



Review Article

PHYTOCHEMISTRY AND PHARMACOLOGICAL ACTIVITIES OF *ARAGVADH* (*CASSIA FISTULA* LINN): A REVIEW

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ABSTRACT

Aragvadh (*Cassia Fistula* Linn) also known as Purging Cassia or Indian Laburnum is an important medicinal plant used in Indian system of medicine. The Purging Cassia - also called *Cassia fistula* Linn. is a moderate to medium sized deciduous tree which is very common in Indian continent. The fruit pulp contains the anthraquinone and rhein(I) in the free state as well as in the form of glycoside, responsible for significant mild purgative action. The oldest record of its medicinal use can be traced as far as 3000 years when *Charak* and *Sushruta* used *Aragvadh* in the treatment of different kinds of skin diseases (*Kushthas*). The present article gives an account of updated information on this important plant which is highly beneficial for different ailments. The review reveals about different activities of plant like purgative, diuretic, laxative, anti-asthmatic, hepato protective, anti-allergic and various other important medicinal properties. This will also provide valuable information which will assist the scientists in getting more advanced knowledge about this plant species.

Key words: *Aragvadh*, *Cassia Fistula* Linn, Purging Cassia, Anthraquinone, *Kushtha*.

INTRODUCTION

Cassia fistula Linn. also known as Purging Cassia or Indian Laburnum is an important medicinal plant used in Indian system of medicine¹. The species is native to the Indian subcontinent and adjacent regions of Southeast Asia. It ranges from southern Pakistan eastward throughout India to Myanmar and Thailand and south to Sri Lanka. In literature, it is closely associated with the Mullai (forest) region of Sangam landscape. It is the national tree of Thailand, and its flower is Thailand's national flower. It is also the state flower of Kerala in India and of immense importance amongst the Malayali population². In *Vedic* Literature, the dried branches of *Aragvadh* are used for Ritual performances (Ap. Gr. 7/18/7)³. *Cassia fistula* Linn. is a moderate sized deciduous tree, distributed throughout India as wild or cultivated plant. It is 18-15m to 24m in height, with greenish

grey smooth bark when young and rough, dark brown when mature. Leaflets are 8-12 pair; flowers are yellow, long drooping racemes; pods are cylindrical and pulpy; seeds are light brown, hard and shiny. *Cassia fistula* Linn. has shown various pharmacological activities like antimicrobial, antifungal, antipyretic, analgesic, larvicidal, anti-inflammatory, anti-oxidant, anti-tumour, hepatoprotective and hypoglycemic. Ayurvedic medicine recognizes its use in *Vibandha*, *Udavarta*, *Gulma*, *Shula*, *Udararoga*, *Hridroga* and *Prameha*^{4,5}. *Aragvadh* is used in Ayurvedic remedies for curing flatulence, inflammation, abdominal distension, hepato biliary disorders, constipation, skin diseases, intermittent fever, especially for black water fever, worm infestation⁶. Traditionally, *Cassia fistula* Linn. is taken in many forms as

*Aragvadhadi kvatha, Aragvadhadi leha, Aragvadhariшта, Mahamarichyadi taila*⁷.

VERNACULAR NAMES

Aragvadha is commonly known as *Rajavriksh, Shampaka, Chaturangula, Arevata, Vyadhighatah, Kritmalah, Suvarnakah, Karnikar, Dirghaphala, Naktamalah* in Sanskrit⁸, *Amlatas* in Hindi, *Sunaru* in Assamese, *Sundali* in Bengali, *Garmal* in Gujarati, *Kakee* in Kannada, *Hari* in Kolkata, *Rajbriksha, Kitola* in Kumaon, *Konnakkaya* in Malayalam, *Bahava* in Marathi, *Rajbirjj* in Nepali, *Sunari* in Oriya, *Karangal* in Punjabi, *Chimkani* in Sind, *Kone* in Tamil, *Rela* in Telugu, *Katha-ul-hind* in Arabic, *Gnoo - kyee* in Burmese⁹, *Purging cassia, Riding pipe, Indian laburnum* in English¹⁰, *Karangal* by Gujjar tribes of Haridwar¹¹.

The plant *Cassia fistula* is known as *Aragvadha* as it destroys even the suspicion of diseases. It bears beautiful (*Pragrah*), golden yellow flowers (*Svarnanga*) adorned by the garland (*kritmala*) due to which it looks like king of trees (*Rajvriksha*). It has long stick like fruit (*Dirghphala*) inside which the marrow is demarcated at every four fingers distance (*Chaturangula*). As a drug, it provides well being (*Arogya, Shimbi, Shampaka*) by alleviating many diseases (*Aragvadha, Vyadhighata*), particularly *Aama (Amaha), fever (Jwarantaka)* and *kustha (Kustha-sudan)*. It is a mild and safe purgative (*Arevata*).^{12,13}

CLASSICAL REFERENCE

The oldest record of medicinal use of *Aragvadh* can be traced as far as 3000 years when *Charak* and *Sushruta* used *Aragvadha* in the treatment of different types of *kustha* (skin disorder). *Charak* had placed it under *kusthaghana, Kandughana*¹⁴, *Virechan*¹⁵ and *Tikta skanda*¹⁶ while *Sushruta* placed it under *Aragvadhadi gana*¹⁷ and *Shyamadi gana*¹⁸. *Ashtang Sangraha* had included it in *Kushtagana gana*¹⁹ and *Ashtang Hridayam* in *Virechan gana, Shleshma nashaka gana*²⁰, *Aragvadhadi gana*²¹ and *Shyamadi gana*²². In *Charak samhita* one complete chapter has been devoted to the mode of action of *Aragvadha* by the name *Chaturangula kalpa in kalpa sthana*²³ and *Aragvadhivyadhya* in *Sutrasthana*²⁴. *Susruta* has mentioned the use of *Aragvadha* in the form of *Kashaya, Arishta, Asava, Sura* and *Avaleh* in the *Mahakustha chikitsa*²⁵.

Kaiyedeve nighantu has mentioned it in *Aushadhi Varga*²⁶. *Dhanwantri nighantu* has included it in *Guduchyadi varga*²⁷, *Bhavaprakash*

nighantu and *Priya nighantu* in *Haritakyadi varga*^{28,29} and *Raj nighantu* in *Prabhadraadi varga*³⁰.

BOTANICAL DISCRIPTION

Cassia fistula Linn. is a moderate to medium sized deciduous tree 6-9 meters tall with a straight trunk and spreading branches. The stem bark is pale grey, smooth and slender when young; and dark brown, rough when old. Very showy in flowering stage, that's why called as king of trees (*Rajvriksha*). Leaves young, flowers bright yellow, 5 cm across, in lax drooping clusters to 60 cm long. Petals 5, obovate veined. The three lowest stamens longer than others, curled and with large anthers. Pod long cylindrical to 60 cm, brown to glossy bark³¹.

Flowering – February to April, **Fruiting** – May to January³².

DISTRIBUTION

It is indigenous to India and naturalized in Tropical Africa, South America and West Indies, found throughout in India from Punjab to Kanyakumari in all deciduous forests and hilly tracts. It is sometimes cultivated for its beautiful yellow flowers, in the gardens and avenues. Common throughout in Dun and Saharanpur, also found in low valleys upto 4000 ft.³³

The heartwood is yellowish or brick-red, tough, very hard and extremely durable excellent for posts carts, and agricultural implements. The dark-brown sweetish pulp of the ripe fruit is an ingredient of spiced native tobacco. The twigs are often lopped for cattle fodder. The gum exuded by the bark is astringent. The bark is used for tanning and dyeing³⁴.

MACROSCOPIC FEATURES

- **Root:** The root bark is reddish brown and rough with numerous horizontal lenticels. The outermost tissue of the bark can be peeled off easily. The inner surface of a fresh bark is smooth and light pink in colour.
- **Stem:** The trunk is almost straight with spreading branches and branch lets. When young, outer surface of the stem is smooth and greenish to pale grey in colour but the older stems are dark brown to greyish white in colour with a rough surface.
- **Leaves:** Alternate, 20-25 cm, long, peripinnate, the leaflets are 4-8 pairs, when fresh are coriaceous and on drying they become papery. Petioles 6-9 mm long. Leaflets large, 5-12 by 3.5-9 cms midrib

densely pubescent beneath. Young leaflets are tender, green, occasionally tinged with pink or of a rich copper colour, mature leaves bright green and glabrous above and paler, somewhat silvery beneath.³⁵

- **Fruits and seeds:** The pods are 40-70 cm long and 20-27 mm in diameter mostly straight, smooth. Internally, the pod is divided by thin, buff colored, transverse dissepiments at intervals of about 0.5 cm. Each compartment contains one seed and the fresh fruit is filled with a black pulp, which contracts on drying, 25-100 seeds of each pod are flat, oval and reddish brown in colour³⁶.

How to Identify

Outer surface of the root is reddish brown and rough with numerous horizontal dots. Stem bark is also rough due to the presence of lenticels. Leaflets are 4-8 pairs, coriaceous flowers are golden yellow in colour. Pods are long, slightly curved, sub-cylindrical, dark chocolate brown, seeds are embedded in the inner compartment of the fruit and are flat, reddish brown in colour with well marked rapnae.³⁷

SUBSTITUTE

Pods of *Cassia grandis* Linn. (Horse cassia) are sometimes used as a substitute. The pods are longer, thicker and heavier than those of *C. fistula* about 50-80 cm long and 4cm in diameter, laterally compressed, surface rough, one prominent ridge on the dorsal side and two on the ventral surface.³⁶

CHEMICAL COMPOSITION

Amaltas is rich in Tannin³⁸, anthraquinones, rhein I, emodin II, kaempferol III, Proanthocyanidins³⁹, steroids, gum (Glactomannans)⁴⁰, waxes, volatile oil and the alkaloid chaksine⁴¹.

The root bark contains Tannins, phlobaphenes and anthraquinone derivatives. Ramiah and Abraham (1977) isolated and identify one proanthocyanidine as fistucacidin⁴².

The aqueous extract of the leaves of the cassia fistula was fractionated by precipitation with an acid. Two glycosides identified as Sennoside A and Sennoside B were isolated. Seasonal variation was found to occur in glycosidal content of the leaf⁴³.

Leaves are found to contain free rhein, rhein glycoside, Sennoside A and Sennoside B. Cassia genus are generally rich in tannins. The fruit pulp contains the anthraquinone rhein (I) in

the free state as well as in the form of glycoside⁴⁴. Kumar et al (1966) have isolated a glycoside fistuline, from the flower⁴⁵.

PHARMACOLOGICAL ACTIVITIES

Antitumor activity

The effects of methanolic extract (ME) of *Cassia fistula* seed on the growth 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 tumour volume and viable tumour cell count in the EAC tumour hosts. Cytological studies have revealed a reduction in the mitotic activity, and the appearance of membrane blebbing and intracytoplasmic vacuoles in the treated tumour cells. Improvement in the haematological parameters following ME treatment, like haemoglobin content, red blood cell count and bone marrow cell count of the tumour bearing mice have also been observed. The results of the present study suggest that ME of *C. fistula* seed has an antitumor activity.^{46,47}

Antimicrobial activity

Antifungal activity of leaf extract of *Cassia fistula* was reported⁴⁸. In-vitro Anti bacterial activity observed in Leaf and Root Extract of *Cassia fistula*⁴⁹. The fruit pulp is active against *Mycobacterium tuberculosis*⁵⁰. The antibacterial activity of *Cassia fistula* has been reported by Patel and Patel⁵¹. The leaves, stem bark and fruit pulp showed antibacterial activity. The fruit pulp was the most potent in this respect. The activity might be due to the presence of flavonoids. The solvent ether extract of the fruit pulp possess the maximum activity and when compared to chloramphenicol, the activity of 1 gm of this extract was found to be more than that seen with 100-g of chloramphenicol⁵². Lilly Kutty and Santa kumari reported that stem bark and root bark possessed antifungal activity⁵³. The antifungal activity was further confirmed by studies on the flavinoidal glycosides isolated from the acetone extract of the root. It is reported (annual report CCRIMH, circuit no. 4, clinical report, 1970, Trivandrum) that cases of *Vipadika* and *Gajacharma*, which were cases of dermatophytic infections showed clearing of lesions with relief of pruritis with *Aragwadha moola twak* leepam⁵⁴.

Purgative activity

The aqueous extract of the fruit pulp had significant purgative action, the activity is due to the presence of anthraquinones present⁵⁵.

Antioxidant activity

The investigation suggest that the antioxidant properties of 90% ethanol extracts of leaves, and 90% methanol extracts of stem bark, pulp and flowers from *Cassia fistula*. The antioxidant activity power was in the decreasing order of stem bark, leaves, flowers and pulp and was well correlated with the total polyphenolic content of the extracts. The reason for low antioxidant activity in the flower and pulp fractions could be the presence of some pro oxidants, such as chrysophanol and reducing sugars which dominate the antioxidant compounds present in the extracts. Thus, the stem bark had more antioxidant activity in terms of reducing power, inhibition of per oxidation, O₂ and DPPH radical scavenging ability⁵⁶.

Anti-leishmaniatic activity

The effectiveness of *Cassia fistula* in the treatment of leishmaniasis, the efficacy of concentrated boiled extract and hydroalcoholic extract of *C. fistula* on leishmaniasis was compared with intralesional injection of Glucantime [meglumine antimonate] in this study. Results indicate that the *C. fistula* fruit gel increases the efficacy of intralesional meglumine antimonate for the treatment of cutaneous leishmaniasis. Combination therapy with intralesional meglumine antimonate and *C. fistula* fruit gel should be considered for the treatment of acute cutaneous leishmaniasis⁵⁷.

Anti ulcer activity

The ethanol leaf extract (ELE) of *Cassia fistula* Linn. (Caesalpinaceae) was evaluated for anti ulcer activity against pylorus ligation - Induced gastric ulcer.⁵⁸

Wound healing activity

C.fistula treated rats showed better wound closure, improved tissue regeneration at the wound site, and supporting histo pathological parameters pertaining to wound healing.⁵⁹

AYURVEDIC PROPERTIES AND PHARMACOLOGICAL EFFECT

According to Ayurveda Literature, *Aragvadha* is *Madhura* (sweet) in *Rasa* (taste); *guru* (heavy), *Mridu* and *Snigdha* in *Guna* (properties); *Sheeta* (cold) in *Virya* (potency) and *Madhura* in *Vipaka* (metabolism). Due to these properties, *Aragvadha* pacifies *Vata* and *pitta*⁶⁰. Pharmacological properties of *Aragvadha* are *Rechaka*, *Jwaraghna*, *Hridhya*, *Raktapitta Shaamaka*, *Kushthaghna*, *Ruchikara*, *Yakrita*

Uttejaka, *Anulomana*, *Shotha hara*, *Vedna sthapaka*, *Pitta saraka*, *Mutra ranjaka* and *Daha prashamaka*⁶¹.

MEDICINAL USES

- *Chrarak* has categorized the pulp of *Aragvadha* under soft purgative (C.S.Su. 25/40)⁶². According to *Charak*, the pulp of its fruit is useful in fever, Heart diseases, gout, flatulence and it can be given even to Infant, old, weak and emaciated person without any harmful effect (C.S. Ka. 8/4,5)⁶³.
- Pulp of its fruit can be given with milk or with *draksha swaras* for fever (C.S.Chi. 3/232)⁶⁴. Decoction of *panchang* of *Amaltas* should be used for bathing, washing and drinking in skin diseases (*kustha*) (C.S.Chi. 7/92)⁶⁵.
- Pulp of fruit can be given with juice of sugar cane in jaundice (C.S.Chi. 16/58)⁶⁶ (A.H.Chi. 16/41)⁶⁷.
- The leaves of *Aragvadh*, bark of *Shleshmatak* etc. should be used separately or jointly as a local paste added with little ghee for curing Erysipelas (C.S. Chi.21/89-92)⁶⁸.
- The tender leaves of *Sunisannaka*, *nimbi*, *arka*, *vetas* and *aragvadha* should be used as vegetable cooked with water and oil and without salt for curing *Urustambha*. (C.S.Chi. 27/27)⁶⁹.
- In *Udara roga* caused by *Pitta*, the patient should be purgated with milk added with paste of *Trivrit* or processed with *Eranda*; or *Satala* and *Tryamana* or *Aragvadha* (C.S.Chi. 13/69-70)⁷⁰.
- According to *Sushruta*, decoction of *Amaltas* leaf should be used to clean wind. (S.S.Chi.19/39)⁷¹.
- Decoction of *Amaltas panchang* should be used in *Haridrameha* (S.S.Chi.11/8)⁷². Medicated *Ghritha* prepared from root bark of *Amaltas* should be regularly taken orally to cure skin diseases (*Kustha*) (S.S.Chi. 9/7)⁷³.
- Powder of *Aragvadha*, *Haridra* and *Himsra* mixed with honey and *ghee* is made into a wick which is applied in wounds for their purification (S.S.Chi. 8/30)⁷⁴.
- Decoction of the leaves of *Karavira*, *Jati*, *Aragvadha*, *Tarkari* and *Arka* should be used for washing Venereal diseases (S.S. Chi. 19/39)⁷¹.

- According to *Vagbhata*, *Ghee* is cooked with root bark of *Aragvadha* and taken with decoction of *Khadira* which helps in destroying *Leprosy* (A.H.Chi. 19/13)⁷⁵.
- For curing *Amavata*, Leaves of *Aragvadha* are fried with mustard oil and taken in evening followed by meal (B.P.Chi. 26/52)⁷⁶.
- Root bark of *Aragvadha* pounded with rice water is used as snuff and paste in case of *Gandamala* (V.M.41/23)⁷⁷.
- . Application of leaf *Kalka* with *Kanji* in skin cures *Dadru*, *Shidhma*, *Kitibha* and other skin disease⁷⁸.
- The local application of paste of root of *Aragvadh* separately pounded with water helps in curing the severe venereal disease. The paste of leaves of *Aragvadh* pounded with breast milk should be applied on wound and *Stria gravidarum* for healing⁷⁹.
- In the Konkan, the juice of the young leaves is used to cure ringworm and to allay the irritation caused by the application of the marking nut juice⁸⁰.

IMPORTANT FORMULATIONS

Aragvadhadi Lehya, *Aragvadhadi Taila*, *Aragvadhadi kwath churna*, *Aragvadhharishta*⁸¹.

CONCLUSION

This substantial literary survey revealed that *Cassia fistula* Linn. is an important medicinal plant which can be used for curing different ailments. The plant shows the presence of many chemical constituents which are responsible for different pharmacological activities. The plant *Cassia fistula* Linn. can be taken as *Amaltas*. The Fruit pulp is sweet, Cold, heavy and act as a good purgative. It cures fever, haematemesis, Leucoderma, eczema and other skin diseases. The paste of the root taken with milk ceases arthritis and ringworm. It is fruit pulp is purgative due to presence of anthraquinones. Constipation is a major complication of high grade fever, so it has been advised to take its pulp regularly in fever. *Virechan* is best kind of treatment for skin diseases, being soft purgative it has been indicated in skin diseases by seers of Ayurveda. So this review clearly reveal the importance of this medicinal plant *Aragvadha* - *Cassia fistula* Linn. But it will be a boon to the Health system only when this traditional knowledge is integrated for demonstration of clinical and biochemical evidence of efficacy.

REFERENCES

1. "The Wealth of India" National Institute of Communication and Information Resources, CSIR New Delhi, 2007; 2:223.
2. http://en.wikipedia.org/wiki/Cassia_fistula (accessed on 15/04/2015)
3. Dr. J.L.N Sastry, *Dravyaguna Vijnana*, Vol. 2, Forward by Prof. K.C. Chunekar, Varanasi: Chaukhambha Orientalia; Year 2005.p. 200
4. Theesan Bahorun, Vidushi S, Neergheen, Okezie IA. Phytochemical constituent of *Cassia fistula*. African journal of Biotechnology, 2005;4:1530-40.
5. The Ayurvedic Pharmacopoeia of India, Government of India, Ministry of health and family welfare, Department of Ayush, New Delhi.
6. Database on "Medicinal plant "Used in Ayurveda, Vol- 02,CCRAS,Propagation and cultivation P.G 34.
7. Indian Medicinal Plant, Dr prakash Paranjpe, Chaukhamba Sanskrit Pratishthan, delhi, pg 16
8. Bhavaprakash Nighantu - Dr. K.C. Chunekar - Chaukhamba Bharti academy reprint 2002 1/148-149, page 68.
9. Nadkarni, A.K. 1954 Indian Materia Medica vol. I-285, Popular book depot, Bombay.
10. Brahma varchas Ayurveda ka Pran - Vanoshdhi Vijnana, yuga nirmaan yojna, Gayatri tapobhumi, Mathura, 6th edition, 2006, page -125.
11. Tiwari, R.C. Ethnomedicinal plants of chandidevi hills of Haridwar in perspective of ayurveda Ph.D. thesis, S.R.K.Ayu. Jodhpur.
12. Namrupajnanam - Dr. P.V. Sharma page 28.
13. Dr J.L.N. Shastri, *Ayurvedokta Oushadha Niruktamala*, Varanasi: Chaukhamba Orientalia, Print: 2001; p. 14
14. *Charaka Samhita*, Prof. Priyavrat Sharma, Chaukhamba Orientalia, Varanasi. Print: 2004; Vol.1 (Sutra sthana to Indriya sthana); p. 26
15. Ibid; p. 19
16. Ibid; p.391
17. Shastri-Ambikadatta - *Sushruta Samhita* part I, Chaukhamba Sanskrit Sansthan, Varanasi. Reprint: 2007; p.142
18. Ibid; p. 143
19. Prof. K.R. Srikantha Murthy, *Ashtanga Samgraha of Vagbhata* Vol. 1, Varanasi: Chaukhambha Orientalia, Reprint: 2005; p. 303.

20. Ashtangahrdayam of Vagbhata, Translated by Kaviraja Atrideva Gupta, Edited by Vaidya Yadunandana Upadhyaya, Chowkhamba Prakashan, Varanasi. Reprint: 2011; p. 104
21. Ibid; p. 105
22. Ibid; p.107
23. Charaka samhita of Agnivesha, Pt. Kashinath Shastri Part 2, Varanasi: Chaukhambha Sanskrit Sansthan. Reprint: 2006; p. 842 – 845
24. Charaka samhita of Agnivesha, Pt. Kashinath Shastri Part 1, Varanasi: Chaukhambha Sanskrit Sansthan. Reprint: 2006; p. 49 - 54
25. Shastri-Ambikadatta - Sushruta Samhita part I, Chaukhamba Sanskrit Sansthan - chikitsa sthan chapter 9, page 50-53, reprint edition 2005.
26. Prof. Priya Vrata Sharma and Dr. Guru Prasada Sharma, Kaiyadeva Nighantu, Varanasi: Chaukhambha Orientalia, Reprint: 2006; p.174
27. Prof. Priya Vrata Sharma and Dr. Guru Prasada Sharma, Dhanwantari Nighantu, Varanasi: Chaukhambha Orientalia, Reprint: 2012; p. 55.
28. Bhavaprakasha Nighantu of Shri Bhavamisra, Commentary by Prof. K.C. Chunekar, Edited by Late Dr. G.S. Pandey, Chaukhambha Bharati Academy, Varanasi. Reprint: 2013; p. 66
29. Prof. Priya Vrat Sharma, Priya Nighantu, Varanasi: Chaukhambha Surbharati Prakashan, Edition 2004, p.14
30. Dr. Indradeva Tripathi, Raja Nighantu of Pandit Narhari, Varanasi: Chaukhambha Krishnadas Academy, p. 273
31. Polunin, oleg and Stainton, Adam - Concise flowers of the Himalaya- Oxford University Press - 4th edition, 2006 page 33.
32. Rawat-Raghubir Singh, Bhatt, Vinod kumar - Nature's pharmacopoeia- Medicinal plant diversity in Doon valley - Navdanya 105, Rajpur Road, Dehradun April - 2002 page 32
33. Singh, Ram Sushil - Vanoshdi nidashika - Uttar Pradesh Hindi Sansthan 6, Mhatama Gandhi marg, Lucknow. IIIrd edition 2002, page 24.
34. Kanjilal, Upendranath - Forest flora of the Chakrata, Dehradun and Saharanpur forest division - Natraj publishers Dehradun 2004, page 206.
35. Lakshmi, N and Kolammal M. Pharmacognostic studies on *Cassia fistula* jour. Res. Indian Med 9(3) page 68-81.
36. Wallis, T.E. Text book of pharmacognosy 5th edition, 252-253. J & A churchil ltd. London.
37. Raghunathan, K. and Mitra, Miss Roma. Pharmacognosy of Indigenous drugs volume 1st CCRAS - New Delhi - page 34.
38. Sarin, Y.K. and Kapoor, L.D. Bull Reg. lab. Jammu India I:136-141.
39. Narayan, V and Seshadri, T.R. Indian chemical journal, Bombay- 1966, 4, 460; 1972, 10, 379-381.
40. Morimoto, I.Y. and Unrao, A.M. Hawaii-farm Sci 1:26-8.
41. Wiesner, K.*et al*, J.Am. chem Soc. 80:521
42. Ramiah, N. and Abraham Koshy, Jour. Res. Indian Med. Yoga & Homeo, 12:(1):77-79
43. Kaji, K.N. and Khorana, M.L, Studies in *Cassia fistula* leaves curr. sci. 33:462.
44. Kapadia, G.J. and Khorana, M.L., Studies on active constituents of *Cassia fistula* l. pulp II lyodia 25(1):59-64.
45. Kumar et al, Chemical examination of *Cassia fistula* flowers. Indian j. chem 4:460
46. Sen A.B. and Shukia Y.N., Chemical examination of *Cassia fistula*, J. Indian Chem. Soc., 45, 744 (1968)
47. Aweng E.R., Nur Hanisah, Mohd Nawi M.A., Nurhanan Murni Y. and Shamsu M., Antioxidant activity and phenolic compounds of *Vitex trifolia* Var, *Simplicifolia* associated with anticancer, ISCA J. Biological Sci. 1(3), 65–68 (2012)
48. Phongpaichit S, Pujenjob N, Rukachaisirikul V. and Ongsakul M. Anti fungal activity from leaf extracts of *Cassia alata*, *Cassia fistula* and *Cassia tora* L. Songklanakarin Journal Sci. Technology, 2004; 26:741- 48.
49. Awal MA, Ahsan SM, Haque E, Asghor QH, Ahmed M. In-vitro Antibacterial activity of Leaf and Root Extract of *Cassia fistula*. Dinajpurmed.Clg. Journal, 2010; 3:10-13.
50. Modi, F.K. and Khorana M.L., A study of *Cassia fistula* pulp. Indian j. pharm 14:61
51. Patel, R.P. and Patel, K.C., Antibacterial activity of *cassia fistula* Indian j. pharm 18:107.110
52. Raghunathan, K. and Mitra, Miss Roma, Pharmacognosy of Indigenous drugs vol. I CCRAS New Delhi Page -37
53. Lilly Kutty, L and Santha Kumari, G., Antimicrobial activities of *Cassia fistula* Linn jour. Res. Indian Med. 4(1):25-36
54. Venkitaraman, S and Radhakrishnan, N., Antifungal activity of the flavonoids
55. Litty Kutty, L., Pharmacological studies of *Cassia fistula* M.D thesis. University of Kerala.
56. Siddhuraju P., Mohan P.S., Becker K., Food Chemistry, 79(1), 61-67 (2002)
57. Abu Sayeed M., Abbas Ali M., Astaq Mohal Khan GRM, Rahman MS Studies on the

- characterization and glyceride composition of Cassia fistula seed oil, Bangladesh J. Sci. Indust. Res., 34, 144-148 (1999)
58. Sivanesan Karthikeyan, Kuppannan Gobianand. Anti ulcer activity of ethanol leaf extract of *Cassia fistula*. Int. Journal of Pharmacognosy, 2010;48:869-77.
59. Kumar Muthusamy Senthil, Sripriya Ramasamy, Raghavan Harinarayanan Vijaya and Sehgal Praveen Kumar. Wound Healing Potential of *Cassia fistula* on Infected Albino Rat Model. Journal of Surgical Research: 2006; 131: 283-289.
60. Prof. D. Shanth Kumar Lucas, Dravyaguna Vijnana, Vol, 2, Varanasi: Chaukhambha Visvabharti, Reprint: Year 2013.p. 144
61. Shri Bhava Mishra, Bhava Prakasha Nighantu, Translated by Prof. K.R. Srikantha Murthy, Vol. 1, Varanasi: Chaukhambha krishnadas academy, Year 2004.p
62. Charaka Samhita of Agnivesha refined and annotataed by Charaka and redacted by Dridhabala, edited by Prof. Priyavrat Sharma, Vol. 1, Varanasi: Chaukhambha Orientalia, Print: 2005 Sutra sthana to Indriya sthana; p. 168
63. Charaka Samhita of Agnivesha, Pt. Kashinatha Shastri, Edited by Dr. Gangasahaya Pandeya, Part 2, Varanasi: Chaukhamba Sanskrit Sansthan, Reprint: 2006; p.842
64. Ibid; p. 120
65. Ibid; p. 213
66. Ibid; p. 422
67. Ashtanga Hridaya of Vagbhatta by Kaviraja Atrideva Gupta, Edited by Vaidya Yadunandana Upadhyaya, Varanasi: Chaukhambha Prakashan, Reprint: 2007; p. 398
68. Charaka Samhita of Agnivesha, Pt. Kashinatha Shastri, Edited by Dr. Gangasahaya Pandeya, Part 2, Varanasi: Chaukhamba Sanskrit Sansthan, Reprint: 2006; p. 527
69. Ibid; p. 686
70. Ibid; p.326
71. Sushruta Samhita of Maharishi Sushruta, Edited with Ayurveda Tattv a Sandipika by Kaviraja Ambika Dutta Shastri, Part 1, Varanasi: Chaukhamba Sanskrit Sansthan, Reprint: 2007; p. 91
72. Ibid; p. 60
73. Ibid; p. 50
74. Ibid; p. 47
75. Ashtanga Hridaya of Vagbhatta by Kaviraja Atrideva Gupta, Edited by Vaidya Yadunandana Upadhyaya, Varanasi: Chaukhambha Prakashan, Reprint: 2007; p. 406
76. Bhavaprakasa of Bhava misra by Pandit Shri Brahma Shankara Mishra, Part 2, Varanasi: Chaukhambha Sanskrit Sansthan, Reprint: 2005; p. 286
77. Dr. (Km.) Premvati Tewari, Vrindamadhava or Siddha Yoga, Varanasi: Chaukhambha Visvabharati, Print: 2007; p. 415
78. Ibid; p. 466
79. Priya Vrat Sharma, Classical Uses of Medicinal Plants, Varanasi: Chaukhamba Visvabharti, Reprint: 2004; p.42
80. Kirtikar K.R. and Basu B.D., Indian Medicinal Plants, Edited by E. Blatter, J.F. Caius and K.S. Mhaskar, Vol. 2, Dehradun: International book distributors; Year 1994.p. 857
81. Prof. D. Shanth Kumar Lucas, Dravyaguna Vijnana, Vol, 2, Varanasi: Chaukhambha Visvabharti, Reprint: Year 2013.p.146

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