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REVIEW ARTICLE

PHARMACOLOGICAL AND PHYTOCHEMICAL PROFILE OF *CASSIA OCCIDENTALIS L*: A REVIEW

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ABSTRACT

Cassia occidentalis Linn. (COL) Family Caesalpiniaceae is a common weed scattered from the foothills of Himalayas to West Bengal, South India, Burma, and Sri Lanka. The main plant constituents in *Cassia occidentalis* include: achrosin, aloe-emodin, emodin, anthraquinones, anthrones, apigenin, aurantiobtusin, campesterol, cassiollin, chrysophanol, chrysoeriol, emodin, physicon, quarcetin, rhamnosides, rhein, sitosterols, tannins, and xanthorine are presents. Different parts of this plant have been reported to possess antiinflammatory, antihepatotoxic, antibacterial and antiplasmodial activities. They possess purgative, tonic, febrifugal, expectorant and diuretic properties. The plant is also used to cure sore eyes, hematuria, rheumatism, typhoid, asthma and disorder of hemoglobin and is also reported to cure leprosy. The scientific research on C. occidentalis suggests a huge biological potential of this plant. Therefore, the aim of this review was to summaries the ethnopharmacology, phytoconsitituents and various therapeutics uses of *Cassia occidentalis.*

Keywords: *Cassia occidentalis*, Anthraquinones, Antimicrobial activity, Antioxidant activity

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INTRODUCTION

C. occidentalis of family caesalpiniaceae is common weed scattered from foothills of Himalaya to west Bengal. South India, Burma and Sri Lanka. Most commonly used names of C. ***occidentalis*** are Kasamarda, Kaasaari (Ayurveda), Kasaundi, Bari Kasaundi (Hindi), Kasondi (Unani), Doddaagace (Kanad), Ponnaviram, Ponnarviriam (Malyalam), Kasinda (Telgu), Paeyaavarai and Thagarai (Siddha/Tamil) [1].

In India, C. occidentalis is a common weed found throughout India (up to an altitude of 1500 m)[1] from Jammu and Kashmir to Kanyakumari and used for a variety of purposes in indigenous and folk medicines [2–4]. In Haryana, it grows widely immediately after the rain and started disappearing in the beginning of cold weather.

It is a straight, somewhat branched, smooth, semi-woody, fetid herb, 0.8-1.5m tall, hard, stout, with a few lateral roots on mid section [5–7]. The stem of the plant is reddish purple. Leaves are alternate, even pinnately compound, each one with 4–6 pairs of nearly sessile, opposite leaflets, with a fetid smell when crushed, each leaflet 4–6 cm long, 1.5–2.5 cm wide, ovate or oblong, lanceolate with a pointed tip and fine white hairs on the margin.

Figure 1: *Cassia occidentalis L*. Plant

Stipules are 5–10 mmlong, often leaving an oblique scar. Inflorescence is a compound of axillary and terminal racemes. The flower is perfect, 2 cm long with 5 yellowish green sepals with distinct red veins and 5 yellow petals. The fruit is a dry, dehiscent, transversely partitioned, faintly recurved, laterally compressed, sickle shaped legume (pod), 7–12 cm

long, 8–10 mm wide, with rounded tip and containing 25–50 seeds. Seeds are oval shaped, 3.5–4.5 mm wide, flattened; pale to dark brown, smooth and with a round pointed tip [8, 9]. Decoction of C. occidentalis roots with black pepper is quite useful for filarial disease[10]. In the Malyagiri hills, a decoction made from 15 leaves each of C. occidentalis, Glycosmis pentaphylla and Vitex negundo is used for bathing the new born baby at the end of 7th, 12th and 21st days, to make the baby almost immune to skin diseases by the Tanla people in Dhenkanal district ofOrissa [11]. The leaves of the plant are used for the treatment of yaws, scabies, itches and ringworm among the Yoruba tribe of southwestern Nigeria. In addition to this, the leaves are also known to be effective against jaundice, headache and toothache. *C. occidentalis* leaves have ethno medical importance like wound healing, treatment of sores, itch, cutaneous diseases, bone fracture, fever, ringworm and throat infection[12].

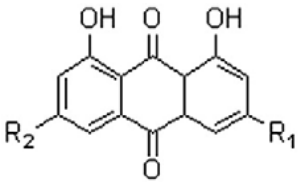
Table 1: Ethnomedicinal Value of C. *occidentalis*

S.N.	Part used	Meicinal uses
1	**Whole plant**	*C. occidentalis* plant extract (4–5 drops) is used in curing eye inflammations in Ayurveda. It is also used in Jamaican folk medicines for curing diarrhoea, dysentery, constipation, fever, cancer, eczema and venereal diseases[13].
2	**Root**	Infusion of roots (10–20 g) is considered beneficial in obstruction of stomach and incipient dropsy. Roots are also used as veterinary medicines for animal diseases, and as antidote in case of poison [14]. Roots of C. occidentalis were also used against gastric complaints, to increase lactation, in whooping cough etc. [15]. In Nigeria, the roots of this plant were boiled with water and taken as tea for constipation and against white discharge in ladies [15]. C. occidentalis is known as 'Ran-tarota'. Infusion from the roots of this plant along with roots of Caesalpinia sepiaria Roxb. and Azadirachta indica A. Juss. is given against the white discharge in ladies.
3	**Leaves**	It is used in a malarial formulation based on a traditional recipe comprising of three antimalarial herbs, leaves of C. occidentalis, leaves of Lippia chevalieri and flower heads of Spilanthes oleraces in Mali[16]. Leaf paste is externally applied on healing wounds, sores, itch and cutaneous diseases. Leaves are also used on bone fracture, fever, ringworm, skin diseases, throat infection and wounds. Twigs are used as tooth brushes. Leaves are burnt and the soot obtained is mixed with coconut oil and applied on eye-lids for cooling sleep [17].
4	**Seeds**	Seeds are roasted brown, pulverized, using a small amount (3 g=1/10th of an ounce), to make tea with brown sugar, used in Fujian as a tea substitute for the people with high blood pressure. Mature seeds are used on ring worms and as febrifuge [18]. The seeds are also useful in leprosy, erysipelas, ulcers, strangury, cough, bronchitis and constipation[19].
5	**Pod**	The 8–10 roasted pods of this plant are eaten for cough problems in India. Decoction of fruits and flowers (10 g) are used in the treatment of mental disorders [18].

PHYTOCHEMISTRY

Phytochemical screening of the plant showed the presence of carbohydrates, saponins, sterols, flavonoids, resins, alkaloids, terpenes, anthraquinones, glycoside and balsam[20]. Presence of these metabolites strongly concluded the great potential of the plant as a source of phytomedicines. As the flavonoids and resins are present, it might be responsible for its anti-inflammatory properties. Chinese folkloric medicine contains flavonoids which has anti-inflammatory effect on both acute and chronic inflammation [21, 22]. Various studies of phytochemicals of C. occidentalis reveal that the amount and nature of phytochemicals vary according to climate. Alkaloids are known for decreasing blood pressure, balancing the nervous system in case of mental illness and antimalarial properties [23]. Eudesmane sesquiterpenes have been reported to contain antibacterial properties.

C. occidentalis root samples have been reported to possess 1.9% free and 4.5% total anthaquinones. Emodin, 1,8-dihydroxyanthraquinone and the flavonoid quercetin were also identified[24]. Rai and Shok in 1983[25] shown that the roots contain rhein and aloe-emodin, both free and glycosidic(Fig. 2). Two new bis (tetrahydro) anthracene derivatives, occidentalol-I (IV, R1=Me and R2=H) and occidentalol-II (III, R1=R2=H) were isolated (Fig. 3) from the roots of C. occidentalis along with chrysophanol, emodin, pinselin, questin, germichrysone, methylgermitorosone and singueanol-I (I, R1=R2=Me). The structures were established on the basis of spectral evidence[26]. A toxic albumin besides chrysophanol has been detected in the seeds of C. occidentalis[27]. Fromthe seeds carbohydrates: maltose, lactose, sucrose and raffinose are also detected[28]. Amixture of C-flavonoids of apigenin (Fig. 4), among them probably vitexin and a 7-heteroside of vitexin, chrysophanol and emodin as well as their glycosides and free physcion have been reported from the leaves of C. occidentalis[25].



Trivial Name	R1	R2
Rhein	COOH	H
Aloe-emodin	CH2OH	H
Chrysophanol	CH3	H
Emodin	CH3	OH
Physcion	CH3	OCH3

Figure 2: Anthraquinones glycones from C. occidentalis plant [29].

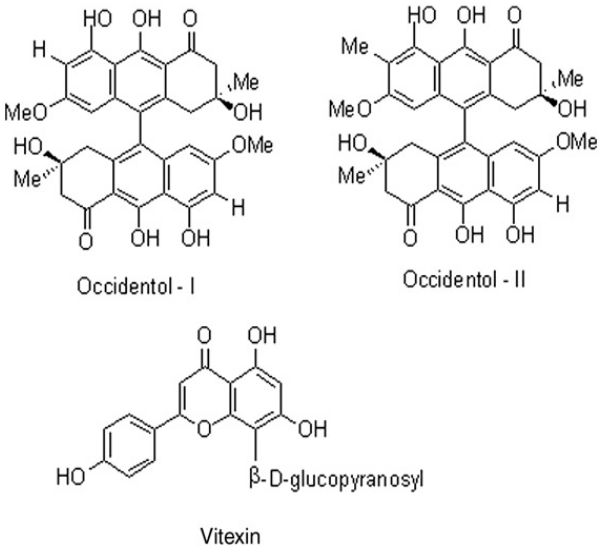


Figure 3: Structures of Occidentol-I, II and Vitexin isolated from C. occidentalis plant[29].

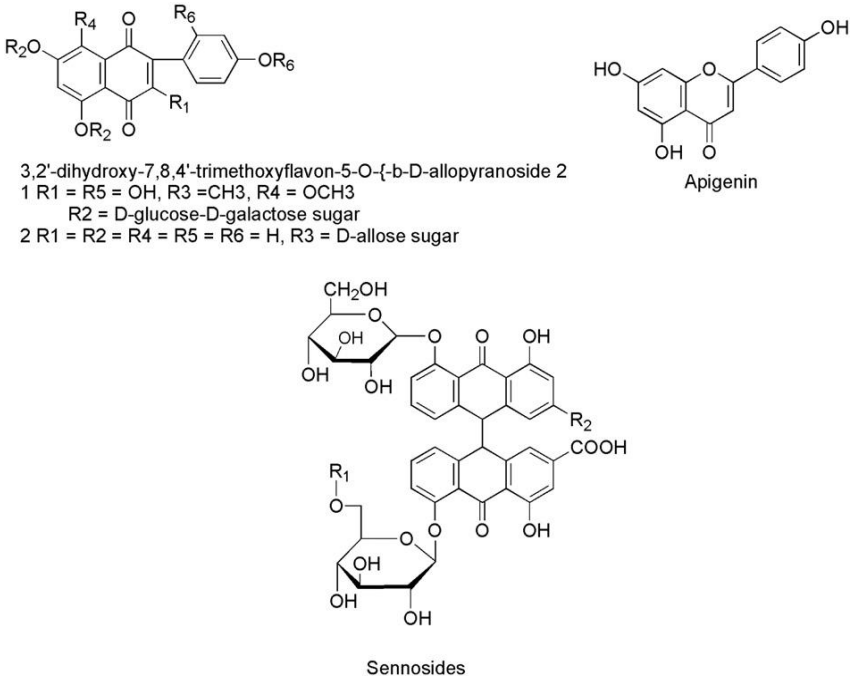


Figure 4: Phytochemicals isolated from C. occidentalis plant [29].

Motal et al. (1985) revealed the importance of tannins for the treatment of inflamed or ulcerated tissues[30]. Saponin which is also one of the constituents of *C. occidentalis* is responsible for numerous pharmacological properties [31]. Saponins are considered a key ingredient in traditional Chinese medicine and are responsible for most of the observed biological effects[32]; it is also known to produce inhibitory effects on inflammation[33].

PHARMACOLOGICAL ACTIVITY

Antidiabetic Activity

Many plant preparations have been reported to possess antidiabetic activity over last several decades[34, 35]. Verma et al reported that *C. occidentalis* exhibit significant Antidiabetic activity in normal and alloxan-induced diabetic rats. The aq. Extracts of C. occidentalis also showed improvement in lipid profile as well regeneration of β-cells of pancreas and so might be value in treatment of diabetes. Antidiabetic activity of this plant may be due to the presence of flavonoids[35].

Antimicrobial Activity

Leaf extracts of this plant were found to be active against different types of microorganisms (Corynebacterium diphtheriae, Mucor sp. Neisseria sp. Salmonella sp., Aspergillus niger) [36]. The leaf extract of C. occidentalis when tested against different

pathogenic bacteria was found to be active against Salmonella enteritidis and Staphylococcus aureus while a negative effect was observed against E. coli and Shigella dysenteriae [37].

Leaves of this plant were extracted with ethanol and water by Sadiq et al. The extracts were used to carry out antimicrobial screening in vitro on staphylococcus aureus, pseudomonas aeruginosa, Escherichia coli, salmonella typhi, shigella spp. Chromatograhic separation was carried out on the active extracts, and the efficacy of the resulting fractions was tested against the susceptible organism. Some of the extracts indicated significant inhibitory activity against the tested organisms. General phytochemical screening was done on the ethanol, water extracts and fractions. Ethanol extract revealed the presence of Tannins, Saponins, Cardiac glycoside, Terpenoids and Anthraquinones while the fraction revealed the presence of Tannins, Terpenoid and Anthraquinones. This result might explain the ethnobotanical use of the plant for the treatment of dysentery, gastro internal disorder, constipation and Typhoid fever[38].

The seeds of this plant possess a strong antibacterial activity against S. aureus, B. subtilis, B. proteus and Vibrio cholerae and against fungi A. flavus, A. niger and Trichophyton mentagrophytes[39-41].

Antioxidant activity

Antioxidants are any substance that delay or inhibits oxidative damage to a target molecule. Antioxidants cause protective effect by neutralizing free radicals, which are toxic by product of natural cell metabolism. Nuhu et al studied *C. occidentalis to ascertain the hepatoprotective potential of the plant extract.* Hypoproteinaemic effects and increase in ALT, AST and ALP were indications that the crude extract of *C. occidentalis* leaves may be slightly toxic as concoction for liver ailments. Their research concluded that infusion of *C. occidentalis* leaves is used as an effective treatment for hepatitis among the rural dwellers in northern part of Nigeria[42].

Vadnere et al evaluated the antioxidant potential of different fractions of whole plant of *Cassia occidentalis* Linn. (Caesalpiniaceae) using various *in vitro* assay including 1, 1- Diphenyl-2-Picrylhydrazyl (DPPH), nitric oxide scavenging activity, hydrogen peroxide scavenging activity, reducing power assay.The results of the study indicate that ethyl acetate fraction of ethanol extract of whole plant of Cassia occidentalis Linn. possess the significant antioxidant activity. Ethyl acetate fraction of ethanol extract of whole plant of Cassia occidentalis Linn. must contain some principles, which possess antioxidant activity[43].

Infusion of the leaves of *C. occidentalis* is used as an effective treatment for hepatitis. The potential of the leaf extract of *C. occidentalis* may be related to its antioxidant activity. Torell et al. [44] and Faure et al. [45] have shown that flavonoids inhibit peroxidation of polyunsaturated fatty acids in cell membranes.

The hepatoprotective activity of aqueous-ethanolic (50% v/v) extract of leaves of this plant was studied on rat liver damage induced by paracetamol and ethyl alcohol by monitoring serum transaminase, alkaline phosphatase, serum cholesterol, serum total lipids and histopathological alterations. The prepared extract produced significant hepatoprotection [46]. This plant is also used in another polyherbal formulation Liv.52 tablet and syrup used extensively in the management of Hepatitis A (HA).

Antimalarial activity

Extract of this plant has a significant antimalarial activity [48–50]. The ethanolic, dichloromethane and lyophilized aqueous extracts of C. occidentalis root bark was evaluated for their antimalarial activity in vivo, in 4-day, suppressive assays against Plasmodium berghei ANKA in mice [48]. No toxic effect or mortality was observed in mice treated, orally, with any of the extracts as a single dose, of 500 mg/kg body weight, or as the same dose given twice weekly for 4 weeks (to give a total dose of 4 g/kg). At doses of 200 mg/kg, all the ethanolic and dichloromethane extracts produced significant chemosuppressions of parasitemia of >60% for C. occidentalis root bark when administered orally.

The C. occidentalis was active and cause 60% chemosuppression. It is also observed that the lyophilized aqueous extract was less active than the corresponding ethanolic extract[48]. Ethanol and chloroform extract of the C. occidentalis leaves have been found to have good antimalarial activity. These extracts produce more than 60% inhibition of the parasite growth in vitro at a concentration of 6 µg/ml [49, 50].

Anti-inflammatory activity

Leaves of this plant have good anti-inflammatory activity as assayed by Sadique et al.[51]. They have used Carrageenan induced paw edema and cotton pellet granuloma assay and found that C. occidentalis was maximally active at a dose of 2000 mg/kg. They have also noted the ability of these extracts to lower the lipid peroxide content, gamma-glutamyl transpeptidase and phospholipase A2 activity in the exudates of cotton pellet granuloma, resulting in the reduced availability of arachidonic acid, a precursor of prostaglandin biosynthesis, and/or by stabilization of the lysosomal membrane system[51]

Anticarcinogenic activity

Li et al. (2003) reviewed the biological activities of tannins and observed that tannins (whether total or pure compound) have remarkable activity in cancer prevention and anti-cancer. This implies that *C. occidentalis* can serve as source of drug for the treatment and prevention of cancer[32].

Ethanolic extract of Senkot tablets (Cassia senna concentrate used as vegetable laxative), was found to be non-mutagenic while it inhibited the mutagenicity of benzopyrene, aflatoxin B1 and methyl methanesulfonate in the Ames histidine reversion assay using Salmonella typhimurium tester strain TA98 and

TA100[52]. They have also found Senkot extract completely inhibited the mutagenicity of promutagens. Antimutagenic effects of Senkot extract could be largely due to an interaction with the metabolic process involved in the activation of procarcinogens. The C. occidentalis extract is found to be effective against the chromosomal aberrations produced by benzopyrene and cyclophosphamide in mice[53].

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