



# INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

## A overview on *Cassia fistula* & its Remedial Assessment

Harsh agrawal, Sharddha Patidar, Shikha Nagle, Puja Rai

BM College of Pharmaceutical Education & Research, Indore

### ABSTRACT

*Cassia fistula* is also known as a golden shower, Indian laburnum, purging cassia or amaltas in India. Owing to the vibrant yellow flowers, the Amaltas flower is designated as the national flower of Thailand and the state national flower of Kerala. It's belonging to the legume family. Amaltas is a miraculous herb that is of deciduous origin. It is usually medium-sized growing to a height of 25 cm. *Cassia fistula* is a moderate sized deciduous plant 10 m tall, flowers yellow, leaves alternate, pinnate, 30-40 cm Long, with 4-8 pairs of ovate leaflets, 7.5-15 cm long, and 2-5 cm broad. Fruits pendulous, cylindrical, brown, septate, 25-50 cm long, 1.5-3 cm in diameter, with 25-100 seeds. It is a very common plant known for its medicinal properties is a semi-wild Indian Laburnum known as a golden shower. The plant *Cassia fistula* is cultivated as an ornamental throughout India. The root is prescribed as a tonic, astringent, febrifuge and strong purgative. The leaves extract reduced mutagenicity in *E. coli*. Extract of the root bark with alcohol can be used for backward fever. The leaves are laxative and used externally as emollient, a poultice is used for chilblains, in insect bites, swelling, rheumatism and facial paralysis. Amaltas comprises an array of bioactive constituents including Glycosides, Anthraquinones, Fistulic Acid, Sennosides, Sugars, Saccharose, Mucilage, Pectin, Anthraquinones, Rhein, Rheinglucoside, Sennosides A And B, Emodin, Chrysophanic Acid, Phlobaphenes, Fistuacacidin, Lupeol, and Sterols like Beta-Sitosterol And Hexacosanol. The fruit of *Cassia fistula* was a good source of Fe and Mn, and their concentrations were considerably higher than those in apple, apricot, peach, pear and Orange and also revealed the presence of aspartic acid, glutamic acid and lysine constituted 15.3, 13.0 and 7.8%, respectively, of the total amino acids in the pulp. The pharmacological/ medicinal properties of the plant are anti tussive, anti cancer, anti diabetic, anti ulcer, anti fungal and many other activities have been reported.

key words- *Cassia fistula*, anti cancer, anti diabetic, anti ulcer, anti fungal

## INTRODUCTION

Medicinal plants are presently in demand and their acceptance is increasing progressively. Undoubtedly, plants play an important role by providing essential services in ecosystems. Without plants, humans and other living organisms cannot live in a way living should be. Anyway, herbals especially medicinal herbs have constantly acted as an overall indicator of ecosystem health

The World Health Organization (WHO) defines traditional medicinal plants as natural plant materials which are used at least or in the absence industrial processing for the treatment of diseases at a local or regional scale. Traditional herbal medicine has been used in developing and developed countries for thousands of years because it is natural and causes comparatively fewer complications. Early medical history is consistent with the history of herbal medicine.

The first books written about medicine were the first books written about plants, including the texts of the *Ebers Papyrus*, written 1500 BC, in which the names of many plants have been appeared. Different types of traditional drugs are widely used in Asia, Africa and Latin America to meet basic health needs. This use is growing rapidly in industrialized countries, which are often referred to as complementary or alternative medicine.<sup>1</sup>

*Cassia fistula* is also known as a golden shower, Indian laburnum, purging cassia or Amaltas in India. The plant which goes by the botanical name *Cassia fistula* is chiefly indigenous to India and Pakistan but is also widely disturbed in various parts of South-east Asia, Thailand, China, South Africa, Costa Rica, Guyana, and are also naturalized in many tropical parts including Mexico, Ecuador, West Indies, Belize, Australia, and Brazil. Owing to the vibrant yellow flowers, the Amaltas flower is designated as the national flower of Thailand and the state national flower of Kerala. It's belonging to the legume family.

Amaltas is a miraculous herb that is of deciduous origin. It is usually medium-sized growing to a height of 25 cm. It has alternate smooth, ovate-shaped, hairy, pinnate, leaves, with 4-8 leaflets on either side, fruits in the form of pendulous, cylindrical, indehiscent pods bearing 20-25 shiny black, seeds. The fruit pods are mainly green when ripe and dark brown when they reach maturity, whereas the flowers are usually bright yellow pentamerous and slightly zygomorphic in shape and occur in bunches.<sup>1, 2</sup>



The plant usually prefers a deep, well-drained, moderately fertile sandy loamy soil, but can also grow on calcareous, red, and volcanic soils. The plant is usually found growing in the rain forest, seasonally dry forest, woodland, riverine, gallery forest, wooded grassland, on dry scrub, thickets and coastal areas, low altitudes, gardens, parks, and even on urban lands. There are more than 500 species of amaltas around the world.

**PLANT DESCRIPTION****TAXONOMICAL CLASSIFICATION**

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

*Cassia fistula* is a moderate sized deciduous plant 10 m tall, flowers yellow, leaves alternate, pinnate, 30-40 cm Long, with 4-8 pairs of ovate leaflets, 7.5-15 cm long, and 2-5 cm broad. Fruits: pendulous, cylindrical, brown, septate, 25-50 cm long, 1.5-3 cm in diameter, with 25-100 seeds. Seeds: lenticular, light brown, lustrous<sup>6</sup>. It is a deciduous tree with greenish gray bark, compound. Leaves: leaflets are each 5-12 cm long pairs. A semi-wild tree known for its beautiful bunches of yellow flowers and also used in traditional medicine for several indications.<sup>2</sup>

**GEOGRAPHICAL SOURCE**

*Cassia fistula* L. (Caesalpinioideae) a very common plant known for its medicinal properties is a semi-wild Indian Laburnum known as a golden shower. The plant *Cassia fistula* is cultivated as an ornamental throughout India. *Cassia* species are annual under shrub grows all over the tropical countries (throughout India, Pakistan, Bangladesh and West-China) and grows well in the wasteland as a rainy season weed. In deciduous and mixed monsoon forests throughout greater parts of India, ascending to 1300 m in outer Himalayas. In Maharashtra, it occurs as a scattered tree throughout the Deccan and Konkan.<sup>3</sup>

**MORPHOLOGY**

*Amaltas* is a moderate sized tree. It attains a height of about 8 to 15 m when mature. Its leaves are up to 5.1 to 12.2 cm long, par pinnate with a 4-8 pair of leaflets, coriaceous when fresh and paper on drying. Midrib is densely pubescent beneath. Leaves alternate, pinnate, 30-40 cm long, with 4-8 pairs of ovate leaflets, 7.5-15 cm long, 2-5 cm broad, entire, the petiolules 2-6 mm long.

Flowers of the *cassia fistula* are pale yellow in color usually in nearly sessile pairs in the axils of the leaves with five petals, upper one is very crowded. Flowers bright yellow in the terminal, drooping racemes, 30-60 cm long; calyx oblong, obtuse, pubescent; corolla with five subequal, obovate, shortly clawed petals, to 3.5 cm across; stamens 10, upper three with erect filaments to 0.7 cm long and with basified anthers<sup>25</sup>. A fruit is cylindrical pod and seeds many in black, sweet pulp separated by transverse partitions. The long pods which are green, when unripe, turn black on ripening after flowers shed <sup>6</sup>. The pulp is dark brown in color, sticky, sweet and mucilaginous, odor characteristic, and somewhat disagreeable. The pod develops numerous transverse septa between the seeds. When fresh the  $\beta$  pods contain a black pulp which on drying adheres to the septa.<sup>5</sup>

## Traditional use

The root is prescribed as a tonic, astringent, febrifuge and strong purgative. The leaves extract reduced mutagenicity in *E. coli*. Extract of the root bark with alcohol can be used for backward fever. The leaves are laxative and used externally as emollient, a poultice is used for chilblains, in insect bites, swelling, rheumatism and facial paralysis. Leaves possess anti-periodic and laxative properties, the leaves are used in jaundice, piles, rheumatism ulcers and also externally skin eruptions, ring worms, eczema. The leaves and bark mixed with oil are applied to pustules, insect bites. The roots are used in chest pain, joint pain, and migraine and blood dysentery. The extract of the root lowered the blood sugar level up to 30%.<sup>6</sup>

Leaves and flowers are both purgative like the pulp. Ashes from burnt pods mixed with little salt are used with honey taking 3-4 times to relieve cough. Root is useful in fever, heart diseases, retained excretions and biliousness. Fruits are used as cathartic and in snake bite. Juice of leaves is used in skin diseases.

## CHEMICAL COMPONENTS

Amaltas comprises an array of bioactive constituents including Glycosides, Anthraquinones, Fistulic Acid, Sennosides, Sugars, Saccharose, Mucilage, Pectin, Anthraquinones, Rhein, Rheinglucoside, Sennosides A and B, Emodin, Chrysophanic Acid, Phlobaphenes, Fistuacacidin, Lupeol, and Sterols like Beta-Sitosterol and Hexacosanol.

*C. fistula* extracts have been attributed to their primary and secondary metabolite composition. Primary metabolite analysis has essentially been focussed on the seed, pollen, fruit, leaf and pod. The composition of protein 12%, carbohydrate 11.75%, lipid 12% and free amino acid 1.42%, respectively. The stem bark of *Cassia fistula* contains two flavonol glycosides, 5, 7, 3', 4'-tetrahydroxy-6, 8-dimethoxyflavone-3-O- $\alpha$ -arabinopyranoside, 5, 7, 4'-trihydroxy-6, 8, 3'-trimethoxyflavone-3-O- $\alpha$ -L-rhamnosyl (1 $\rightarrow$ 2)-O- $\beta$ -D-glucopyranoside and a xanthone glycoside, 1, 8-dihydroxy-3, 7-dimethoxyxanthone-4-O- $\alpha$ -L-rhamnosyl (1 $\rightarrow$ 2)-O- $\beta$ -D-glucopyranoside.<sup>8</sup>

The fruit of *Cassia fistula* is a good source of Fe and Mn, and their concentrations were considerably higher than those in apple, apricot, peach, pear and Orange and also revealed the presence of aspartic acid, glutamic acid and lysine constituted 15.3, 13.0 and 7.8%, respectively, of the total amino acids in the pulp.

The seeds yield a gum (7.65%) which is the most efficient suspending agent for calomel, kaolin and talc.<sup>9</sup> Extraction of the dried and crushed seeds with petroleum ether (b.p. 60-80°C) in a specially modified Soxhlet apparatus gave 5.0% brownish yellow oil. Subsequently, Chrysophanic acid was also isolated from this oil.<sup>9</sup> Mucilage (25.8%) was isolated from the seeds by extraction with hot water.<sup>9</sup>

The seeds constituted the same amino acids with 16.6, 19.5 and 6.6%, respectively while, isolated 5-Nonatetracontanone, 2-hentriacontanone, triacontane, 16-hentriacontane and beta-sitosterol from the hexane fraction of the fruits. Fruit pulp contains sugar, gum, astringent matter, gluten, coloring matter and water proteins (19.94%) and carbohydrates (26.30%); arginine, leucine, methionine, phenylalanine, tryptophan, aspartic and glutamic acids;

A new dimeric proanthocyanidin CFI isolated along with (-) epiafzelechin, (+) catechin, kaempferol, dihydrokaempferol and 1, 8-dihydroxy-3-methylanthraquinone.<sup>10</sup>

## PHARMACOLOGICAL/ MEDICINAL PROPERTIES

### ANTI- TUSSIVE ACTIVITY

The methanol extract of *Cassia fistula* was investigated for its effect on a cough model induced by sulphur dioxide gas in mice. The extract exhibited significant, dose-dependent antitussive activity compared with the control. The antitussive activity was comparable with that of codeine phosphate, a prototype antitussive agent. *C. fistula* extracts (400 and 600 mg/kg, p.o.) inhibited coughing by 44.44 and 51.85%, respectively, with respect to the control group.

### ANTI-CANCER ACTIVITY

It has been found that methanolic extract (ME) of *Cassia fistula* seed on the growth of Ehrlich ascites carcinoma (EAC) and on the life span of tumour bearing mice.<sup>13</sup> ME treatment showed an increase of life span, and a decrease in the tumour volume and viable tumour cell count in the EAC tumour hosts.<sup>12</sup>

### ANTI-DIABETIC ACTIVITY

The hypoglycemic effects of the hexane extract of stem bark of *Cassia fistula*, in normal and streptozotocin induced diabetic rats. Hexane extract of *C. fistula* bark at doses 0.15, 0.30, 0.45 g kg<sup>-1</sup> body weight for 30 days suppressed the elevated blood glucose levels in diabetic rats. Aqueous extract of *Cassia fistula* flowers (ACF) locations was screened for its antioxidant effect in alloxan induced diabetic rats. And seeds of *Cassia fistula* were investigated for their hypoglycemic activity. They were found to have marked hypoglycemic activity on normal members of albino rats 21 & 22 days.

### ANTI-ULCER ACTIVITY

The ethanol leaf extract (ELE) of *Cassia fistula* was evaluated for antiulcer activity against pylorus ligation-induced gastric ulcer. Ranitidine (30 mg/kg b.w.) and ELE at doses of 250, 500, and 750 mg/kg b.w. were administered orally in different groups of rats (n = 6), 1 h prior to pyloric ligation. Four hours after pyloric ligation, the gastric juice was collected for evaluation of various parameters.<sup>12</sup>

### ANTI-FUNGAL ACTIVITY

Ethyl acetate extract of *Cassia fistula* flower shows antifungal activity due to the presence of Rhein (1,8-dihydroxyanthraquinone-3-carboxylic acid) isolated from *Cassia fistula* flower the ethyl acetate extract of *Cassia fistula* flower was studied against the growth of many fungi such as *Trichophyton mentagrophytes* (MIC 31.25 µg/ml), *Trichophyton simii* (MIC 125 µg/ml), *Trichophyton rubrum* (MIC 62.5 µg/ml) and *Epidermophyton floccosum* (MIC 31.25 µg/ml). According to Singh et al., and Subramaniam, extracts of *Cassia fistula* leaves with acetone, diethyl ether and methanol shows antifungal activity against *Candida albicans*.

The effect of seed extract on the growth profile of the *Candida albicans* was examined via time-kill assays and in vivo efficacy of the extract was tested in an animal model. The complete inhibition of *C. albicans* growth was shown by *C. fistula* seed extract at 6.25 mg/mL concentration. The time-kill assay suggested that *C. fistula* seed extract had completely inhibited the growth of *C. albicans* and also exhibited prolonged anti-yeast activity.<sup>13</sup>

### ANTI-VIRAL ACTIVITY

Sundararaj et al., (2006) reported that 100% mortality was recorded from the *Cassia fistula* extract at 48 hr. at 50 and 100% concentrations. At 72 hr., 100% mortality was observed in all extracts at all three concentrations. Ethanolic extract of pod and stem bark of *Cassia fistula* were found active against Ranikhet disease virus (RDV) and Vaccinia virus, Ethanol extract of fruit reported active against Foot and Mouth Disease virus (FMDV). In aqueous hot extract of pods and leaves of *Cassia fistula* were examined against infectious bovine rhinotracheitis (IBR) virus.<sup>18</sup>

Antiviral activity of *Cassia fistula* was assayed by using different concentration of non toxic doses of both the extracts against 10TCID<sub>50</sub> dose of IBR virus MDBK cell line. cytopathic effect was observed by

microscopic examination and confirmed by using MTT dye up take assay. Result of this study suggest that pod hot aqueous extra ct of Cassia fistula shows dose dependent anti IBR virus activity.

### **ANTI-INFLAMMATORY**

RajuIlavarasanet. al., (2005) revealed the anti-inflammatory activities of the aqueous (CFA) and methanolic extracts (CFM) of the Cassia fistula bark were assayed in Wistar albino rats. Cassia fistula bark extracts showed significant radical scavenging by inhibiting lipid peroxidation initiated by CCl<sub>4</sub> and FeSO<sub>4</sub> in rat liver and kidney homogenates. Both extracts exhibited significant antioxidant activity in DPPH, Nitric oxide and Hydroxyradical induced invitro assay methods. Both extracts showed Dose-Dependent protective effect against lipid peroxidation and free radical generation in liver and kidney homogenates which shows that Cassia fistula bark extracts (CFA & CFM) posse significant anti-inflammatory properties.<sup>14</sup>

Gobianandet. al., (2010) also suggested the antiinflammatory activity of C. fistulla plant various doses of ethanolicextract(ELE) (50, 100, 250, 500 and 750 mg kg-1b wt) were tested for anti-inflammatory against hind paw oedema and cottonpellet granuloma. Effect and the results were compared with standard drugs (diclofenac and indomethacin). And observations specify that the ELE significantly inhibited both the carrageenan-induced hind paw oedema and cotton-pellet granuloma in a dose dependant manner.

### **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.<sup>15</sup>

### **AYURVEDIC MEDICINAL USE**

In Ayurvedic medicine, Golden Shower Tree is known as "disease killer". Its fruit pulp is used as mild laxative as well as cardiac conditions and stomach problems such as acid reflux. Flowers used for fever, root as a diuretic. The bark and leaves are used for skin diseases. The seeds are recognised as antibilious, aperitif, carminative, and laxative while the root is used for curing adenopathy, burning sensations, leprosy, skin diseases, syphilis, and tubercular glands.

The leaves of the tree is used for erysipelas, malaria, rheumatism, and ulcers, the buds are used for biliousness, constipation, fever, leprosy, and skin disease and the fruit for abdominal pain, constipation, fever, heart disease, and leprosy. Thus every part of this plant is recognized for its medicinal properties. The plant is being considered as a firewood source in Mexico.The reddish wood, hard and heavy, strong and durable, is suited for cabinetwork, farm implements. The bark has been employed in tanning, often in conjunction with avaram. The drug "Cassia fistula", a mild laxative, is obtained from the sweetish pulp around the seed.<sup>16</sup>

### **CONCLUSION**

The extensive survey of literature revealed that Cassia fistula is an important medicinal and traditional plant with diverse chemical, pharmacognosy, and pharmacological spectrum. Before the introduction of modern medicines, disease treatment was entirely managed by herbal remedies. This plant is used by traditional medical practitioners for the treatment of various diseases. It is known as a rich source of tannins, flavonoids and glycosides present in Cassia fistula might be medicinally important and/or nutritionally valuable. The plant is rich in carbohydrates, Linoleic, Oleic, and Stearic. The present review summarizes some important pharmacological studies on Cassia fistula and phytochemical investigations and isolated principles from them. Coined as the "Golden Shower Tree", Amaltas is blessed with myriad health benefits. Thanks to the goodness of the essential bio-active ingredients, it is widely used for treating flu and feverish conditions, managing cough and cold, sore throat, treating digestive anomalies, enhance cardiac functioning, preventing skin infections, promoting digestion and many more.

It is quite obvious that the plant is widely used in traditional medicinal system of India and has been reported to possess hepatoprotective, anti-inflammatory, antitussive, antifungal and also used to check wounds healing and antibacterial properties. It is known as a rich source of tannins, flavonoids and glycosides present in *Cassia fistula* might be medicinally important and/or nutritionally valuable. The plant is rich in carbohydrates, Linoleic, Oleic, and Stearic acid. Leaf of *Cassia fistula* mainly contains Oxalic Acids, Tannins, Oxyanthra-quinones, Anthraquinones derivatives.

The present review summarizes some important pharmacological studies on *Cassia fistula* and phytochemical investigations and isolated principles from them, which can be investigated further to achieve lead molecules in the search of novel herbal drugs.

## REFERENCES

- 1)Ali M. Ashraf, Sagar H. A., Sultana M. C., Azad A. K., Begum K. and Wahed M. I. I., "Antihyperglycemic and Analgesic Activities of Ethanolic Extract of *Cassia fistula* (L.) Stem Bark" *Int J Pharm Sci Res.*, February, 2012; Vol. 3(2): 416-423 19.
- 2)Bhakta T, Banerjee S, Mandal S C, Maity T K, Saha B P and Pal M. Hepatoprotective activity of *cassia fistula* leaf extract. *Journal of phytomedicine.*; 2001: 8; 220-24
- 3)Bhakta T, Banerjee S, Mandal S C, Maity T K, Saha B P, Pal M. Hepatoprotective activity of *Cassia fistula* leaf extra ct. *Phytomedicine*; 2001: 8(3); 220-224.
- 4)Bhakta T, Mandal S C, Sinha S, Saha B P, Pal M. *Journal of Medicinal and Aromatic Plant Sciences*; 2001: 22/23(4A/1A); 70-72.
- 5)DasSangita, Sarkar PK, Sengupta A, Chattopadhyay AA. Clinical study of *Aragvadha* (*Cassia fistula* Linn) on *Vicharchika* (Eczema). *J. Res. Educ. Indian Med*, 2008: 27-32. 43.
- 6)Gupta M, Mazumder U.K, Rath N. and Mukhopadhyay DK. Antitumor activity of methanolic extract of *Cassia fistula* Linn seed against Ehrlich Ascites Carcinoma. *Journal of Ethanopharmacology*, 2000; 72: 151-156.
- 7)Ilavarasan R, Mallika M, Venkataraman S. *African Journal of Traditional, Complementary and Alternative Medicines*; 2005: 2(1); 70-85.
- 8)Ilavarasan R, Mallika M, Venkataraman S. Anti-inflammatory and antioxidant activities of *Cassia Fistula* Linn bark extracts. *Afr. J. Trad.* 2005;2(1):70-85.
- 9)Jain, S.K., *Medicinal Plants*, National Book Trust, New Delhi., p.37.1968.
- 10)Kalantari H, Jalali M, Jalali A, Mahdavinia M, Salimi A, Juhasz B, Tosaki A, Gesztelyi R. Protective effect of *Cassia fistula* fruit extract against bromobenzene-induced liver injury in mice. *Hum Exp Toxicol.* 2011 Aug; 30(8): 1039-44.
- 11)Mozaffarpur SA, Naseri M, Esmaeilidooki MR et al. The effect of *cassia fistula* emulsion on pediatric functional constipation in comparison with mineral oil: a randomized, clinical trial. *DARU, J Pharm Sci.* 2012;20(1):83.
- 12)MuleSomnathNavanath. Evaluation of anti-inflammatory activity of *Cassia fistula* Linn and *Ficus benghalensis*. *Journal of Pharmacy Research*, 2009; 2: 8
- 13)Pradeep K, Raj Mohan CV, Gobianand K, Karthikeyan S. Protective effect of *Cassia fistula* Linn. on diethylnitrosamine induced hepatocellular damage and oxidative stress in ethanol pretreated rats. *Biol Res.* 2010; 43(1): 113-25. doi: 0716-97602010000100013. 24.
- 14)Singh S., Singh s., Yadav A. A Review on *Cassia* species: Pharmacological, Traditional and Medicinal Aspects in Various Countries. *Ame J of Phytomed and Cli Therapeutics*: 1(3): 291-312: 2013.
- 15)Singh KN and Bharadwaj UR Hypoglycaemic Activity of *Albizzia stipulata*, *Albizzia moluccana* and *Cassia fistula* Leguminous Seed Diets on Normal Young Rats. *Ind. Journal of Pharmacology*, 1975; 7: 47-50.
- 16)Sundararaju P, Saritha V. Effect of leaf extracts of *Acalypha indica*, *Cassia fistula* and *Solanum torvum* on *Pratylenchus coffeae*. *Indian Journal of Nematology*; 2006;36(1); 144-145.
- 17)Sivanesan Karthikeyan, Kuppannan Gobianand. Antiulcer activity of ethanol leaf extract of *Cassia fistula*. *Int. Journal of Pharmacognosy*, 2010; 48: 869-77.

- 18)Thirumal M, Surya S and Kishore G. . . Cassia fistula Linn - pharmacognostic, phytochemical and pharmacological review.Crit Rev. PharmaceutSci; 1:43-65: 2012.
- 19)Vaishnav M M, Gupta K R. Rhamnetin 3-O-gentiobioside from Cassia fistula roots. Fitoterapia; LXVII: 1996: 78-79.
- 20)Van Gorkom B A, de varies E G, Karrenbeld A, Kleibeuker J H. Anthranoid laxatives and their potential carcinogenic effect. Aimentry Pharmacology and Therapeutiecs; 1999: 13; 443-452.

