

Review on ethnobotany, phytochemistry, and pharmacological properties of *Cassia auriculata*

Abstract

The herbal medicines are selecting over modern medicine due to their efficacy, safety, and lesser side effects. *Cassia auriculata* extremely used in Ayurvedic medicine. *C. auriculata* is commonly known as tanner's cassia, and it belongs to the family Caesalpiniaceae. It is reported to contain many phytoconstituents such as alkaloids, terpenoids, phenols and tannins, sugar saponins, flavonoids, quinines, steroids, and proteins. The ethnobotanical survey revealed that the *C. auriculata* was used for the treatment of diabetes, joint pain and inflammation, muscle pain, illness, cold, venereal disease, hair cleanser, reduce body heat, abdominal pain, vomiting, diarrhoea, and toothache. *C. auriculata* have many pharmacological properties, such as anti-diabetic, anti-oxidant, hepatoprotective, anti-cancer, anti-inflammatory, anti-hyperlipidemic activities, and many more. The present review focused on its botanical characters, phytochemical constituents, ethnobotanical uses, and pharmacological properties of *C. auriculata*.

Keywords: *Cassia auriculata*, ayurvedic formulations, ethnobotanical uses, pharmacological activities

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Introduction

Traditional herbs hold a long history of practice and are mostly considered to be secure than synthetic drugs. In the 21st century, herbal medicines are being preferred to modern medicine due to their safety, cultural acceptability, efficacy, and lesser adverse effects. Plants and plants products have been used with varying success to relieve and prevent disorders all the time.¹ WHO has predicted that 80% of the world population depends on folklore medicine for their chief health care needs. The screening of medicinal plants for further pharmacological studies of bioactive compounds.²

Many phytotherapy of some medicinal plants have been mentioned for treating diseases, one such plant is *C.auriculata* profoundly used in Ayurvedic medicine.³ *C. auriculata* belongs to the family Caesalpiniaceae. The common name is tanners cassia.⁴ It has a different names in different languages like English (tanners Cassia),Hindi (tarwar), Telugu, Kannada (avarike) (tangedu), Tamil (avarai, avaram), Sanskrit (avartaki, pitapuspa, pitakalika, manojyana, carmaranga, pitakala), Malaysia (mataran tea, tanners tea).⁵ This shrub is evergreen and has attractive yellow colour flowers that grow in various parts of India as well as other parts of Asia.⁶ *C. auriculata* is mainly used traditionally for the treatment of diabetes, rheumatism, conjunctivitis. Further disorders like leprosy, ulcer, eye irritation, skin disorders.^{7,8} The plant is been reported for their antidiabetic,⁹ anti-oxidant,¹⁰ antibacterial,¹¹ hepatoprotective,¹² nephroprotective,¹³ anti-cancer,¹⁴ anti-inflammatory,¹⁵ anti-microbial¹⁶ and anti-hyperlipidemic activities.¹⁷ The present review was written to provide the overview of this plant on its various pharmacological properties, its traditional and folklore use and phytochemical nature.

Botanical characters

Leaves: Leaves are dull green; these are alternate, stipulate, paripinately compound leaves with 16-24 pairs of leaflets. Leaves are

firm, narrowly rugged, pubescent, and thin, with vertical and linear gland between the leaflets of each pair. And shortly stalked, 2-2.5cm long, 1-1.3cm wide. Marginally overlapping, rectangular, dull-witted at both ends, and glabrous (Figure 1).



Figure 1 Leaves.

Flowers: Flowers are bright yellow and irregular and large (5cm). The pedicels are glabrous, and 2.5cm long, the five sepals are separate, concave, membranous, and unequal. Two external and three internal sepals, outer ones are longer than the inner ones. The petals 5 in numbers are free imbricate, crisped along the edge, and bright yellow veined. The panthers are 10 in numbers also separated by the three stamens barren; the ovary is unilocular, superior, with peripheral ovules (Figure 2).



Figure 2 Flowers.

Fruit: Fruits are pale brown or green in colour and little legume, 7-11cm long, 1.5cm broad, rectangular, long style base, flat, thin, papery, pilose, undulate crimped and tripped with long style base. It has about 12-20 seeds per fruit, each in its distinct cavity (Figure 3).¹⁸



Figure 3 Fruits.

Ethnobotanical uses: The ethnobotanical survey of the hill area in Tamilnadu, Maharashtra, Andhra Pradesh, and Gujarat revealed that *C. auriculata* leaf paste was used in joint pain and inflammation.¹⁹ Fresh leaves were being used in muscle contraction, body pain, and gastritis.²⁰ The paste of the useful in sores on skin and ulcers.²¹ Further, leaf decoction is to arrest thirst during illness.²² Leaves are used to cure common cold and internally infusion to treat mouth disease and with jaggery to cure tympani ties.²³ In addition to leaves, flowers are also used as health beneficial agents. Crushed flowers are mixed with goat milk to cure venereal disease.²⁴ Dried powder of flowers is used to clean the hair, and taken by diabetic patients and to reduce body heat.²⁵ The root is used by chewing, and the juice is swallowed to cure abdominal complaints, vomiting and diarrhea.²⁶ Powder of various parts used to treat toothache by applying that powder to the gums (Table 1).²⁷

Table 1 Ethnobotanical uses of *Cassia auriculata*

Parts of <i>Cassia auriculata</i>	Ethnobotanical uses
Leaves	Joint Pain And Inflammation
	Muscle Contract
	Illness
	Cold
Flowers	Gastritis ^{19,23}
	Venereal Disease
	Hair Cleaner
	Reduce Body Heat
	Diabetes ^{24,25}
Roots	Abdominal Pain
	Vomiting
	Diarrhea
	Toothache ^{26,27}

Phytoconstituents: Chemical constituents of *C. auriculata* are alkaloids, terpenoids, phenols and tannins, sugar saponins, flavonoids, quinines, steroids and proteins.²⁸

Flowers: Flowers of *C. auriculata* shows a significant amount of alkaloids, glycosides, saponins, phenols, tannins, phloro-tannins, phenols terpenoids, triterpenes carbohydrates, proteins, and amino acids. And also revealed the presence of anthraquinone, aloec-emodin, and sitosterols.^{29,30}

Leaves: A total twenty-nine compounds were identified in the leaves of *C. auriculata* mainly 3-omethy- d glucose (48.50%) , alpha-tocopherol-beta-D -mannosidase (14.22%) , n-hexadecanoic acid (3.21%), resorcinol (11.80%), octadecenal (2.18%) and carboxylic acid (1.98%).³¹

Seeds: The seeds of *C. auriculata* contain 40.8% of light yellow coloured fatty acid. Major components among fatty acids content are palmitic, oleic, and linoleic acids. The ethanolic seed extract showed the presence of benzoic acid, 2- hydroxyl methyl ester (0.07%), glycine, n-(trifluoroacetyl), 1-methylbutyl ester(0.10%), 2'3 dihydro 3'5dihydro-6methyl-4hpyran-4one(0.12%), cupric acid ethyl ester (.016%), resorcinol (0.21%), water-soluble galactomannan like beta-D-manopyranosyl-1(1-4)-o-beta-D-manopyranosyl(1to4)-o-beta-D-monopyranose.³²

Roots: Roots of *C. auriculata* shows the presence of anthraquinone glycosides such as 1,3-dihydroxy-2 methylantraquinone, 1,3,8-trihydroxy- 6methoxy -2 methyl- lantraquinone, 1, 8- dihydroxy -6 -methoxy-2methylantraquinone-3-o-rutinoside, 1,8-dihydroxy-2-methylantraquinone-3-o-rutinoside and flavone glycoside. And also, some compounds like root bark are a chalcone 3,6,-dihydroxy-4-methoxychalcone, and two leucoanthocyanins like leucocyanidin-3-o-rhamnopyroside and leucopeonidin-3-o-1-rhamanopyroside (Table 2).³³

Table 2 Chemical constituent reported in *Cassia auriculata*

Parts studied	Chemical constituent
Flowers	Alkaloids, glycosides, saponins, phenols, terpenoids, flavonoids, tannins and steroids ^{29,30}
Leaves	O-methyl-d-glucose, resorcinol, alpha-tocopherol-beta -mannosidase, and carboxylic acid ³¹
Seeds	Palmitic acid, linoleic acid, benzoic acid 2-hydroxyl methyl ester, 1-methyl butyl ester, and resorcinol ³²
Roots	Anthraquinone glycosides and flavone glycosides ³³

Ayurvedic formulations and preparations

C. auriculata was found to be the main ingredient in avarai kudineer, talapotaka churna, sugnil, Kalpa herbal tea, avarai panchanga choornam, diasulin.³⁴

Diasulin: A herbal preparation of *C. auriculata*, *Curcuma longa*, *Gymnema Sylvestre*, *Coccinia indica*, *Momordica charantia*, *Scoparia dulcis*, *Syzygium cumini*, *Trigonella foenum graecum*, *Tinospora cordifolia*. Diasulin was used in the treatment of diabetes.³⁵

Sugnil: A polyherbal formulation from a combination of nine Indian medicinal plants, which are *Aristolochia bracteata* (whole plant), *Shorea roxburghii* (gum), *C. auriculata* (flower), *Casearia esculanta*(leaf), *Coscinium fenestratum* (bark), *Curcuma longa* (tubers), *Eugenia jambolana* (seeds), *Gymnema sylvestre* (leaves), and *Triphala* (fruits). It is used to reduce of vascular complications in diabetes mellitus.³⁶

Kalpa herbal tea: *C. auriculata* is one of the main ingredients of tea and it was used in the treatment of diabetes.

Avarai panchanga choornam: It has equal quantities of fruits, leaves, roots, flowers, and bark, to prepare Avarai panchanga choornam, which is extensively used in the management of diabetes.³⁷

Kudineer: It is a polyherbal formulation consisting of seven herbal ingredients, viz., *C. auriculata*, *C. fistula*, *Syzygium Jambos*, *Oxal scandens*, *Saussurea lappa*, *Terminalia arjuna*, and *Cyperus rotundus*. Useful in the treatment of diabetes and antimicrobial and fungal infection.³⁸

Talapotaka churna: It is a poly-herbal preparation contains *C. auriculata*, *Embllica officinalis*, *berberis aristata*, and *Curcuma longa*. It is useful in reducing blood glucose level hence this churna is used to treat diabetes (Table 3).³⁹

Table 3 Uses of ayurvedic formulations of *Cassia auriculata*

Formulation	Used to treat
Avarai kudineer	Diabetes, fungal and microbial infection
Kalpa herbal tea	Diabetes
Talapotaka churna	Diabetes and obesity
Diasulin	Diabetic
Sugnil	Diabetic
Avarai panchanga choornam	Diabetes and obesity

Pharmacological activities

Anti-diabetic activity: Several studies have reported the anti-diabetic activities of *C. auriculata*. For instances, anti-diabetic activity of the ethanolic flower and bud extract of *C. auriculata* was studied using a high-fat fed diet cum streptozotocin-induced animal model. This study shows that extract of *C. auriculata* bud has more anti-diabetic activity compared to flower extract.⁴⁰ Aqueous flower extract of *C. auriculata* is reported to show anti-diabetic activity in streptozotocin-induced diabetes rats.⁴¹ Dianthrone rich methanolic extract of *C. auriculata* flowers in alloxan induced diabetic rats.⁴²

Furthermore; the various fractions such as hydroethanolic, ethyl acetate and n-butanol extract of flowers were studied in alloxan produce diabetic rats. From this study, it was concluding that n-butanol was found to be more potent compared to other fractions, and n-butanol fraction is responsible for its anti-hyperglycemic effect.⁴³ The aqueous extract of leaves in streptozotocin-induced diabetic rats, the extract has anti-hyperglycemic contradictory activity.⁴⁴

Antioxidant activity: The various fractions of *C. auriculata* flower-like petroleum ether, ether, ethanol, and methanolic extracts, from these extracts the petroleum ether shows less potent towards scavenging and reducing power.⁴⁵

Anti-hyperlipidemia activity: Ethanolic flower extract of *C. auriculata* in triton WR1339 induces hyperlipidemia in rats and the ethanol flower extract has anti-hyperlipidemic activity.⁴⁶ Ethanolic extract of aerial parts of *C. auriculata* has anti-hyperlipidemic activity through *in-vitro* studies the aerial part of the plant extract inhibit lipase activity.⁴⁷ Ethanolic cassia auriculata flower extract reported for their anti-hyperglycemic effect in the budding yeast cells.⁴⁸

Hepatoprotective activity: *C. auriculata* is the main component of many herbal preparations in liver disorders. And the study found that *C. auriculata* leaf extract has shown hepatoprotective activity against alcohol-induced liver damage, by protecting against free radical-mediated oxidative stress. hepatotoxicity.⁴⁹ Methanolic leaf extract is used to evaluate potential events against carbon tetrachloride-induced liver damage on Wistar albino rats. the outcome of this study was methanol extract has liver protective property.⁵⁰ *C. auriculata* leaves acetone extract shows a protective effect on d-galactosamine induced cytotoxicity in mice model.⁵¹ The methanol extract of *C. auriculata* roots have potent hepatoprotective activity against ethanol and anti-tubercular drug-induced hepatotoxicity.⁵²

Anti-inflammatory and analgesic activity: Analgesic and anti-inflammatory activity of petroleum ether and ethyl acetate fraction of *C. auriculata* was carried out by using various experimental models of pain and inflammation. This study found that the ethyl acetate fraction is more effective compared to petroleum ether.⁵³ The methanol extract of *C. auriculata* leaf shows analgesic and anti-inflammatory activity, by using tail immersion and hot plate method, cotton pellet induced chronic granulomatous and carrageenan-induced rat paw edema methods. It shows that anti-inflammatory activity and central analgesic activity is due to its antioxidant mechanism.⁵⁴ Anti-inflammatory activity of *C. auriculata* and the anti-inflammatory activity was elevate by using albumin denaturation assay, proteinase inhibitory activity and membrane stabilization assays the result shows that acetone flower extract of *Cassia auriculata* possess anti-inflammatory activity.⁵⁵

Antibacterial activity: Anti-bacterial activity of flowering stages of the cassia auriculata buds, seedling and dried stage with different solvents like DMSO, methanol, and water, it concluded that fresh flowers of the cassia auriculata have potent antibacterial activity.⁵⁶ *In vitro* study of *C. auriculata* flower methanol extract shows antibacterial effect by using agar disc diffusion method.⁵⁷

Anti-cancer activity: *C. auriculata* leaf extract is cause apoptosis, which is useful in human breast cancer, larynx cancer and cell lines through its in-vitro method. The *C. auriculata* leaf extract inhibits the growth of hepG-2 and mcf-7 cells through the induction of apoptosis.⁵⁸ Isolated compounds obtained from *C. auriculata* are helpful in the prevention of cancer against colon cancer cell line HCT15, and the various compounds from *C. auriculata* possess chemopreventive activity.⁵⁹

Immunomodulatory activity: Polyphenols derived from flowers of *C. auriculata* induce T cell immunity by increasing the number of cells and decreasing ROS stimulation by neutrophils that produce multiple mechanism aged individuals.⁶⁰

Anthelmintic property: The anthelmintic activity of methanolic, chloroform and petroleum ether leaf extract of *C. auriculata* against earthworms and the methanolic extract exhibits more anthelmintic activity.⁶¹

Anti-ulcer activity: Methanolic extract of *C. auriculata* leaf decreases the ulcer formation in pyloric ligated rats. The percentage of incidence of ulcer and ulcer index parameters were used to an evaluate antiulcer activity, and the extract shows a decrease in and ulcer index compare to control group.⁶²

Anti-microbial activity: Methanol, chloroform, and aqueous extract of *Cassia auriculata* leaf show anti-microbial effect by a suitable

diffusion method. The methanol and chloroform extracts exhibit potent inhibitory activity compared to aqueous extract.⁶³ The saponin rich fraction of *Cassia auriculata* roots used as a natural remedy to cure various infections and diseases caused by microorganisms.⁶⁴

Nephroprotective activity: The ethanolic root extract of *C. auriculata* has nephroprotective activity in gentamicin and cisplatin induced

renal damage, because of the antioxidant property.⁶⁵

Anti-arthritis property: *C. auriculata* leaf has shown anti-arthritis activity in Freund's complete adjuvants induced arthritis model. The study indicates that ethyl acetate extract has a potent effect against arthritis, due to its significant phytoconstituents (Table 4).⁶⁶

Table 4 Pharmacological actives of *Cassia auriculata*

S.no	Parts studied	Activities
1.	Ethanol, methanol, and aqueous flower extract.	Anti-diabetic ^{40,41}
2.	Ethanolic flower extract. Aqueous acetone extract of leaves,	Anti-hyperlipidemia ⁴⁶ Hepatoprotective ⁵⁰⁻⁵²
3.	Methanolic extract of the root, Ethanolic extract of leaves.	
4.	Ethanolic extract of <i>Cassia auriculata</i> .	Antioxidant ⁴⁴
5.	Ethanol extract of roots.	Nephroprotective activity ⁶⁵
6.	<i>Cassia auriculata</i> leaf extract.	Anticancer ⁵⁹
7.	Ethanolic extract of a leaf.	Anti-inflammatory ⁵³
8.	Methanol, chloroform, and aqueous extracts of leaves.	Antimicrobial activity ^{63,64}
9.	Ethyl acetate fractions of <i>Cassia auriculata</i> .	Anti-arthritis Property ⁶⁶
10.	Polyphenols derived from flowers <i>Cassia auriculata</i> .	Immunomodulatory activity ⁶⁰
11.	Methanolic extract of <i>Cassia auriculata</i> leaf.	Anti-ulcer Property ⁶²
12.	Methanolic, chloroform, and petroleum ether leaf extract. Ethanol, methanol, aqueous, and acetone extract of fresh and dried flowers.	Anthelmintic Property ⁶¹ Antibacterial ^{56,57}

Conclusion

Overview of *C. auriculata* revealed that the plant is the source of many therapeutically important chemical constituents. Ethnobotanical, ayurvedic, and folklore claims indicate the traditional medicinal system of India. *C. auriculata* is the main ingredient in various herbal formulations such as avarai kudineer, talapotaka churna, sugnil, Kalpa herbal tea, avarai panchanga choornam, and diasulin. These studies have exposed that it has anti-diabetic, anti-hyperlipidemia, antioxidant, hepatoprotective, anti-cancer, anti-inflammatory, anti-ulcer, immunomodulatory, anti-microbial, anti-bacterial, anthelmintic, nephroprotective, anti-arthritis activity. Further, studies have been done on its bioactive principles of *Cassia auriculata*, which are responsible for the health benefits offered by these plants so that the bioactive compounds could give some leads for new drug discovery to various chronic diseases.

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Conflicts of interest

We declare that there is no conflict of interest that could be perceived as prejudicing the impartiality of the research reported.

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