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CASSIA FISTULA LINN: A REVIEW OF PHYTOCHEMICAL AND PHARMACOLOGICAL STUDIES

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ABSTRACT: *Cassia fistula* Linn. (*Family:* Caesalpinaceae), commonly known 'Sonali' or 'Bandarlati', has been used in different traditional system of medicines for various ailments since ancient times. *Cassia fistula* grows throughout in Bangladesh and in many other Asian countries such as India, China, Hong Kong, Philippines, Malaysia, Indonesia, and Thailand. This article aims to provide a comprehensive review on the phytochemical and pharmacological aspects of *Cassia fistula*. In traditional medicine, it has been used in the treatment of diabetes, hematemesis, leucoderma, pruritis, intestinal disorder and as antipyretics, analgesic and laxative. The fruits, stem bark, and leaves of this plant contain a variety of biologically active compounds such as anthraquinones, flavonoids, flavon-3-ol derivatives, alkaloid, glycosides, tannin, saponin, terpenoids, reducing sugar and steroids those have various medicinal properties. The fruit and stem bark extract shows various activities like antipyretic, anti-inflammatory, antioxidant, antidiabetic, hypolipidemic, hepato-protective, antimicrobial, antitumor, antiulcer etc. The article reviews the various activities of the plant.

INTRODUCTION: *Cassia fistula* Linn also known as the golden shower tree (Bengali name: Sonali or Bandor lathi), belongs to the family *Caesalpiniaceae*, is widely used for its medicinal properties, its main property being that of a mild laxative suitable for children and pregnant women.

It is also a purgative due to the wax aloin and a tonic [1] and has been reported to treat many other intestinal disorders like healing ulcers [2].

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According to the WHO, more than 70% of the world's population must use traditional medicine to satisfy their principal health needs.

In developing countries 80% population are using traditional medicine in primary medical problems [3, 4]. Plant drugs and herbal formulations are frequently considered to be less toxic and free from side effects than synthetic one [5].

In traditional medicine, *Cassia fistula* is one of the most commonly used plants in Unani and Ayurvedic medicines, this plant has been described to be useful against skin diseases, liver troubles, tuberculous glands and its use in the treatment of haematemesis, pruritus, leucoderm and diabetes has been suggested [6]. Traditionally, the plant is also used as an infusion, decoction, or powder, either

alone or in combination with other medicinal plants. In modern times, and in any controlled clinical trials, commercial preparations have tended to be standardized extracts of the whole plant. The plant has documented to possess analgesic[7], anti-inflammatory [8], antioxidant [9], antidiabetic [10], as well as hepatoprotective activity [11].

Since many disease conditions commonly treated with *Cassia fistula* in traditional medical systems are considered self-limiting, its purported benefits need critical evaluation. This review summarizes current scientific findings and suggests areas where further research is needed and also to verify the therapeutic efficacy of *Cassia fistula*.

Plant Description: *Cassia fistula* is a moderate sized deciduous tree 10 m tall, flowers yellow, leaves alternate, pinnate, 30-40 cm long, with 4-8 pairs of ovate leaflets, 7.5-15 cm long, 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. *Cassia fistula* grows throughout in Bangladesh and in many other Asian countries and is used as a traditional herbal medicine in India, China, Hong Kong, the Philippines, Malaysia, Indonesia, and Thailand.

Taxonomic Classification:

Kingdom - *Plantae*

Subkingdom – *Tracheobinota*

Super Division - *Spermatophyta*

Division - *Mangoliophyta*

Class – *Magnoliopsida*

Sub Class - *Rosidae*

Order - *Fabales*

Family - *Fabacae*

Genus - *Cassia*

Species - *fistula*

Vernacular Names:

Bengali - *Bundaralati, Sonalu, Soondali, Sondal*

English - *Golden Shower*

Guajarati - *Garmala*

Hindi - *Sonhali, Amultus*

Kannad - *Kakkemara*

Marathi - *Bahava*

Tamil - *Shrakkonnai, Konai, Irjviruttam*

Telegu - *Kondrakayi, Raelachettu, Aragvadhamu*

Sanskrit - *Nripadruma*

Arab - *Khayarsambhar*

Oriya - *Sunaari*

Punjabi - *Amaltaas, Kaniyaar, Girdnalee*

Urdu - *Amaltaas*

Herbal Medicine Uses: There are many *Cassia* species worldwide which are used in herbal medicine systems. These particular families of plants are used widely for their laxative actions. *Cassia fistula* is no exception... it is often used as a highly effective moderate laxative that is safe even for children.

However, in large doses, the leaves and bark can cause vomiting, nausea, abdominal pain and cramps. *Cassia fistula* is also 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 the root is used 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 and the leaves and/or bark is used for pain and inflammation.

Ayurvedic Medicine Uses: 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.

Phytochemical Studies: The plant is rich in phenolic antioxidants such as anthraquinones, flavonoids and flavan- 3-ol derivatives. *Cassia fistula* the results shows positive for alkaloids, terpenoids, reducing sugars, saponins, tannins, carbonyl, phlobatanin, and steroids [12]. *Cassia fistula*'*s* laxative actions come from a group of well documented compounds called anthraquinone. The seeds contain approximately 2% anthraquinones, 24% crude protein, 4.5% crude fat, 6.5% crude fiber, and 50% carbohydrates. The stem bark contains two flanol glycosides and a xanthone glycosides [13]. The leaves have been documented with 15.88% crude protein, 6.65% crude fat, 20% crude fiber, and 39.86% carbohydrates. In addition, the plant also contain fistulic acid, rhein, rheinglucoside, galactomannan, sennosides A and B, tannin, phlobaphenes, oxyanthraquinone substances, emodin, chrysophanic acid, fistuacacidin, barbaloin, lupeol, beta-sitosterol, and hexacosanol [14, 15].

Pharmacological Studies:

1. **Antidiabetic Activity:** The antidiabetic potential of the total alcoholic extract & its ethyl acetate fraction of the bark of *Cassia fistula* was studied in alloxan induced diabetic rats. The ethyl acetate fraction exhibited significant reduction in blood glucose levels than alcoholic extract. The activity was found comparable with standard drug glibenclamide [16]. The mechanism of hypoglycemic and antidiabetic action of hydroalcoholic extract of *Cassia fistula* Linn in rats was reported [17]. The ethanolic extract of *Cassia fistula* Linn Stem bark were investigated for their anti-hyperglycemic activity [18]. Aqueous extract of *Cassia fistula* (Linn.) flowers (ACF) was screened for its antioxidant effect in alloxan induced diabetic rats. The seeds of *Cassia fistula* were investigated for their hypoglycemic activity. They were found to have marked hypoglycemic activity on normal albino rats but not on alloxan produced diabetic albino rats [19, 20].

2. **Hypolipidemic Activity:** The effect of 50% ethanolic extract of *Cassia fistula* Linn. Legume was assessed on serum lipid metabolism in cholesterol fed rats. The effect of 50% ethanolic extract of *Cassia fistula* legume was assessed on serum lipid metabolism in cholesterol fed rats [21].

3. **Hepatoprotective Activity:** Protective effects of cassia seed ethanol extract against carbon tetrachloride-induced liver injury in mice [20].

Protective effect of *Cassia fistula* Linn on diethylnitrosamine induced hepatocellular damage and oxidative stress in ethanol pretreated rats [21]. Protective effect of *Cassia fistula* fruit extract against bromobenzene-induced liver injury in mice was reported [22].

4. Protective effect of *Cassia fistula* fruit extract on bromobenzene-induced nephrotoxicity in mice was also studied [23].

5. **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 invitro assay methods. Both extracts showed Dose-Dependent protective effect against lipid peroxidation and free radical generation in liver and kidney homogenates [24, 25]. Antioxidant activity of *Cassia fistula* Linn) flowers in alloxan induced diabetic rats [26]. Fruit pulp powder of *Cassia fistula* was investigated for its antioxidant activity both in vitro and in vivo [27].

6. **Antipyretic Activity:** The methanol extract of buds of *C. fistula* for its antipyretic action on normal body temperature and yeast-induced pyrexia (fever) in rats. The results obtained are comparable to those for paracetamol, a standard antipyretic agent [28].

7. **Anti-inflammatory Activity:** The anti-inflammatory property of aqueous extract of leaves and fruits of *Cassia fistula* was reported [29].

8. **Antitussive activity:** The methanol extract of *Cassia fistula* was investigated for its effect on a cough model induced by sulphur dioxide gas in mice. It exhibited significant antitussive activity when compared with control in a dose dependent manner [30].

9. **Antilaishmanial activity:** Hexane extract from the fruits showed significant antileishmanial activity against the promastigote form of Leishmania L. chagasi [31].

10. **CNS activity:** The methanol extract of the seed *Cassia fistula* was tested for different pharmacological actions in mice. A depressant action of ME was also evident from the behavioural studies on mice. These results contribute with novel antiprotozoal compounds for future drug design studies [32].

11. **Antimicrobial Activity:** Antifungal activity of leaf extract of *Cassia fistula* was reported [33]. In-vitro Antibacterial Activity observed in Leaf and Root Extract of *Cassia fistula* [34]. Antibacterial and Antifungal activity from extract *Cassia fistula*, antibacterial activity of *Cassia fistula* was recorded and reported [35, 36].

12. **Antitumor activity:** Effects of methanolic extract (ME) of *Cassia fistula* seed on the gr owth of Ehrlich ascites carcinoma (EAC) and on the life span of tumour bearing mice were studied. ME treatment showed an increase of life span, and a decrease in the tumor volume and viable tumor cell count in the EAC tumor hosts [37].

13. **Larvicidal and ovicidal activity:** The methanolic leaf extract of *Cassia fistula* was tested for larvicidal and ovicidal activity against *Culex quinquefasciatus* and *Anopheles stephensi*. The results show that the leaf extract of *C. fistula* is promising as a larvicidal and ovicidal agent against *C. quinquefasciatus* and *A. stephensi* [38].

14. **Antiparasitic Activity:** The fractionation through bioguided antileishmanial activity of the dichloromethane extract of *Cassia fistula* fruits (Leguminosae) led to the isolation of the active isoflavone biochanin A, identified by spectroscopic method [39].

15. **Anti-itching activity:** Vicharchika (eczema) is a chronic skin disease with no permanent cure in modern medicine. Raising serum IgE level is the commonest immunological marker for eczema. This study suggests of significant efficacy of Aragvadha on the patients of Vicharchika (eczema) [40].

16. **Antiulcer activity:** The ethanol leaf extract of *Cassia fistula* Linn was evaluated for antiulcer activity against pylorus ligation- induced gastric ulcer [41].

17. **Wound healing activity:** The methanolic extract of *C. fistula* leaves was examined for its wound healing property in the form of an ointment in two types of wound models in rats; result showed wound contraction ability, epithelization period, tensile strength and regeneration of tissue at wound area [42].

    Formulated ointment was topically applied on the infected wound. Wound reduction rate, histological analysis, biochemical analysis, and gelatin zymography were obtained to assess the healing pattern. *C. fistula* treated rats showed, better wound closure, improved tissue regeneration at the wound site, and supporting histopathological parameters pertaining to wound healing [43].

CONCLUSIONS: Before the introduction of modern medicines, disease treatment was entirely managed by herbal remedies. It is estimated that about 80% of the world population residing in the vast rural areas of the developing and under developed countries still rely mainly on medicinal plants. 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. Fruit of *Cassia fistula* contains Rhein Glycosides Fistulic Acids, Sennosides A B, Anthraquinones, and Flavanoid-3-ol-derivatives. Ceryl Alcohol, Kaempferol, Bianthraquinone Glycosides, Fistulin, Essential Oils, Volatile Components, Phytol (16.1%), 2-Hexadecanone (12%), Crystals, 4-Hydroxy Benzoic Acids Hydrate have been reported from the plant.

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.

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REFERENCES:

1. Satyavati GV, Sharma M., In Medicinal plant in India, ICMR, New Delhi, 1989.
2. Biswas K, Ghosh AB, In Bharatia Banawasadhi, Calcutta University, Advancement of learning, Calcutta, 2, 1973; 336.
3. Bailey C. J and C. Day, Diabetes Care 12, 553, 1989, doi: 10.2337/ diacare.12.8.553.
4. Grover J.K., Yadav S., and Vats V. Medicinal plants of India with antidiabetic potential. J. Ethnopharmacol, 2002, 81: 81-100.
5. Bailey CJ, Day C: Traditional treatments for diabetes: Diabetes Care, 1989; 12: 553-564.
6. Dutta A, De B, Seasonal variation in the content of sennosides and rhein in leaves and pods of *Cassia fistula*, Indian J. Pharmacol. Sci.1998; 60: 388-390.
7. N.W. Sheikh, R. D. Patel, N. I. Upwar, N. K. Mahobia, M. V. Seth, U. R. Panchal., Analgesic study of methyl alcohol extract of *Cassia fistula* Pod, J. Pharmacy Res., 2010; 3(9), 2218-2219
8. Ilavarasan R., Mallika M. and Venkataraman S., Anti-inflammatory and antioxidant activities of *Cassia fistula* Linn. Bark extracts. Afr. J. Trad. CAM, 2005; 2 (1): 70 - 85
9. Luximon-Ramma, A., Bahorun, T., Soobrattee, M. A. and Aruoma, O. I. Antioxidant activities of phenolic, proanthocyanidin, and flavonoid components in extracts of *Cassia fistula* J Agric Food Chem. 2002; 50(18): 5042-5047.
10. Malpani S.N. *et al.* Antidiabetic Activity of *Cassia fistula* Linn Bark in Alloxan Induced Diabetic Rats. Int. J. Phar. Sci. and Res. Jan-April, 2010; 2(1): 382-385
11. Bhakta, T., Banerjee, S., Mandal, S. C., Maity, T. K., Saha, B. P. and Pal, M., Hepatoprotective activity of *Cassia fistula* leaf extract, Phytomedicine. 2001; 8(3): 220-224.
12. Lee Ching Kuo, LEE Ping Hung et al. The chemical constituents from the aril *Cassia fistula* Linn. Journal of Chinese Chemical Society, 2001; 48: 1053-58.
13. Yueh-Hsiung Kuo, Ping-Hung Lee, and Yung-Shun Wein. Four New Compounds from the Seeds of *Cassia fistula*. J. Nat. Prod, 2002; 65: 1165 67
14. Amitabye Luximon-Ramma, Theeshan Bahorun, Mohammed A Soobrattee. and Okezie I. Aruoma. Antioxidant Activities of Phenolic, Proanthocyanidin, and Flavonoid Components in extract of *Cassia fistula* Linn. Journal of Agri. Food Chemistry, 2002; 50: 5042-47.
15. Sircar P.K, Dey B, Sanyal T, Ganguly SN, and Sircar SM. Gibberellic acid in the floral parts of *Cassia fistula* Linn. Journal of Phytochemistry, 2001; 9: 735-36.
16. Malpani SN, Manjunath KP, Hasanpasha Sholapur, Savadi RV Akki Kusum S. and Darade SS. Antidiabetic activity of *Cassia fistula* Linn. Bark in alloxan induced diabetic rats. Int. Journal of Pharm. Sciences, 2010; 2: 382-85
17. Silawat Narendra, Jarald E Edwin, Jain Neetesh, Yadav Akash, Deshmukh T Pradeep. The mechanism of hypogl ycemic and antidiabetic action of hydro alcoholic extract of *Cassia fistula* Linn in rats. Journal of the Pharma Research, 2009; 01: 82-92.

18. 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. Singh KN and Bharadwaj UR Hypoglycaemic Activity of *Albizzia stipulata*, *Albizzia* m*oluccana* and *Cassia fistula* Leguminous Seed Diets on Normal Young Rats. Ind. Journal of Pharmacology, 1975; 7: 47-50.
20. T. Bhakta., P.K. Mukherjee., K. Sana, M. Pal and Saha B.P. Hypoglycemic activity of *Cassia fistula* Linn. (Leguminosae) leaf (methanol extract) in alloxan-induced diabetic rats. J. Ethnopharmacol, 1997; 9: 35-38.
21. Gupta Uttam Chand and Jain G.C. Study on Hypolipidemic activity of *Cassia fistula* Linn Legume in Rats. Asian J. Exp. Sci, 2009; 23: 241-248.
22. Xie Q, Guo FF, Zhou W. Protective effects of Cassia seed ethanol extract against carbon tetrachloride-induced liver injury in mice. Acta Biochim Pol. 2012; 59(2): 265-70.
23. 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. 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. doi: 10.1177/0960327110386256.
25. Kalantari H, Jalali M, Jalali A, Salimi A, Alhalvachi F, Varga B, Juhasz B, Jakab A, Kemeny-Beke A, Gesztelyi R, Tosaki A, Zsuga J. Protective effect of *Cassia fistula* fruit extract on bromobenzene-induced nephrotoxicity in mice.Hum Exp Toxicol. 2011 Oct; 30(10): 1710-5. doi: 10.1177/0960327110396532
26. Ilavarasan Raju, Mallika Moni and VenkataramanSubramanian. Anti-inflammatory and Antioxidant activity of *Cassia fistula* Linn Bark extracts. Afr.J. Trad.Cam, 2005; 2: 70-85.
27. P. Siddhurajua, P. S. Mohanb and K. Becker. Studies on antioxidant activity of Indian Laburnum (*Cassia fistula): a* preliminary assessment of crude extracts from stem bark, leaves flowers and fruit pulp. Journal of Food Chemistry, 2001; 79: 61-67.
28. Manonmania G, Bhavapriyaa V, Kalpanaa S, Govindasamya S and T. Apparananthamb. Antioxidant activity of *Cassia fistula* (Linn.) flowers in alloxan induced diabetic rats. Journal of Ethanopharmacology, 2005; 97: 39-42.
29. Bhatnagar M, Sunil V, Vyas Y, Sharma D, Sharma K. Antioxidant Activity of Fruit Pulp Powder of *Cassia fistula.* Pharmacognosy Journal, 2010; 2: 219-28.
30. T. Bhakta, S. C. Mandal, B. P. Sanghamitra Sinha Saha, M. Pal, Journal of Medicinal and Aromatic Plant Sciences, 2001, 22/23(4A/1A): 70-72.
31. Mule Somnath Navanath. Evaluation of anti-inflammatory activity of *Cassia fistula* Linn and *Ficus benghalensis.* Journal of Pharmacy Research, 2009; 2: 8
32. T. Bhakta, Pulok, Mukherjee, Kakali Saha, M. Pal and BP. Saha. Studies on Antitussive Activity of *Cassia fistula* Leaf Extract. Journal of Pharma. Bio, 1998; 36: 140-43.
33. Patricia Sartorelli, Samanta P, Andrade Marcia SC. Melhem, Frederico O. Prado, Andre G. Tempone. Isolation of antileishmanial sterol from the fruits of bioguided fractionation. Journal of Phytotherapy Research, 2007. 21: 644-47.
34. Mazumder UK, Gupta M. and Rath N. CNS activities of *Cassia fistula* in mice. Journal of Phytotherapy Research, 1998; 12: 512-22.
35. Phongpaichit S, Pujenjob N, Rukachaisirikul V. and Ongsakul M. Antifungal activity from leaf extracts of *Cassia alata*, *Cassia fistula* and *Cassia tora* L. Songklanakarin. Journal Sci. Technology, 2004; 26: 741-48.
36. Awal MA, Ahsan SM, Haque E, Asghor QH, Ahmed M. In-vitro Antibacterial Activity of Leaf and Root Extract of *Cassia fistula* Dinajpur med. Clg. Journal, 2010; 3: 10-13.
37. Abo KA, Lasaki SW, Deyemi AA. Laxative and antimicrobial properties of Cassia species growing in Ibadan. Nigerian Journal of Natural Products and Medicine, 1999; 3: 47-50.
38. Duraipandiyana V. and Ignacimuthu S. Antibacerial and antifungal activity of *Cassia fistula* Linn.: An Ethnomedicinal plant. Journal of Ethanopharmacology, 2007; 112: 590-94.
39. 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.
40. M. Govindarajan, A. Jebanesan, T. Pushpanathan, Parasitology Research, 2008, 102(2), 289-292.
41. Patricia Sartorelli, Camila Salomone Carvalho, Juliana Quero Reimao, Marcelo Jose Pena Ferreira and Andre Gustavo Tempone. Antiparasitic activity of biochanin A, an isolated isoflavone from fruits of *Cassia fistula* (Leguminosae). Journal of Parasitology Research, 2009; 104: 311-314.
42. Das Sangita, 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. Sivanesan Karthikeyan, Kuppannan Gobianand. Antiulcer activity of ethanol leaf extract of *Cassia fistula*. Int. Journal of Pharmacognosy, 2010; 48: 869-77.

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