone-4-O- α-L-rhamnosyl (1→2)-O-β-Dglucopyranoside phenolic compounds, flavonoids, proanthocyanidin [13, 43]. Twenty-seven compounds including eight long-chain hydrocarbons, 1-hexacosanol, 1-octacosanol, hexadecanoic acid, octadecanoic acid, monounsaturated fatty acid, linolic acid, heptacosyleicosanate, glyceryl-1- tetraeicosanoate; three sterols, β-sitosterol, stigmasterol, β-sitosteryl-3-O-Dglucopyranoside, one triterpene, lupeol, eight anthraquinones, chrysophanol, emodin, physcion, citreorosein, rhein, rhein methyl ester, ziganein, 1,4,5- trihydroxyanthraquinone, two coumarins, isoscopoletin, scopoletin, three aromatic compounds, isovanillic acid, vanillic acid, and 2,4-dihydroxybenzaldehyde and two chromones, 2,5-dimethyl-7-hydroxychromone, 2,5-dimethyl-7-methoxychromone, isolated and identified from the bark [54].

Flower Pollens: Carbohydrate, lipid, and free amino acid, as well as phenylalanine, methionine, glutamic acid and proline, were found [54]. Fistucacidin (3, 4, 7, 8, 4'-pentahydroxyflavan), an optically inactive leucoanthocyanidin, was initially isolated from the heartwood [54].

Arial Part: Twenty-seven compounds including eight long-chain hydrocarbons, 1-hexacosanol, 1-octacosanol, hexadecanoic acid, octadecanoic acid, monounsaturated fatty acid, linolic acid, heptacosyleicosanate, glyceryl-1-tetraeicosanoate; three sterols, beta-sitosterol, stigmasterol, beta-sitosterol-3-O-Dglucopyranoside; one triterpene, lupeol; eight anthraquinones, chrysophanol, emodin, physcion, citreorosein, rhein, rhein methyl ester, ziganein, 1,4,5- trihydroxyanthraquinone; two coumarins, isoscopoletin, scopoletin; two chromones, 2,5-dimethyl-7- hydroxychromone, 2,5-dimethyl-7-methoxychromone; three aromatic compounds, isovanillic acid, vanillic acid and a couple of,4-dihydroxybenzaldehyde were isolated and identified from the Arial parts of *Cassia fistula* [42].

Leaves: Leaves 20-40 cm, rachis and petiole glandles, 4-8 pairs, distinctly stalked, 5-15 cm long, ovlong or ovate, clothed with young, caduceus, silvery pubescence [55]. Leaves contain isoniazid, rifampicin flavonoids, steroids, triterpenoids, anthraquinone, rhein volatile oils both in aglycone and glycoside forms like rhein, sennosides, chrysophanic, aloe-emodin and sennosides, (-)-epiafzelechin 3-O-B-D glucopyranoside bioflavonoids and twotriflavonoids alongside (-)-epiafzelechin, (-)- epicatechin and procyanidin B-2 from the leaves, L1(Hexane), L2($CHCL_3$), L_3CHCL_3, L4, sennoside A and B [8, 56, 43, 57, 58] . The leaf oil consists of only seven components identified as eugenol, (E)-phytol, camphor, limonene, salicylic alcohol (linalool and 4- hydroxy benzyl alcohol. Four new compounds as 5-(2-hydroxy phenoxy methyl) furfural, (2‘S)-7-hydroxy-5- hydroxymethyl-2-(2‘-hydroxypropyl) chromone, benzyl 2- hydroxy-3,6-dimethoxybenzoate and benzyl 2β- O-glucopyranose - 3, 6 – dimethoxy - benzoate, alalongsideour known compounds, 5-hydroxymethylfurfural, (2‘S)-7- hydroxy-2-(2’-hydroxypropyl)-5-methylchromone are present [14]. The leaves contain anthraquinone glycosides [59].

Flower: Flowers contain ceryl alcohol, kaempferol, rhein, and a bianthraquinone glycoside and fistula, and also leucopelargonidin tetramer having a free glycol unit [60]. Anthroquinone, oxyanthroquinone, rhein, essential oil, tannins, isoflavanoids, glycosoids, phenolic compounds, potassium, calcium, iron, and manganese. Proanthocyanadins, catechins tannins, fistulic acids, anthrones, senosides, alkaloids, Aurantiamide acetate, Bsitosterol, BD Glucoside and triterpenes [42, 56 , 43, 47, 61, 62].

Pods: The pods contain procyanidin B-2, epicatechin-(4 β→ 8)-ent-epicatechin, epiafzelechin-(4β→8)-epiafzelechin, epiafzelechin-(4β→8)-ent-epiafzelechin, epicatechin-(4β→8)-epiafzelechin and epicatechin-(4 β→ 8)-ent-epiafzelechin and their enantiomers [63]. The crushed ripe pod pulp is rich in protein (19.94 %) and carbohydrates (26.3%) [60]. The finely powdered fruit (pod) gives a dark yellow essential oil with a honey-like odor on steam distillation. Water that distills over with the oil contains normal butyric acid [19].

Pulp: Arginine, leucine, methionine, phenylalanine, tryptophan, aspartic and glutamic

acids are isolated from fruit pulp. a replacement dimericproanthocyanidin CFI was isolated alongside (-) epiafzelechin, (+) catechin, kaempferol, dihydrokaempferol and 1,8-dihydroxy-3- methylanthraquinone [64]. The crushed ripe pod pulp is rich in protein (19.94 %) and carbohydrates (26.3%). They contain sennosides A and B, rhein and its glucoside, barbaloin, aloin, acid, butanoic acid, their ethyl esters, and oxalic acids [60]. Sugar, gum astringent matter, gluten, coloring matter and water also are found in pulp [19]. Resins, volatile oil, etc. are extracted from the pulp [65].

Fruit Extracts: Phytochemicals present are rhein, 5, 3, 4-trihydroxy 6 methoxy-7-O-alpha-L-rhamnopyranosy-(12)-O-beta–Dgalactopyranosoid [43]. Four new compounds, 5-(2-hydroxy phenoxymethyl) furfural, (2′S)-7-hydroxy-5-hydroxy methyl – 2 - (2′-hydroxypropyl) chromone, benzyl – 2 – hydroxyl 3, 6-dimethoxy-benzoate, alongside four other compounds two oxy anthraquinone, 5-hydroxy methylfurfural, (2S)7-hydroxy-2-(2-hydroxy propyl)-5- methyl chromone, steroid, aminoalkanoic acid, flavanoids, aspartic acid, glutaminic acid, lysine [45]. A polar compound including, triacontane, 16-hentriacontanol, sitosterol 5- nonatetracontanone, 2-hentriacontanone alongside oil (probably an isoprenoid unit), tetramer, alloin, leuco-ppelargonidin tonic [66, 52].

TABLE 3: THE DETAIL STUDY OF PLANT WITH ITS CHEMICAL CONSTITUENTS AND PHARMACOLOGICAL ACTIVITY

S. no.	Part of Plant	Chemical Constituents	Extract Chemical	Pharmacological Activity
1	Root	Betulinic Acid	Dichloromethane, chloroform, ethanol, or methanol [118 , 119, 120]	Human immunodeficiency virus (HIV) [121], [122], anti-bacterial [122,123], anti-malarial [124], anti-inflammatory [125, 126, 127, 128] anthelmintic [129], antinociceptive [130], anti-HSV-1 [131, 132] and anticancer activities [133, 134, 135, 136]
2	Root	β-sitosterol	Methanol [137]	antioxidant, anti-malaria, anti-bacterial and anti-inflammatory [138]
3	Flower	Anthraquinone	Water, 20% ethanol (aq), 40% ethanol(aq), 60% ethanol (aq), 70% ethanol (aq), 80% ethanol (aq), ethanol, 70% methanol (aq), methanol, 70% acetone (aq), acetone and dichloromethane [139]	Antibacterial [140, 141], antiviral [141,142], antifungal [141], anticancer [143] and estrogenic [141]
4	Seed	Galactomannans	Ethanol [144]	Antiviral Activity, Antimicrobial Activity, Anticoagulant, and Fibrinolytic Activities, Chemopreventive Activity, Anticancer Activity, Antioxidant Activity, Analgesia and Chondroprotection Activities, Immunomodulatory Activity, Antileishmanial Activity [145]
5	Seeds	Terpenoids	Hexane [146]	anti-tumor, anti-inflammatory, anti-bacterial, antiviral, antimalarial, promoting transdermal absorption, preventing and treating cardiovascular diseases, lowering blood sugar, insecticidal, immunomodulatory, antioxidant, antiaging, and neuroprotective effects [147]
6	Flower pollen	Phenylalanine	Ethanol [148]	anti-microbial, anti-inflammatory and diuretic action [149]
7	Arial part	Palmitic acid	Ethanol [150]	stomach distress, ulcer, pain, fever, respiratory problems, cough, and asthma [151, 152]
8	Arial part	Lupeol	n-hexane [153]	anti-inflammatory, anti-microbial, anti-protozoal, antiproliferative, anti-invasive, anti-angiogenic, and cholesterol-lowering agent, wound healing, diabetes, cardiovascular disease, kidney disease, and arthritis [154]
9	Arial part	Triterpene	Ethanol [155]	anti-angiogenic, antipruritic, antiallergic, anti-tumor, antiviral, anti-microbial, antioxidant, and spasmolytic activities [156, 157,158,159]
10	Leaves	Isoniazid	Ethanol [160]	anesthetics, anticancer, antibiotics, antituberculosis, antiretroviral drugs and heart medications [161]

Uses:

Effect on Central Nervous System and Eyes: Internally, it are often wont to relieve headaches and migraines [67]. It's utilized in ophthalmic and skin diseases [67, 68].

Effect on the Respiratory System and Ear, Nose, and Throat: When used with kishneez, it helps cure diphtheria due to its mushil (purgative) action [67]. Gargling with the pulp of amaltas with coriander and luabeasapghol is effective in diphtheria, pharyngitis and tonsillitis [67, 69]. The paste of the basis of amaltas with rice water is employed externally in mumps. The decoction of leaves of amaltas is poured into the ear just in case of otalgia and gonorrhoea [67]. When it's used with turbid it helps to expel the balgham [69]. It's utilized in the shape of gulqand in dry cough [67, 69].

Effect on the Cardiovascular System: The roasted leaves or pulp of amaltas are used with rice to treat palpitation [67, 68, 70]. The pulp cooked in milk is employed to treat anaemia and palpitation [67, 70].

Effect on the Gastrointestinal Tract: It relieves ileus when used with bihidana, isapghol, reshaekhitmi and roghanebadam [67]. It helps to cure obstruction within the liver and jaundice when used with kasni, tukhmekathoos and mako. It's useful in colitis [67, 71]. The flowers of amaltas have laxative action and help to alleviate constipation [2, 71]. The inhalation of flowers of amaltas also features a laxative effect [67]. Amaltas is often utilized in the shape of a suppository to alleviate constipation [72]. It helps to cure ileus and liver obstruction [67]. It relieves constipation thanks to its laxative action [67, 68].

Effect on the Urogenital System and Excretion: Post amaltas is beneficial in ihtibas al-tamth and usr-i-tamth within the sort of joshanda either separately or with other medicines, because it possesses mudirr-i-haydproperty [73]. It's useful in 'user al-wilada (dystocia) because it helps within the easy delivery of the baby and placenta [67, 73]. Ten grams of joshandae postamaltas is employed for induction of labor because it eases dystocia and placental expulsion [67, 73]. The decoction of the flower of amaltas is employed to treat hysteria [70]. Post amaltashelp to eliminate all the three senses of humor [68, 72, 74], when it's used with imply it helps to eliminate excessive safra from the body, alongside turbud it eliminates balghamikhilt [72]. When it's used with bisfaij it eliminates abnormal sawda from the body [74]. Effect on the locomotor system*:* Owing to its muhallil-iawram property the leaves of amaltas are utilized in the shape of a paste in gout, joint pains, and hard swellings. It's wont to cure inflammation of joints and internal organs because it has anti-inflammatory properties [72].

Effect on the Integument: The root and paste of pulp of amaltas are beneficial in skin diseases like leprosy [67, 29]. The juice of leaves is beneficial in erysipelas [29]. The syphilitic ulcers are cured when it's washed with a decoction of amaltas leaves [67].

Effect on the Fever: The pulp and seeds of amaltaspossess the antipyretic action [67, 68].

Muzir: Mida; Anth; [67] Musqit [75]

Musleh: Roghanmastagi; Roghanbadam [67, 72]

Badall: Turbud [67]

Miqdar: Post amaltas-6-12 gms [75]

Murakabat: Itrifalmuqilmullaiyan [76] Lauqekhiyarsambhar [73] Matbookhmudirr-i-hayd [75].

Herbal Medicine Uses: There are many Cassia species worldwide that are utilized in herbal medicine systems. These particular families of plants are used widely for their laxative actions. The golden shower tree is not an exception. It's often used as a highly effective moderate laxative that's safe even for youngsters. However, the leaves and bark can cause vomiting, nausea, abdominal pain, and cramps in large doses. Golden shower tree is additionally 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, and laxative properties, while the basis is employed for adenopathy, burning

sensations, leprosy, skin diseases, syphilis, and tubercular glands. The leaves are employed there for erysipelas, malaria, rheumatism, and ulcers. In Brazilian herbal Medicine, the seeds are used as a laxative ; therefore, the leaves and/or bark are used for pain and inflammation [77].

Ayurvedic Medicine Uses: Golden Shower Tree is understood as a "disease killer" in Ayurvedic Medicine. Its fruit pulp is employed as a light laxative and also as cardiac conditions and stomach problems like acid reflux. Flowers are used for fever, and roots as a diuretic. The bark and leaves are used for skin diseases. The seeds are recognized as antibilious, aperitif, carminative, and laxative, while the basis is employed for curing adenopathy, burning sensations, leprosy, skin diseases, syphilis, and tubercular glands. The leaves of the tree are used for erysipelas, malaria, rheumatism, and ulcers, the buds are used for biliousness, constipation, fever, leprosy, and disease of the skin, and therefore the fruit for abdominal pain, constipation, fever, heart condition and leprosy. Thus every part of this plant is recognized for its medicinal properties [72]. Aragvadha is employed in Ayurveda remedies for flatulence, anti-inflammatory, abdominal distension, hepatobiliary disorder, constipation, skin diseases, and intermittent fever, especially for malaria and worm infestation [78]. Traditionally, golden shower tree L is taken in many forms, like Aragvadhadikvatha, Aragvadhadi Leha, Aragvadharishta and Mahamarichyaditaila. The plant is being considered a firewood source in Mexico. The reddish wood, hard and heavy, strong and sturdy, is fitted to cabinetwork and farm implements. The bark has been employed in tanning, often in conjunction with avaram. The drug "Cassia fistula", a light laxative, is obtained from the sweetish pulp around the seed [72].

Pharmacological Studies:

1. Anti-bacterial Activity: The ethanolic and methanolic extracts of the golden shower tree exhibited anti-bacterial activity against three gram-positive species including *S. aureus, S. epidermidis* and *B. cereus* and two Gram-negative bacterias including *E. coli* and *K. pneumonia* [26]. Anti-bacterial activity of golden shower tree (in Khuzestan, Iran) by using its methanolic and ethanolic extract against three Gram +ve bacteria and five Gram -ve bacteria by Disc diffusion method. *E. coli* and *K. pneumonia* were much suffering from extracts. Tube dilution assay was used to determine minimum inhibitory concentration (MIC) and Minimum bactericidal concentration (MBC). Overall results confirmed the presence of an anti-bacterial agent in *Cassia fistula* [80].

2. Antifungal Activity: 4-hydroxy carboxylic acid hydrate obtained from the extracts of the flower of the golden shower tree (an ethnomedicinal plant) showed antifungal activity against *Richophyton mentagrophytes* (MIC 0.5 mg/ml) and *Epidermophyton floccosum* (MIC 0.5 mg/ml) 10(81). Golden shower tree showed anticandidal activity against three Candida organisms' namely *C. albicans*, *C. glabrata* and *C. tropical* is. The fruit pulp and seed extracts were compared. It had been concluded that the crude extract features a promising source of anticandidal compounds. The anthraquinone and rein actively present in both extracts may possess anticandidal properties [82]. Golden shower tree leaves were investigated for antifungal activity by using crude methanolic extract against some pathogenic fungi. Results declared extract with IC_{50} of 0.9 mg/ml that proved golden shower tree potentially strong inhibitor against *Penicillium marneffei* fungi [83].

3. Antipyretic Activity: In an experimental study , methanolic extract of powdered pods of golden shower tree contains a marked antipyretic effect in yeast-induced pyrexia in rats. Methanolic extract at 500 mg/kg showed an equivalent effect as paracetamol at a dose of 20 mg/kg i.p [84]. The extract caused a far better hypothermal activity against yeast-induced pyrexia in rats. Injection of yeast induces pyrexia by increasing prostaglandin synthesis and is employed to screen [85].

4. Anti-inflammatory Activity: The methanolic extract of fruit inhibits the 5-Lipooxygenase mediated peroxidation of arachidonic acid-free radical-induced lipid peroxidation and hence inhibited leukotrienes biosynthesis which inhibits prostaglandin synthesis by inhibiting inflammatory mediators [21, 86]. The anti-inflammatory activities of the aqueous (CFA) and methanolic extracts (CFM) of the golden shower tree bark were assayed in Wistar albino rats. The extracts were found to

possess a big anti-inflammatory effect in both acute and chronic models [87].

5. Analgesic Activity: The analgesic activity of golden shower tree methanol extract was studied by thermal, mechanical, and writhing methods. As compared to the potent inhibitory activity of morphine and aspirin, the analgesic activity of the extract was moderate against acute inflammatory pain. The findings validate the therapeutic use of this drug in analgesia [88].

6. Hypolipidemic Activity: The effect of 50% ethanolic extract of golden shower tree legume on serum lipid metabolism in cholesterol-fed rats. Administration of *C. fistula* legume extract at the doses of 100, 250 and 500 mg/kg b.wt./day alongside cholesterol significantly prevented the increase in the serum total and LDL-cholesterol, triglycerides and phospholipid during a dose-dependent manner [89].

7. Antiplasmodial Activity: Antiplasmodial activity of *Cassia fistula* using crude extract of leaf, fruit and bark was studied in *Plasmodium falciparum* (DIO). Leaf extract of *Cassia fistula* was concluded to havethe highest activity against chloroquine-sensitivestrains [90].

8. Antiparasitic Activity: The ant parasitic activity of biochanin A, an isolated isoflavone from the dichloromethane extract of golden shower tree fruits. This compound showed a 50% effective concentration (EC_{50}) value of 18.96 micron/mL against promastigotes of Leishmania (L.) chagasi results contribute to novel antiprotozoal compounds for future drug design studies [91].

9. Anti-diabetic Activity: The anti-diabetic potential of the entire alcoholic extract & its ester fraction of the bark of the golden shower tree was studied in alloxan-induced diabetic rats. The ester fraction significantly reduced blood sugar levels more than alcoholic extract. The activity was found to be comparable to standard drug glibenclamide [92]. The mechanism of hypoglycemic and anti-diabetic action of hydroalcoholic extract of golden shower tree Linn in rats was reported [93]. The ethanolic extract of golden shower tree Linn Stem bark was investigated for its antihyperglycemic activity [94].

Aqueous extract of golden shower tree (Linn.) flowers (ACF) was screened for its antioxidant effect in alloxan-induced diabetic rats. The seeds of the golden shower tree were investigated for or her hypoglycemic activity. They were found to possess marked hypoglycemic activity on normal albino rats but not on alloxan-produced diabetic albino rats [95, 96].

10. Immunomodulatory Activity: In a study, the golden shower tree extract showed significant stimulation of cell-mediated immunity and no effect on humoral immunity. Golden shower tree was administered orally at doses of 100 and 200 mg/kg to healthy rats divided into five groups six in each. The assessment of immunomodulatory activity was administered by testing the humoral (antibody titer) and cellular (footpad swelling) immune, responses to antigenic challenges by sheep RBCs and by neutrophil adhesion test. Golden shower tree significantly potentiated the cellular immunity by facilitating the footpad thickness responses to the sheep RBCs in sensitized rats with a dose of 100 and 200mg/ kg of the DTH response [97].

11. Antifertility Activity: Golden shower tree reversibly suppresses fertility in male rats. Withdrawal of extract restored all the altered parameters, including organ weights, fertility, circulatory level of hormones and tissue biochemistry, to regulate levels after 120 days [98]. Oral administration of aqueous extract of seeds of golden shower tree to mated female rats from day 1- 5 of pregnancy at the doses of 100 and 200 mg/kg weight resulted in 57.14% and 71.43% prevention of pregnancy, respectively, whereas 100% pregnancy inhibition was noted at 500 mg/kg BW [99].

12. As Laxative: A study determined the entire anthraquinone glycoside content in leaves of golden shower tree which is the active laxative form. The content of total anthraquinone glycosides within the decoction leaf extracts was 0.62- 2.01% dry weight (average 1.52% dry weight), while within the dried leaves was 0.09-o.63% w/w (average 0.36% w/w) calculated as rein. The decoction extract of the leaves containing average total anthraquinone glycosides is

often used as an alternate source of a staple for various laxative preparations [59].

13. Anticandidal Activity: Anticandidal activity was analyzed by using seed extract of golden shower tree against *Candida albicans* through time-kill assays followed by SEM and TEM observation. The expansion of *C. albicans* was completely inhibited within the time-kill assay by seed extract of *C. fistula* at 6.25 mg/ml. Sc extracts treated C. albicans showed a good change within the outer cell membrane and cytoplasmic contents compared to regulating. Yeast growth was also inhibited in vitro that showed antifungal activity of extracts. The antifungal activity showed 6-fold decreased Candidiasis in 2.5 g/kg extract-treated animals [46].

14. Antileishmanial Activity: A study was designed to gauge the antileishmanial the activity of crude extract and fractions from the fruits of *Cassia fistula*. Hexane extract from the fruits showed significant antileishmanial activity against the promastigote sort of Leishmania *L. chagasi* [98].

15. Antiulcer Activity: The golden shower tree Linn's ethanol leaf extract was evaluated for antiulcer activity against pylorus ligation-induced gastric ulcers. Four hours after pyloric ligation, the digestive juice was collected for evaluation of varied parameters results were found that the extract exhibits significant antiulcer activity [99, 100].

16. Larvicidal and Ovicidal Activity: Ovicidal and Larvicidal activity of leaf of golden shower tree decided by using its methanolic extracts which were lethal to larvae of *Culexquin quefasciatus* and Anopheles Stephens with LC_{50} values of 17.97 and 20.57 mg/l respectively. An egg raft of quinquefasciatus showed great hatchability after 120 of treatment which confirmed extracts as Ovicidal and Larvicidal activity (101).

17. Antiestrogenic Activity: Ovariectomized female rats were used for investigated the antiestrogenic activity of the golden shower trees using petroleum ether extract of seeds on their uterine histoarchitecture [41].

18. Antioxidant Activity: Antioxidant activities of the golden shower tree's aqueous (CFA) and methanolic extracts (CFM). Both extracts exhibited significant antioxidant activity in DPPH, gas, and Hydroxyl radical-induced *in-vitro* assay methods. Both extracts showed Dose-Dependent protective effect against lipid peroxidation and radical generation in liver and kidney homogenates [102,103]. The antioxidant properties of 90% ethanol extracts of leaves and 90% methanol extracts of stem bark, pulp, and flowers from golden shower trees. The antioxidant activity power was within the decreasing order of stem bark, leaves, flowers, and pulp and correlated well with the entire polyphenolic content of the extracts. Thus, the stem bark had more antioxidant activity [104].

19. Hepatoprotective Activity: The hepato-protective activity of the n-heptane extract of golden shower tree leaf in rats. Hepatotoxicity inducing was with carbon tetrachloride: liquid paraffin mixture (1:1). The extract has been shown to possess a big protective effect by lowering the serum levels of transaminases (SGOT and SGPT), bilirubin, and alkaline phosphatase (ALP) at a dose of 400 mg/kg which was like that of a typical hepatoprotective agent [105].

20. Anti-tumor Activity: Effects of methanolic extract (ME) of golden shower tree seed on the expansion of *Ehrlich ascites* carcinoma (EAC) and therefore the lifetime of tumor-bearing mice were studied. ME treatment showed a rise in a lifetime, and a decrease in the tumor volume and viable tumor cell count within the EAC tumorhosts [106].

21. Anticancer Activity: Golden shower tree pulp and seed extracts contained anti-cancer compounds and inhibited the proliferation of cervical and carcinoma cells by inducing apoptosis. MTT and LDH assays confirmed the cytotoxic activity whereas inhibition of colony formation proved the expansion inhibitory effect of *C. fistula* pulp and seeds. Modulation of apoptosis regulatory genes, caspase enzyme activity and fragmentation of genomic DNA is suggesting the pulp and seed extracts induced apoptosis and may be successfully exploited within the herbal formulation of cancer chemoprevention and chemotherapy [107].

22. Wound Healing Activity: Infection is the major problem to treat the wound.

Antibiotic resistance by the pathogenic microorganism renders the drug ineffective. The alcohol extract of C. fistula leaves was analyzed for anti-bacterial effect against Staphylococcus aureus and *Pseudomonas aeruginosa* [108]. The methanolic extract of *C. fistula* leaves was examined for its wound-healing property within an ointment in two sorts of wound models in rats; the result showed wound contraction ability, epithelization period, lastingness, and regeneration of tissue at the wound area [109].

23. Anticonvulsant Activity: A study revealed significant anticonvulsant activity of methanolic extract of golden shower tree seeds pentylenetetrazol-induced convulsions in mice. The extract significantly delayed the onset and antagonized the PTZ-induced seizures. Thus it's suggested that the methanolic extract of the golden shower tree seeds could also be effective against human generalized myoclonic seizures [110].

24. Antinociceptive Activity: The anti-nociceptive activity of the ethyl-acetate fraction of golden shower tree pods was evaluated using the acetic acid-induced writhing model, hot plate test, tail immersion test, and formalin-induced paw licking model. The study concluded that golden shower tree L. pod has central and peripheral anti-nociceptive potential and justified the normal use of this plant for treating different painful conditions [111].

25. Anti-psoriatic Activity: *Cassia fistula* fruit extract containing herbal cream showed good activity within the psoriasis-like skin mouse model by exposing antiproliferant activity, reducing epidermal thickness, and including orthokeratosis. At a 6.25% (w/w) fruit extract dose, psoriasiform was ameliorated well without dermal irritation [112].

26. Nephroprotective Activity: The hydro-alcoholic extract of the golden shower tree fruit showed a big nephroprotective effect on bromobenzene-induced nephrotoxicity in mice. Negative control mice received normal saline; positive control mice got 460 mg/kg of bromobenzene; golden shower tree treated mice received 200, 400, 600 and 800 mg/kg of golden shower tree fruit extract followed by 460 mg/kg bromobenzene (daily by oral gavage for 10 days). On the 11th day, the mice were sacrificed, blood samples were obtained to assess blood urea nitrogen (BUN) and creatinine levels and kidneys were removed for histological examination [113].

27. Skin Disease Activity: The efficacy of golden shower tree decoction was evaluated by purgation therapy in several skin diseases. The decoction of golden shower tree fruit was given for producing purgation in fifty subjects affected by skin diseases thanks to vitiated pitta dosha. The result showed that the golden shower tree has a big effect in ameliorating skin diseases thanks to its pitta origin and may be a safe drug of choice for purgation therapy [114].

28. Anthelmintic Activity: During a study, it's been observed that methanolic extract of golden shower tree fruit pulp and seeds showed significant anthelmintic activity against *Pheretima posthuma* earthworm. The extract paralyzed and killed the worms for a very short time at a dose of 100 mg/ml [115].

29. Antitussive Activity: The methanol extract of the golden shower tree was investigated for its effect on a cough model induced by sulfur dioxide gas in mice. It exhibited significant antitussive activity compared to control during a dose-dependent manner [116].

30. Anti-itching Activity: Vicharchika (eczema) may be 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 serious efficacy of Aragvadha on patients with Vicharchika (eczema) [117].

CONCLUSION: Before introducing modern medicines, herbal remedies entirely managed disease treatment. It is estimated that about 80% of the world population residing in the vast rural areas of developing and underdeveloped countries still rely mainly on medicinal plants. It is quite obvious that the plant is widely used in the traditional medicinal system of India. The extensive literature survey revealed that *Cassia fistula* is a noteworthy medicinal plant with a diverse pharmacological spectrum.

It is very noteworthy in the curing of various infirmities and performs as an anti-inflammatory, carminative, analgesic, laxative, antibacterial, antifungal, anti-diabetic, antioxidant, hepatoprotective, antifertility, wound healing, antiulcer, anti-tumor, antifertility, antipyretic and anti-cancer, *etc*. a. As well as literature survey about its pharmacological activities was also carried out in this recent review. *Cassia fistula* is used to treat many diseases; some are constipation, skin diseases, leprosy, burning sensation, fever and syphilis. This plant's pharmacological activity has been confirmed by the scientific parameters, which are accredited to its phytochemical constituents. The complete profile of the phytochemical constituent of *Cassia fistula's* root, stem, leaf, flower and seed is also studied in this article. Phytochemical and Pharmacological reviews on plants will give valuable information which will assist the scientists in getting more advanced knowledge about a plant species. However, further, detailed clinical research appears worthwhile to explore the full therapeutic potential of this plant in order to establish it as a standard drug.

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