

Cassia tora Linn.-A Review on Medicine powerhouse

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Abstracts: Medicinal plants role in treatment science gets justified by the history of its application by our ancestors, in almost all disease conditions. The basis of this fact; relies on the subsequent development of regionalized traditional knowledge, namely, Western medicine, Unani medicine, and Ayurvedic medicine; originating at Mesopotamia – Egypt, Islamic block countries, and India. *Cassia tora* L., Casalpiniaceae, is a wild crop and grows in most parts of India as a weed. *Cassia tora* L. grows in hot, wet, tropical, climates both wild and commercially. *Cassia* is a tonic, carminative and stimulant. Proven scientific records of possessing anthraquinones, chrysophanol, emodin, rhein, euphol, basseol, etc. supports its applicability in different disease forms. The plant has a proven pharmacological publication of having antifungal, antioxidant, ACE-inhibitor effect, effective treatment in psoriasis, antiulcer activity, antimicrobial activity, immunostimulatory effect, anticancerous, hypolipidemic, antimutagenic, hepatoprotective, antilarvicidal, and many more. Therefore, this review would focus on covering the updates of the pharmacological potential explored and stated in journals.

INTRODUCTION

Times have changed since few decades, in the remedial world. Now is a situation of total U-turn towards traditional system via selecting plants as a source for producing and developing medicines. Selection criteria lies on the two main factors namely, lower side effects and better efficacy. Another reason is that still 80 % of population residing in developing block of world, relies on traditional system of medicine, or traditional knowledge. Medicinal plants are richest source of traditional system of medicine, modern medicine, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates, and chemical entities for drugs. [1-2] India is a country of vast bio-diversity and has nearly 20,000 of plants of medicinal importance. [3] Estimate of 250,000 flowering plants, 8000 species is weeds. [4] Most of the world is ignorant of the positive side of the plant, that is, its medicinal value. [5-6] the study of weeds as potential traditional medicine has not been accepted so far in the medicine world. Due to large scale loss of diversity of plants, natural habitats, documentation of medicinally important weeds is need of hour. [7-11] Apart from this traditional knowledge of medicinal plants has always guided the search for novice leads. No matter what advances in medicinal drug discovery technology take place, like high throughput screening and many advanced techniques in pharmaceuticals and pharmacology; traditional knowledge would always be referred as a soul criteria in search of prospective drug leads. [12]

In many parts, the practice of screening of medicinal herbs as a potential source of biodynamic compounds of therapeutic value in phytochemical research has already begun. Ethnomedicobotanical study of tribal people can bring out even more efficient herbal drugs. Foreg., In an exploratory survey of medicinal plants used by the siddi community of utara kannada have revealed that they are using atleast 58 plants to heal various disorders. Traditionally *Cassia tora* has been used for hair follicle infections and boils-furancle. [13]

Cassia tora

Cassia tora L. (Caesalpiniaceae) is widely distributed in tropical and asian countries. The seeds of *Cassia tora* are reputed in Chinese medicine as vision-improving, antiasthenic, asperient, and diuretic agents. *Cassia tora* have shown to possess various biological and pharmacological activities including antihepatotoxic, antiallergic, antimutagenic, antifungal, radical scavenging, and antimicrobial. [13] Moreover *Cassia* is a large genus of around 500 species of flowering plants in the family leguminosae and is widely distributed throughout Asia including India, Mauritius, China, East Africa, South Africa, America, Mexico, West Indies and Brazil. It is found as weed throughout India, mainly in Himachal Pradesh, Bihar and Orissa. It constitutes as a part of an important Ayurvedic preparation "Dadhughnavati" which is one of the successful antifungal formulation. [14] The leaves are used as laxatives in the form of decoction. Both leaves and seeds constitute a valuable remedy in skin diseases, chiefly for ringworms and itch. In China, the seeds are used externally for all sorts of eye diseases. In Indo-China, the pods are used in dysentery and diseases of the eye. In Nigeria, the leaves are used as a mild laxative. The weed is used in various Gold Coast medicines, chiefly as a purgative. In Madagascar and La reunion, the root is considered bitter, tonic, stomachic. The leaves are used as antiperiodic, aperients, anthelmintic; they are given to children with intestinal wounds. [15] Traditionally, *Cassia tora* L., had been used as ear drops by wrapping the fresh leaves in banana leaf and further heating for 5 min. The expressed juice from these leaves are used as ear drops to cure ear troubles. Root paste is applied as paste in case of snake bites; seed paste is applied on skin diseases like itches, eczema, and ringworm. [16] The seed juices have been found applicable in traditional practices for easy expulsion of worms. [17] In folk medicines, *Cassia tora* have been associated with lot of significance, such as, in Ayurveda *Cassia tora* (Tagirisa) have been associated as aperient, germicide, anodyne; in Siddha medicinal system, its associated with Veneral diseases, glandular swellings, fever, skin diseases, urticaria- roots, seeds, and leaves been regarded as important plant parts. [18]

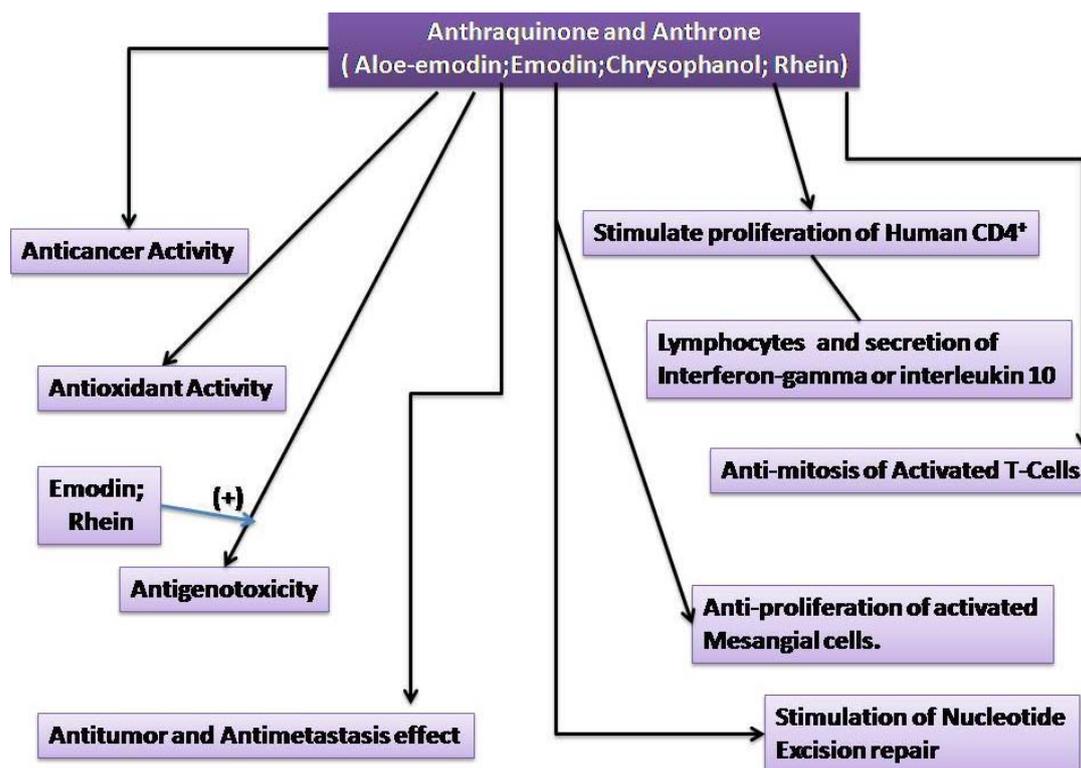
General Botanical Characteristics of *Cassia*

Cassia species belong to family Caesalpiniaceae. Caesalpiniaceae is often treated as a subfamily,

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IMMUNO-STIMULATORY EFFECT OF *Cassia tora* (L.) Roxb.

Figure 1: A brief on pharmacological aspects of anthraquinone in *Cassia tora* (L.)

Caesalpiniodeae, of the large family leguminosae. It is closely related families Mimosaceae and papilionaceae. Caesalpiniodeae consist of trees, shrubs and a few woody herbs found in the tropics. Some species of caesalpiniaceae yield dyes. All species of *Cassia* have bright yellow flowers of characteristic shape. The typical flower consists of five similar sepals and petals. Caesalpinoideae usually have small bracteoles, neither resembling nor taking the place of the calyx, which is normally developed and more or less conspicuous. Stamens which are polymorphic are ten in number with the upper 2-3 often reduced. Pods could be cylindrical or flattened, dehiscent, or indehiscent, with or without septa between seeds, constricted or between seeds. Leaves are paripinnate. Petiolar glands are present. A few list of *Cassia* species are as follows; *C.rotundifolia* Pers., *C.Jaegri* key in Bull., *C.nigracans* Vahl., *C.kirki* Oliv., *C.mimosoides* Linn., *C.manni* Oliv., *C.aubrevellei* Pellegr. In Bull., *C.sieberiana* DC., *C.aerereh* Del., *C.alata* Linn., *C.podocarpa* Guill. and Perr., *C.siamea* Linn., *C.italica* (Mill.), *C.fruticosa*.^[18]

The content of anthraquinones seems to be closely linked to the plants physiological processes, and the most frequent substitution pattern is that of emodin. It was discovered that in *Cassia* senna seedling, chrysophenol was the first anthraquinone formed, then aloe-emodin appeared, and finally rhein. During fruit development, the amount of aloe-emodin glycoside and rhein glycoside fall markedly, and sennosides accumulate in the pericarp.

It also shows the significance of seasonal changes in the concentration of anthraquinone content. Anthraquinone attained peak levels during the months of October and March, corresponding to the dry season in the northern

part of Nigeria; and a significant decrease occurred during the rainy season i.e. April to September.

The concentration of aglycone rose slightly during the rainy season, apparently, due to conversion of some glycosides to the aglycones. The free aglycone content, found to be considerably lower than glycoside content, is desirable for optimum laxative activity and reduced toxicity.^[19-20]

Phytochemical Studies

Zooming into the chemical constituents present in *Cassia tora*, the significant constituent gets highlighted i.e. Chrysophanol, an aglycone, emodin (1, 3, 8- trihydroxy-6-methylanthraquinone). The synthesis and accumulation of secondary metabolites in plants is regulated by space and time and is affected by the abiotic factors such as light intensity, soil minerals, osmotic stresses like drought and salinity, and seasonability. Abiotic environmental factors that constrain the production of secondary metabolites in plants indirectly influence the interactions of plants with their biotic environment. *Cassia tora* mainly consist of anthraquinone glycosides and flavonoids. The root shows the presence of 1, 3, 5-trihydroxy-6-7-dimethoxy-2-methyl anthraquinone and β -sitosterol. Seeds contain naphtho- α -pyrone-toralactone, chrysophanol, physcion, emodin, rubrofusarin, chrysophonic acid-9-anthone. The leaves are rich in emodin, tricontan-1-ol, stigmasterol, β -sitosterol- β -D-glucoside, freidlen, palmitic, stearic, succinic and d-tartaric acids, uridine, quercetin and iso-quercetin. The flowers are reported to contain kampferol and leucopelargonidin. It contains three naphthopyrone glucosides, *Cassiaside*, rubrofusarin-6-O- β -D-gentiobioside and toralactone-9-O- β -D-gentiobioside. Coming to emodin,

it forms a basis of a range of purgative anthraquinone derivatives and from ancient times has been used as a laxative compound. Recent studies indicate that emodin exhibits numerous biological actions, such as it affects the immune system, vasomotor system and metabolic processes. Other biological activities depicted by it are anti-inflammatory, antimicroorganism and antifeedant. The bases of underlying many of these mechanisms have been controversial. [21-44]

EXPLORED MEDICINAL IMPORTANCE-AN UPDATE

Antigenotoxicity Activity

(Wu & Yen, 2004) studied the antigenotoxic activity in the plant extracts, and found the three anthraquinones, chrysophenol, emodin, and rhein with unroasted seeds having higher anthraquinone concentration to show increased intensity of anti-genotoxic effects, by showing suppression of Trp-P-1 induced DNA damage. The water extracts of *Cassia tora* showed marked inhibition of genotoxic effects induced by Glu-P-1 and Trp-P-1 in both the Ames test and comesy test. [45]

Anti-inflammatory Effect

(Maity et al., 1998) studied the anti-inflammatory activity of the plant extract of *Cassia tora* (L.) Roxb. and found effective reduction in the inflammation due carragenan. [46]

Antimicrobial Activity

(Valsaraj et al., 1997) studied the antimicrobial activity on selected plant of Indian origin and found effective antibacterial, antifungal, and antimicrobial activity against *B. subtilis*, *E. coli*, *P. aeruginosa*, *S. aureus*. [47]

(Lubbe et al., 2011) studied the application of medicinal plants and their advantages to the healing world or as cosumables. A special mention of *Cassia tora* is mentioned, signifying the presence of Cinnamaldehyde from *Cassia tora* as effective in treatment of fungi as preventive measure. [48]

(Phongpaichit et al., 2004) investigated the significance of antifungal activity in *Cassia tora* along with other *Cassia* species, and found the *Cassia* species effective in treatment against pathogenic fungi (*T.rubrum*, *M. gypseum*, and *P.marneffe*). The antifungal activity is attributed to the chrysophanic-9-anthrone, isolated from defatted seeds of *Cassia tora*. [49]

(Das et al., 2010) detected phytoconstituents like alkaloids, carbohydrates, flavonoids, phytosterol, and saponins. It demonstrated significant antimicrobial activity against 30 strains of *E.coli*, *K. pneumonia*, *S. typhi*, *V. Cholera*, *B. subtilis*, *P. aeruginosa*. The minimum inhibitory concentration of extracts was lower than the minimum bacteriostatic concentration, suggesting that the plant extract were bacteriostatic at lower concentration but bactericidal at higher concentration. All these indicate the antibacterial activity possessed by *Cassia tora* L. extracts by causing lysis and eradication of bacteria by degrading bacterial cell walls. It thus finds its application in herbal medicines and cosmetics. Cosmetic industry shall explore its full potential and made it available commercially for its significance to the people. [50]

Antinociceptive and Smooth Muscle Contracting

(Chidume et al., 2002) reported the confirmed experimental proof of *Cassia tora* L. leaves to act as spasmogetic evaluated using guinea pig ileum, rabbit jejunum, and mice intestinal transit. The extracts in dose-dependent manner exhibited significant increase in reduction of noception by mice to the increase force applied externally. [51]

Anti-oxidant Property

(Zhenbao et al., 2007) evaluated antioxidant potential of methanolic extracts of the plant *Cassia tora* (L.) also known as Juemingzi. The oxidative stress is associated with the degenerative and pathological processes such as aging, coronary heart disease and cancer. Many chemical antioxidants are available such as superoxide dismutase, catalase, and the glutathione peroxidase system, butyrate hydroxyanisole, butylated hydroxytoluene, and tert-butylhydroxyquinone are commercially available and currently used. However, these substances may be inappropriate for human consumption as their possible toxic properties for human health and environment, restrict their wide usage among people. Alternative antioxidant substances can be obtained from plant sources, such as *Cassia tora* (L.) Roxb. It is a well known plant for projecting pharmacological actions like diuretic, diarrhea and antihypertensive. It found the percentage inhibition of peroxidation in linoleic acid emulsion for ethyl acetate, n-butanol and water fractions are 82.1%, 56.4%, and 39.5%. The extract showed a sufficient inhibitory effect on oxidation of LDL, and inhibited the effect of TBARS (tert-butylhydroxyquinone). The higher significance was on inhibition of Cu⁺ stimulation oxidation by LDL. [52]

(Prabhu & Krishnamoorthy, 2011) investigated antioxidant activity of the plant *Cassia tora* L. using three *in vitro* assays, mainly, total antioxidant capacity by phosphomolybdenum method, DPPH free radical scavenging method, and ferric ion reducing assay. The extract showed strong antioxidant activities in all the three assays, indicating significance of ethanolic functions as an efficient antioxidant to scavage free radicals and reducing free radical induced damages. [53]

Anti-protease Activity

(Tripathi et al., 2011) studied detailed experimental investigation of *Cassia tora* as an effective protease inhibitor in bacterial and fungal strains. The protease inhibitory action was confirmed with the help of 1.) Spot analysis test, 2.) Casein digestion method, 3.) Electrophoretic analysis. Upon significant detection and proof of protease inhibitory activity, it can be thus employed in crop protection, since it has shown significant inhibition in spore germination in *Aspergillus flavus*. [54]

Effective Recovery in Nephrotoxicity

(Sohn et al., 2009) reported the significance of *Cassia tora* in the recovery of cisplatin-induced nephrotoxicity in animals. [55]

Glycemic Control

(Nam & Choi, 2008) reported their investigation of *Cassia tora* L. seeds significance in the reduction of serum glucose

levels and increase in secretion of insulin and found it to be beneficial in postprandial blood glucose control stimulated via increase in insulin secretion. [56]

Hepatoprotective Activity

The hepatoprotective activity of the *Cassia tora* L. was observed by (Dhanasekaran *et al.*, 2009). It experimented the role of ononitol monohydrate isolated from the seeds of *Cassia tora* L. in the carbon tetrachloride induced toxicity In Vivo study, ononitol monohydrate decreased the levels of serum transaminase, lipid peroxidation, and TNF- α but increase the levels of antioxidant and hepatic glutathione enzyme activities. The Ononitol monohydrate isolated from the *Cassia tora* exhibited higher hepatoprotective activity compared to the standard drug Silymarin. [57]

(Bhaskar *et al.*, 2012) also reported the significance of Ononitol monohydrate in the antifeedant and larvicidal against *Helicoverpa amigera* and *Spodoptera litura*. The activities were concentration dependent. [58]

(Rajan *et al.*, 2009) investigated the significance of *Cassia tora* against carbon tetrachloride induced hepatotoxicity induced liver damage in albino rats. The investigations indicated remarkable decrease in serum level market enzymes, like, serum glutamatic oxaloacetic transaminase and lactate dehydrogenase. The vitamin E and glutathione were restored to normal levels. [59]

Hypolipidemic Activity

(Patil *et al.*, 2004) examined the effect of ethanolic extract of *Cassia tora* (L.) Roxb. and found the reduction caused by the ethanolic extract in the total cholesterol level and serum cholesterol level, increased due to triton administration. Triton WR 1339 acts as a surfactant to block the uptake of lipoprotein from the circulation by extra hepatic tissues resulting in an increase in the level of circulatory lipoprotein. In hyperlipidemic model ethanolic extract and its ether soluble fraction and water soluble fraction decreased serum levels of total cholesterol by 42.07, 40.77 and 71.25 %, respectively. The ethanolic extract, ether and water fraction decreased the LDL-cholesterol levels by 69.25 %, 72.06 %, and 76.12 % respectively. The lipid lowering effect of the *Cassia tora* may be due to inhibition of cholesterol biosynthesis and to increased fecal bile acid excretion. The drug showed increased levels of High density lipoprotein-cholesterol levels in triton induced hyperlipidemia models. [60]

(Xie *et al.*, 2012) in its research article, emphasized the importance of *Cassia tora* while reporting the scientific basis of traditional Chinese medicines. It has reported the involvement of Semen *Cassia* a ripe seed of *Cassia tora* (Leguminosae) in clearing the liver fire to improve eyesight and moistens the intestines to relax the bowels. *Cassia* seeds exert their hypolipidemic effects via acting directly on the gastrointestinal tract. [61]

Immunomodulatory Effect

(Cherng *et al.*, 2007) studied the immunomodulatory effect of the extracts of *Cassia tora*, and found anthraquinone mainly emodin, rhein, chrysophanol and aloe-emodin

depicting stimulatory effect on proliferation of resting peripheral blood mononuclear cells (PBMC) and secretion of INF- γ , without mitogen activation (Thus stopping cancerous cells growth, and restricting normal cells to become cancerous). A peripheral blood mononuclear cell is any blood cell having a round nucleus. For e.g. lymphocytes, a monocyte, or a macrophage. These blood cells are a critical component in the immune system to fight infection and adapt to intruders. The lymphocyte population consists of T cells (CD⁴⁺ and CD⁸⁺). [62] The peripheral blood mononuclear cell also includes basophils and dendritic cells (Wikipedia, 2012). [63] INF- γ acts as a multipotent immune activator because it plays an important role in modulating nearly all phases of immune and inflammatory responses and is associated with effective host defense against intracellular pathogens and cancer (Billiau & Vandebroek, 2011). Lymphocyte proliferation is correlated to the increase of the number of CD⁸⁺ T-cells and activated PBMC in mitogen PHA and to the elevation of the number of CD⁴⁺ T-cells in anthraquinone groups. [64]

Novel Cancer Medicine

(Rejiya *et al.*, 2009) studied the antiproliferative and antioxidant activity in the plant extracts of the *Cassia tora* [65], and further found with add on from (Tanaka *et al.*, 1998), [66] the significance of polyphenols found in the plant extract to exhibit anti-oxidant, antitumor, and antiviral properties depending upon chemical structure of each polyphenol. It is said that polyphenols have inhibitory effects on mutagenicity and carcinogenesis in humans, further the mechanism of antiproliferation exhibits via apoptosis and necrosis (Vaux *et al.*, 1999). [67]

Natural ACE Inhibitors

(Somanadhan *et al.*, 1999) reported potential Angiotensin-converting-enzyme inhibitory activity from the plant extracts of *Cassia tora* Linn. [68]

Additional Significances

(Kaur *et al.*, 2008) studied a novel galactomannan activity in the combination of Starch and *Cassia* gum, to be used as beneficial food processing agent. The property of thickening of *Cassia tora* gum, when added to starch, provided additional strength to the paste, which is highly applicable and advantageous for the food processing industry. [69]

(Bhardwaj *et al.*, 2011) carried out investigation of possible insecticidal activity in the plant extracts, and found it to be having effective and acceptable strong insecticidal lead source. [70]

Significance in Oral Treatment

Cassia tora has been reported in the article published by (Hebbar *et al.*, 2004), to be applicable in treatment of plaque and caries. often known as Tagate, Tarotigya, Nayichogache in kannada. In Kannada tribes, *Cassia tora* have been in used for massage in the teeth and gums to protect plaque and caries. [16]

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