ISSN 0976 – 3333

Available Online at www.ijpba.info

International Journal of Pharmaceutical & Biological Archives 2015; 6 (6): 1 –9

REVIEW ARTICLE

A Phytopharmacological Review of Plant – *Cassia auriculata*

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Received 27 Aug 2015; Revised 29 Nov 2015; Accepted 10 Dec 2015

ABSTRACT

Cassia auriculata used for long period in various chronic diseases therapeutically. Aim of the current review is to search literature for the pharmacological properties, safety/ toxicity studies, pharmacognostic studies and phytochemical investigation of *Cassia auriculata* plant. Particulars of pharmacological activities, phytochemical isolation, toxicity studies etc. were extracted from the published reports focusing on the safety profile of the plant. Safety of the whole plant was concluded in the review. The compiled data may be helpful for the researchers to focus on the priority areas of research yet to be discovered.

Key words: *Cassia auriculata*, phytopharmacological review, safety.

INTRODUCTION

Traditional medicine is still the primary form of treating diseases of majority of people in developing countries including India; even among those to whom western medicine is available, the number of people using one form or another of complementary of alternative medicine is rapidly increasing worldwide. Increasing knowledge of metabolic process and the effect of plants on human physiology has enlarged the range of application of medicinal plants. Nearly 50% of medicines in the market are made of natural basic materials. Interestingly, the market demand for medicinal herbs is likely to remain high because many of the active ingredients in medicinal plants cannot yet be prepared synthetically. The World Health Organization (WHO) estimates that about 80% of the populations living in the developing countries rely almost exclusively on traditional medicine for their primary healthcare needs. In almost all the traditional medical systems, the medicinal plants play a major role and constitute their backbone. Indian materia medica includes about 2000 drugs of natural origin almost all of which are derived from different traditional systems and folklore practices. Out of these drugs derived from traditional system, 400 are of mineral and animal origin while the rest are of the vegetable origin. India has a rich heritage of traditional medicine and the traditional health care system has been flourishing in many countries. Traditional medicine is an important part of healthcare. During the last decade, the use of herbal medicine has been increased. Consequently, an increase in traditional tread in herbal medicines and other type of traditional medicines has occurred. Proper use of these different types of medicines has therefore become a concern. In recent years, the use of herbal medicines worldwide has provided an excellent opportunity to India to look for therapeutic lead compounds from an ancient system of therapy, i.e. Ayurveda, which can be utilized for development of new drug [1]. Over 50% of all modern drugs are of natural product origin and they play an important role in drug development programs of the pharmaceutical industry [2]. Dietary measures and traditional plant therapies as prescribed by ayurvedic and other indigenous systems of medicine are used commonly in India.[1] Worldwide revolution for the improvement of patient safety is gaining momentum; hence drug safety for the subject becomes even more prominent in the present day scenario. Cultivation of medicinal plants with laboratory generated species is being attempted on the basis of chemical composition and is likely to be used in increased manner for commercial purposes. These changes may have profound impact on the safety and efficacy of the Ayurveda drugs in the market.

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Hence, a mechanism is required to be put in place to address them [3].

Plant description:

Cassia auriculata Linn commonly known as Tanners Senna, is also known as Avaram tree.

Regional and Other Names:

Tanner's Cassia, Tanner's Senna, Mature Tea Tree(English) Avartaki, Pitapuspa, Pitkalika, Manojyna, Pitkala, Charmaranga (Sanskrit), Tarwar, Awal, Tarval (Hindi), Tangedu, Merakatangeedu (Telagu), Arsual, Taravada, Tarwad (Marathi) [4].

Distribution:

It is distributed throughout hot deciduous forests of India. Wild in dry regions of Madhya Pradesh, Tamil Nadu Rajasthan and other parts of India.

Pharmacological properties as per Ayurveda

Guna : Laghu, Ruksha
Rasa : Tikta , Kashay
Vipaka : Katu
Veerya : Sheet
Doshghnata : Kapha-pittaghna
Vyadhi : Stambhan, Krimighna, Mutrasangrahaniy, Shukrastambhan, Kusthaghna, Atisar,
Pramehaghna [5].
Flower: Pramehashamana
Tender Fruits: Vamihara, Krimihara, Sarvapramehahara, Trishnaghna, Akshihita, Ruchya.
Seeds: Madhumehaghna, Vishahara, Raktaatisaraghna
Root: Trishnahara, Pramehaghna, Shwasaghna, Raktapittashaman, Shukrakshayahara [6]

Formulations and preparations:

1. Talapotaka Churna (Vaidya Chintamani,Prameha Roga prakarana) [7]
2. Aavarai kudineer (Siddha Formulation for Diabetes Mellitus) [8]
3. SUGNIL (Siddha Formulation for Diabetes Mellitus) [9]
4. Avarai Panchaga Choornam (Antidiabetic Formulation) [10]
5. Kalpa herbal tea (Antidiabetic Formulation) [10]
6. Diasulin (Antidiabetic polyherbal Formulation) [11]

Botanical description:

The leaves:

Alternate, stipulate, paripinnate compound, very numerous, closely placed, rachis 8.8-12.5 cm long, narrowly furrowed, slender, pubescent, with an erect linear gland between the leaflets of each pair, leaflets 16-24, very shortly stalked 2-2.5 cm long 1-1.3 cm broad, slightly overlapping, oval oblong, obtuse, at both ends, mucronate, glabrous or minutely downy, dull green, paler beneath, stipules very large, reniform-rotund, produced at base on side of next petiole into a filliform point and persistent.

Flowers:

Irregular, bisexual, bright yellow and large (nearly 5 cm across), the pedicels glabrous and 2.5 cm long. The racemes are few-flowered, short, erect, and crowded in axils of upper leaves so as to form a large terminal inflorescence (leaves except stipules are suppressed at the upper nodes). The 5 sepals are distinct, imbricate, glabrous, concave, membranous and unequal, with the two outer ones much larger than the inner ones. The petals also number 5, are free, imbricate and crisped along the margin, bright yellow veined with orange. The anthers number 10 and are separate, with the three upper stamens barren; the ovary is superior, unilocular, with marginal ovules.

The fruit:

A short legume, 7.5–11 cm long, 1.5 cm broad, oblong, obtuse, tipped with long style base, flat, thin, papery, undulately crimpled, pilose, pale brown. 12-20 seeds per fruit are carried each in its separate cavity [8].

Chemical constituents:

Pod husk contains nonacosane and nonacosan-6-one, chrysophanol, emodin and rubiadin [8], β-sitosterol, polysaccharides, flavonoids, anthracene derivatives and some dimeric procyanidins [12], Saponins and tannins. Yesu Raj *et al*. (2011) found fatty acid esters, fatty acid amide, terpenoids, diterpene alcohols, phytols as major compound groups in the methanol fractions from the seed extract of Cassia auriculata by GC- MS analysis. The chemical composition of the leaves of Cassia auriculata was investigated by Anandan *et al*. (2011) and revealed the presence of 3-O-Methyl-d-glucose (48.50%), α-Tocopherol-β-D mannoside (14.22%), Resorcinol (11.80%), n-Hexadecanoic acid (3.21%), 13-Octadecenal, (Z)- (2.18%) and 1,2,3,4-Tetrahydroisoquinolin-6-ol-1-carboxylic acid (1.98%) which were identified by GC – MS analysis. Senthilkumar and Reetha (2011) isolated an antibacterial compound - Oleanolic acid from the leaves of Cassia auriculata and identified by IR spectrum, HNMR, CNMR and Mass spectrum studies. Juvekar and

Halade (2006) investigated the flowers of Cassia auriculata which revealed the presence of anthroquinones, aloe emodin and sitosterols [13].

Phytochemistry of Cassia auriculata Plant Parts:

A. Phytochemical Analysis of Ethanolic extracts of Cassia auriculata Leaves and Flowers [14]

Photochemical	Leaves	Flowers
Alkaloids	+	+
Phenols	+	+
Glycosides	+	+
Flavonoids	+	+
Tannins	+	+
Saponins	+	+
Proteins	+	+
Carbohydrates	+	+

+ = Presence; - = absence

B. Photochemical Analysis of *Cassia auriculata* Flower Extract [15]

Tests	Methanol	Ethyl acetate	Hexane
Tannins	+	+	+
Phenols	+	+	_
Flavonoids	+	+	_
Glycosides	_	_	_
Steroids	+	+	_
Terpenoids	_	_	_
Reducing	_	+	+
Anthraquinone	_	_	_
Quinones	+	+	_
Saponins	_	_	_
Coumarins	+	+	_

C. Phytochemical Analysis of the Methanol, Petroleum ether and Chloroform extracts of *Cassia auriculata* Leaves [16]

Test for Phytochemical	Methanol	Petroleum ether	Chloroform
1. Alkaloids			
Dragendroff' test	+	_	
Hager's test	+	_	
Wagner's test	+	_	
Mayer's test	+	_	+
2. Carbohydrates			
Anthrone test	+	+	+
Benedict's test	+	+	
Fehling's test	+	+	
Molisch's test	+	+	
3. Starch Iodine test	_	_	_
4. Glycosides			
Keddes test	+	_	_
Killer killani test	+	_	_
5. Flavonoids			
Shinoda's test	+	_	_
Lead acetate test	+	_	_
Ferric chloride test	+	_	_
6. Triterpenoids			
Libermann Burchard's test	_	_	_
7.Resins	+	_	_
8. Saponins	+	+	
9. Steroid			
Libermann Burchard's test	_	_	_
Salkowaski reaction	_	_	_
10. Proteins			
Millon test	+	_	_
Biuret test	+	_	_
11. Tannins			
Ferric chloride test	+	_	_

D. Phytochemical Analysis of the Ethanolic extract of Cassia auriculata Seed [17

Phytoconstituents	Inference
Alkaloids	+
Flavonoids	+
Carbohydrates	+
Glycosides	_
Saponins	_
Tannins	+
Phytosterol	+
Triterpenoids	_
Proteins	_
Aminoacids	+
Anthraquinones	+
Phenols	+

Medicinal Uses:

The plant has been reported to possess antipyretic [18], hepatoprotective, antidiabetic, antiperoxidative and antihyperglyceamic [19] and microbicidal activity [20]. C.auriculata has been shown to antiviral activity and anti spasmodic activity [14]. The plant is used in the traditional system of medicine for female antifertility, leprosy, worm infestation, diarrhoea, disease of pittam [21]. The plant has been widely used as a cure for rheumatism (Kirtikar and Basu, 2006) and conjunctivitis (Pari and Lata, 2002). The various parts of the plant were reported to exert a beneficial effect to alleviate the symptoms of diabetes (Surana *et al*., 2008) [13].

The flowers are used to treat urinary discharges, nocturnal emissions, diabetes and throat irritation [22].

The Bark is used in skin conditions; bark as astringent [8]; useful in checking secretion or haemorrhage. They also restore the disordered processes of nutrition [23].

The Leaf extract has a protective action against alcohol induced oxidative stress to the cells as evidenced by the lowered tissue lipid peroxidation and elevated levels of the enzymatic and non-enzymatic antioxidants and experimentally induced alcohol related liver damage. The leaf extracts also shows emollient effect [14].

The seeds of tanner's cassia find their application in purulent opthalmia i.e., inflammation of the eye or conjunctiva. They should be finely powdered and blown into the affected eyes [23]. Seeds are astringent, sour, cooling, constipating, depurative, aphrodisiac, anthelmintic, stomachic, alexeteric, useful in diabetes, chyluria, ophthalmic, dysentery, diarrhoea, swellings, abdominal

disorders, leprosy, skin diseases, worm infestations, chronic purulent conjunctivitis [12].

The Roots are used in skin diseases and asthma [8]. The roots are astringent, cooling, alterative, and depurative and alexeteric, and are useful in skin diseases, leprosy, tumors, asthma and urethroroea [12].

Leaves, Flowers and Fruits as antihelmintic; its leaves and petals are both mildly astringent in taste. It also checks the flow of extra amount of urine and helps in absorption of required amount of fluids in the kidneys and intestines [23].

The anti-inflammatory activity: The anti-inflammatory activity of various extracts of leaves was carried out using carrageenan induced rat paw edema. Carrageenan induced inflammation represents a classical model of edema formation and hyperalgesia, which has been extensively used for evaluation of anti-edemal effect of drugs. The sub-planter administration of carrageenan in rat is responsible for the typical biphasic edema in which the first phase observed around 0-2 hours is attributed to the release of histamine and serotonin. The second phase of swelling which last for 2-6 hours is due to release of prostaglandin- like substances. Methanolic extract of C. auriculata leaves showed potent anti-inflammatory activity compared to aqueous, hydroalcoholic and ethyl acetate extracts. As the anti-inflammatory effect was more significant during later phase of inflammation, it can be concluded that there might be inhibition of inflammatory mediators such as prostaglandins, leukotrienes, polymorphonuclear cells or bradykinins. In accordance with previous studies steroids, flavonoids, alkaloids, terpenoids and tannins have been shown to possess of anti-inflammatory activity. Thus the anti-inflammatory effect of methanolic extract may be due to presence of of active constituents like alkaloids, flavonoids, tannins and steroids. However, chemical constituents and mechanism responsible for the pharmacological activities remain to be investigated. The anti-inflammatory activity of C. auriculata seems to be related to its histamine, kinin and prostaglandin inhibitory activity [24].

Antimutagenic activity: Effective cancer chemotherapy as well as immunosuppressive therapy with Cyclophoshamide (CP) is severely limited due to its unwanted toxicity. The cytotoxic effect of CP is attributed to the inhibition of cell division by damaging the DNA of proliferating cancerous cells. However, at the same time it also damages the DNA of the healthy tissues with high cellular turnover such as the bone marrow, gastro-intestinal tract and germ cells. Therefore, although CP activated metabolites have been shown to be beneficial for treating cancer, the side effects of these metabolites causes great concern. CP generates active metabolites, 4-hydroxycyclophosphamide, phosphoramide mustard and acrolein. Among these metabolites acrolein is highly toxic in nature and generates oxidative stress and damage DNA by inducing single strand breaks. Preliminary phytochemical studies indicates that C. auriculata extract contains carbohydrates, glycosides, alkaloids, tannins, phenolic and flavonoidal compounds. Flavonoids are a group of polyphenolic compounds, which exhibits biological effects. The presence of high phenolic and flavonoid content has contributed directly to the antioxidant activity by neutralising the free radicals. Flavonoid rich extract of *C. auriculata* pre-treatment attenuates the CP induced genotoxicity in the bone marrow. The ethyl acetate extract of *C. auriculata* Linn possess significant anti-mutagenic potential against CP induced chromosomal aberration. The chemoprotective potential of *C. auriculata* could be due to its antioxidant property. Thus, *C. auriculata* has the potential as an adjuvant to Cyclophoshamide for preventing the adverse effects associated with these drugs [25].

Antimicrobial activity:

The methanol extract of *C. auriculata* leaves exhibit strong antimicrobial activity against all the tested organisms. *B. cereus* (18 mm), *S. aureus* (14 mm), *E. coli* (16 mm), *K. pneumoniae* (14 mm), *P. aeruginosa* (10 mm) and *P. mirabilis* (16 mm). **The chloroform extract** showed good activity against *B. cereus* (20 mm), *S. aureus* (12 mm), *E. coli* (14 mm), *K. pneumoniae* (14 mm) and *P. mirabilis* (12 mm).

The aqueous extracts showed moderate activity against *B. cereus* (12 mm), *S. aureus* (10 mm) and *P. mirabilis* (8 mm). The Gram‑positive bacteria are strongly inhibited by all the extracts of *C. auriculata* (L) than the Gram‑negative bacteria and it shows minimum activity against *P. aeruginosa*. The plant extracts showed the presence of carbohydrate, protein, alkaloids flavonoids, saponin and tannin in methanol and chloroform; carbohydrate, protein, alkaloids, saponin and tannin in aqueous; rest of steroids in chloroform. The antimicrobial activity may be due to the presence of phytochemical constituents like

flavonoids and phenolic compounds present in the plant as secondary metabolites [26].

Antioxidant activity: Cassia auriculata showed antioxidant activity using improved assay based on the decolorization of the radical monocation of 2,2-azinobis–(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS) and 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging method.

Sodium nitroprusside serves as a chief source of free radicals. Scavengers of nitric oxide compete with oxygen leading to reduced formation of Nitric Oxide (NO). The absorbance of the chromophore formed during diazotization of the nitrite with sulphanilamide and subsequent coupling with napthylethylene diamine is used as the marker for NO scavenging activity. The chromophore formation was not complete in the presence of MECA (methanolic extract of Cassia auriculata), which scavenges the NO thus formed from the sodium nitroprusside and hence the absorbance decreases as the concentration of the MECA extract increases in a dose dependent manner.

Lipid peroxidation has been implicated in the pathogenesis of various diseases including arthritis. It is well established that bioenzymes are very much susceptible to LPO, which is considered to be the starting point of many toxic as well as degenerative processes. The MECA extract exhibited protection against lipid peroxidation induced by FeSO4. Initiation of lipid peroxidation by ferrous sulphate takes place through Ferryl perferryl complex. The MECA inhibited the FeSO4 induced lipid peroxidation in a dose dependent manner. The inhibition could be caused by the inhibition of formation of Ferryl perferryl complex. The presence of flavonoids in Cassia auriculata flowers may be responsible for antioxidant activities.

The DPPH system is a stable radical generating procedure. It is well known that the DPPH has ability to capture free radicals is due to the delocalization of the unpaired electron all over the molecule. DPPH is a potent scavenger for many other radicals due to the easiness in following the procedure – violet color of DPPH faints into the yellow color of its reduced congener (DPPH-H), with a high shift in the visible spectra (from 520 nm to 330nm). Cassia auriculata is widely used in number of pharmacological actions with high content of flavanoids and bioflavonoid seems to have a high potential for antioxidant activity. Inhibition of lipid peroxides can be explained as one of the important biochemical paradigm in understanding of the mechanism(s) of the action of MECA flowers [10].

Antipyretic Activity of Cassia auriculata: L.Pari and M.Latha *et al* (2002) presented antipyretic properties of serial extract of leaves of Cassia auriculata, and presented that most of the extract caused a significant inhibition of Oral administration of 0.45 g/kg body weight of the aqueous extract of the flower for one day it showed good results for antipyretic activity.[27] Vedavathy and Rao has also done the similar work in the year of 1991. It showed a good resolution for the antipyretic activity [18].

Anthelmintic Activity: (Satish B. Kosalge, Ravindra A. Fursule *et al* 2009)., The aqueous extract of *Cassia auriculata* leaves, were investigated for the anthelmintic potential against earthworms (*Eicinia faeteda*), tapeworms(*Raillietina spiralis*) and roundworms(*Ascardia galli*). Various concentrations (10-50 mg/ml) of plant extract were tested in the bioassay and different parameters such as determination of time of paralysis and time of death of the worms were recorded. All the extracts exhibited significant anthelmintic activity at highest concentration of 50mg/ml. Piperazine citrate (10 mg/ml) was used as reference standard and distilled water as control [28].

Hepatoprotective activity: Jeeva Jothi Dhanasekaran; Mathangi Ganapathy *et al* (2011) worked on Cassia auriculata Linn leaf and flowers extract on alcohol induced liver injury in albino rats and presented data of excellent hepatoprotective effects [28].

Antidiabetic activity: In experimental diabetes, enzymes of glucose and fatty acid metabolism are markedly altered. Persistent hyperglycemia is a major contributor to such metabolic alterations, which lead to the pathogenesis of diabetic complications. The study was designed by L Pari, M Latha in 2002, to study the effect of *Cassia auriculata* flower extract on hepatic glycolytic and gluconeogenic enzymes and STZ-diabetic rats were given the plant's extract per os for 30 days. In conclusion, the observations showed that the aqueous extract possessed an antihyperglycemic effect and suggested that enhanced gluconeogenesis during diabetes is

shifted towards normal and that the extract enhanced the utilization of glucose through increased glycolysis. The effect of the extract was more prominent than that of glibenclamide [27].

PTP 1B inhibitory activity: The PTP super family comprises more than 100 enzymes. The aberrant of PTP activity contributes to several human pathologies, such as diabetes, obesity, cancer and immune disorders. PTP 1B is a key member in the down-regulation of the insulin and leptin signalling pathway by dephosphorylating the insulin receptor, insulin receptor substrates (IRS). Development of PTP 1B inhibitors from natural products or synthetic counterparts is one of the biggest issues. An active compound from *C. auriculata* flowers has PTP 1B inhibitory activity. The GC–MS analysis revealed that the spectra obtained from n-butanol fraction was propanoic acid 2-(3-acetoxy-4, 4, 14-trimethylandrost-8-en-17-yl). This isolated compound was found to possess significant PTP 1B inhibitory activity. Recent studies have shown that PTP 1B inhibitors have emerged as potential therapeutics for treatment of type-2 diabetes and obesity. PTP 1B inhibitors also exert beneficial systemic effects such as circulating HbA1c and the reduction of fructosamine levels, insulin sensitivity, plasma metabolic profile reinstallation and reduction of serum insulin and leptin levels. The antidiabetic activity of the isolated compound showed effects comparable to that of glibenclamide in Alloxan-treated diabetic rats. PTP 1B is known to have several binding sites such as electrostatic, hydrophobic and hydrogen-bonding sites and also several N-terminals favourable for binding to the acidic site. The molecular features of the isolated compound propanoic acid, 2-(3-acetoxy-4,4,14-trimethylandrost-8-en-17-yl) might facilitate the hydrophobic interaction and the hydroxyl group in propanoic acid, maybe presumed to form hydrogen bonds [29].

Antihyperlipidaemic Activity:

Findings of work done by L Pari and M Latha in 2002 indicate that the Cassia auriculata flowers possess antihyperlipidaemic effect [27]. A marked increase in the frequency of cholesterol, free fatty acids, triglycerides and phospholipids were observed in diabetic control rats. Treatment with aqueous extract of *Cassia auriculata* flowers significantly reduced the lipid levels. Excess of fatty acids in serum produced by the streptozotocin-induced diabetes promotes conversion of excess fatty acids into phospholipids and cholesterol in liver. These two substances along with excess triglycerides formed at the same time in liver may be discharged into blood in the form of lipoproteins. The abnormal high concentration of serum lipids in the diabetic subject is due, mainly to increase in the mobilisation of free fatty acids from the peripheral fat depots, since insulin inhibits the hormone sensitive lipase. Hypercholesterolemia and hypertriglyceridemia have been reported to occur in streptozotocin diabetic rats and significant increase observed in experiment was in accordance to these studies. The marked hyperlipidaemia that characterise the diabetic state may therefore be regarded as a consequence of the uninhibited actions of lipolytic hormones on the fat depots. The antihyperlipidaemic effect of aqueous extract of Cassia auriculata flowers may be due to the down regulation of NADPH and NADH, a cofactor in the fat metabolism. Higher activity of glucose-6-phosphatase provides H+ which binds with NADP+ in the form of NADPH and is helpful in the synthesis of fats from carbohydrates. When glycolysis slows down because of cellular activity, the pentose phosphate pathway still remain active in liver to breakdown glucose that continuously provides NADPH which converts acetyl radicals into long fatty acid chains. Aqueous extract of *Cassia auriculata* flowers may be capable of oxidising NADPH. Enhanced hexokinase activity in aqueous extract of *Cassia auriculata* flowers treated rats suggests greater uptake of glucose from blood by the liver cells. Activities of enzymes suggest that enhanced lipid metabolism during diabetes is shifted towards carbohydrate metabolism and it enhances the utilisation of glucose at the peripheral sites. One of the possible actions of aqueous extract of *Cassia auriculata* flowers may be due to its inhibition of endogenous synthesis of lipids. Metabolic aberrations in streptozotocin diabetic rats suggest a high turnover of triglycerides and phospholipids. Aqueous extract of *Cassia auriculata* flowers may antagonise the metabolic aberration and thereby restore the normal metabolism by tilting the balance from high lipids to high carbohydrate turnover. Alteration of fatty acid composition by increased lipid levels contribute to lowering the resistance of tissues and higher rate of oxidative stress. Decreased activity of glucose- 6-phosphatase through pentose phosphate shunt results in high reduced glutathione to oxidized glutathione ratio (GSH/GSSG), which is coupled with conversion of NADPH to NADP. Aqueous extract of Cassia

auriculata flowers may produce high NADP+ which results in down regulation of lipogenesis and lower risk of the tissues for oxidative stress and high resistance for diabetes. Antihyperlipidaemic effect could represent a protective mechanism against the development of atherosclerosis [27].

Acute oral toxicity study was carried out by Pai Aruna, Karki Roopa in 2011, as per the OECD guidelines, draft guidelines 423 adopted on 17th December, 2001, received from Committee for the Purpose of Supervision and Control of Experiments on Animals (CPCSEA), Ministry of social justice and empowerment, Govt. of India. Administration of the stepwise doses of all the extracts of *Cassia auriculata* seeds 50 mg/kg b. wt. up to the dose 5000 mg/kg b. wt. caused no considerable signs of toxicity in the tested animals [12]. Also work of Deshpande Supriya S., Kewatkar Shailesh and Paithankar Vivek V. in 2012 revealed that there was no toxic effect up to dose of 2,000 mg/kg of ethyl acetate extract of roots of *Cassia auriculata* Linn. nor any significant variation in behavior of animal was observed.[25] Acute toxicity studies conducted by Kalaivani *et al*. in 2008 revealed that the administration of graded doses of Cassia auriculata leaves and flowers extracts up to a dosage of 1000 mg/kg b. wt. /day for 30 days produced no effect on the general behavior or appearance of the animals and all the rats survived the test period [14].

CONCLUSION

It is quite evident from this review that *Cassia auriculata* contains a number of phytoconstituents which reveals its uses for various therapeutic purposes. The Plant or its individual parts can be used as antidiabetic, anthelmintic, hepatoprotective, antifungal and antimicrobial, antiinflammatory, antipyretic, antioxidant, antihyperlipidemic activity. More research is needed to isolate the constituents responsible for the biological actions. It was also observed that no clinical trials have been done so far. So from the current review of literature, it was concluded that the plant is having high medicinal value. The traditional and ethnomedicinal literatures showed that the plant is very effective and safe for medicinal uses. By using the reverse pharmacological approaches in natural drug discovery a potent and safe drug can be investigated from the plant for various chronic diseases.

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