Review Article

World J Curr Med Pharm Res. 2022; 4(6): 147-150

WORLD JOURNAL OF CURRENT MEDICAL AND PHARMACEUTICAL RESEARCH

www.wjcmpr.com ISSN: 2582-0222

Cassia alata: phytopharmacological, traditional, and medicinal considerations

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Abstract

The traditional medicine, *Cassia alata*, also known as *Ketepeng Cina* in Indonesia and *Gelenggang* in Malaysia, has been used to cure a variety of illnesses particularly skin conditions. Additionally, it has been suggested that C. alata may have antifungal, anticancer, anti-inflammatory, and antioxidant properties. Alatinon, alanonal, flavones, flavonols, and flavonoid glycosides, as well as -sitosterol-D-glucoside, are among the isolated metabolite substances from C. alata. Mostly from the leaves, chemicals have been isolated. The secondary metabolites from other plant components such as the seed, flower, and bark, which are also said to have strong antibacterial and antifungal activity, need to be further identified. Due to its biological activity and secondary metabolites, this plant has been demonstrated to have pharmacological activities against selected diseases.

Article History:

Received: 11.10.2022
Revised: 28.10.2022
Accepted: 29.11.2022

Keywords:

Cassia alata, Physicochemical constituent, Pharmacological activity.

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DOI: https://doi.org/10.37022/wjcmpr.v4i6.244

Introduction

A country's natural richness includes medicinal plants. They play an important role in delivering primary health care services to the rural population [1]. Plants have played an important role in human lives. Since, ancient times, about 80% of the world's population depends solely on traditional remedies for their health care needs. The 7000-8000 plant species are used today because of the presence of some biologically active and naturally occurring phytochemicals present in them, which protect them from pollution, stress, and drought, as well as pathogenic microorganisms. The herbal medicines are safer and more effective [2]. *Cassia alata*, a traditional medicinal plant used for this study, has been very successful in many human ailments and is involved in the therapeutic of several forms of skin infections, intestinal parasitosis, syphilis and haemorrhage. *Senna alata* (previously named *Cassia alata*) is a medicinal plant of the Leguminosae family. It has many common names such as Candle bush, Emperor Candlestick, Christmas candle, Acapulo, Ringworm bush and Calabra bush [3].

Cassia species are already reported in the ancient ayurvedic literatures and literature survey indicated its use against various skin diseases such as ringworm, eczema, and scabies. Because of the high incidence of skin diseases, especially among the weaker section of the Indian population, it was felt worthwhile undertaking research on this plant. According to Ayurveda the leaves and seeds are acrid, laxative, antiperiodic, anthelmintic, ophthalmic, liver tonic, cardio tonic and expectorant. The leaves and seeds are useful in leprosy, ringworm, flatulence, colic, dyspepsia, constipation, cough, bronchitis, cardiac disorders. Cassia species powder made from Cassia species seeds and Cassia species splits are some ancient natural ingredients. In India, Cassia species is used as a natural pesticide in organic farms. Roasted seeds are substituted for coffee, like tephrosia seeds. Cassia species powders are most popularly used in the pet-food industry. It is mix with guar gum for use in mining and other industrial application. The extracts of Cassia species have been used as a remedy for various skin ailments, rheumatic disease and as laxatives. The extract of Cassia species leaves has been found to possess significant hepatoprotective activity and anti-inflammatory activity [4]. It is a shrub with usually an average height of between 1 and 5 meters and has horizontally spread branches. Its leaves are par pinnate of between 30 to 60 cm long and consisting of 8 to 20 pairs of leaflets. Each leaflet is oblong or elliptic-oblong and rounded at both ends. Its flowers are dense in auxiliary racemes, about 20 to 50 cm long and 3 to 4 cm broad. The inflorescence looks like a yellow candle. The plant fruits are thick, flattened with wings and glabrous pods [5].

Geographical distribution - Height: 30-90 cm, Crop: Annual herb, Altitude: 1000-1400 meters,

1. Leaves - Color: Green color, Shape: Petiole, opposite, conical at one end, ovate, oblong and base oblique, Height: 6-8cm long.
2. Flowers - Color: Pale yellow, Shape: Sessile pairs in the axils of the leaves with five petals, upper one are very crowded.
3. Pods - Shape: Incompletely septate, membranous with numerous brown oblong rhombohedral seeds, Height: 6-12 inch long 6

Synonyms

- *Cassia bracteata* L.f.
- *Cassia herpetica* Jacq.
- *Cassia rumphiana* (DC.) Bojer
- *Herpetica alata* (L.) Raf.

Common Name

Alcapulco, candelabra bush, candelabra plant, candle bush, candlestick senna, Christmas candle, emperor's candlesticks, empress candle plant, golden candelabra tree, golden-candle senna, ringworm bush, ringworm plant, ringworm senna, ringworm shrub, ringworm-bush, ringworm-shrub, Roman candle tree, seven golden candles, seven golden candlesticks, stick senna, yellowtop weed, Senna alata.

Taxonomical classification [7]

- kingdom: Plantae;
- order: Fabales;
- family: Fabaceae;
- subfamily: Caesalpinioideae;
- tribe: Cassieae;
- subtribe: Cassiinae;
- genus: Senna;
- species: S. alata

Biological activity of *C. alata*. [8]

Part of Plant	Biological activity
Leaf	• Anti-allergic • Anti-inflammatory • Antioxidant
Seed	• Antioxidant • Thrombolitic • Anticancer • Antimicrobial
Stem Bark	• Antimicrobial
Root	• Antioxidant • Antimicrobial
Pod	• Antioxidant
Flower	• Antioxidant • Antimicrobial

Fig No: Cassia alata

Phytochemical Constituents [9]

There are major secondary metabolites of *C. alata* which has been noticed and it has been reported to be flavonoids including kaempferol and its glycosides (e.g., kaempferol-3-O-gentiobioside and kaempferol-3-O-_-d-glucopyranoside), anthraquinones derivatives (e.g., alatonal, alatinone, chrysaphanol, emodin, rhein, aloe-emodin), essential oils, fatty acids and terpenoids (e.g., palmitic, oleic, linoleic acids, terpenoids (_-sitosterol, stigmasterol, campesterol) and other metabolites for instance, ellagitannins and p-hydroxybenzoic acid (Hennebelle et al., 2009). 10

Flavonoids are a broad class of chemicals that are made up of the A and C rings of benzo-1-pyran-4-quinone. Through antioxidative action, flavones can help prevent various ailments, including cancer [11].

- Leaves - Anthraquinone glycosides, rhein, emodine, physion, chrysophanol, Obtusin, chrysoobtusin, chryso-obtusin-2-O-β-D-glucoside, obtusifolin, Flavnoids.
- Root - Betulinic acid, chrysophanol, Physcion, Stigmasterol, 1hydroxy-7-methoxy-3-methyl-anthraquinone, 8-O-methylchrysophanol, 1-Omethylchrysophanol, Aloe-emodin.
- Seed - Anthraquinones, Aurantio-obtusin, Chryso-obtusin, obtusin, Chrysoobtusin-2-O-beta-D-glucoside, Physcion, Emodin, Chrysophanol, Obtusifolin, Obtusifolin-2-O-beta-D-glucoside, Phenolic glycosides, rubrofusarin-triglucoside, nor-rubrofusaringentiobioside, demethylflavasperonegentiobioside, torachrysonegentiobioside, torachrysonetetraglucoside, torachrysoneapioglucoside. Gums (7.65%), Stem bark - 1hydroxy-5-methoxy-2-methyl anthraquinone, d-mannitol, myricyl alcohol, β-sitosterol, glucose, tigonelline, 1-stachydnine and choline.

Table list of Chemical constituents of Cassia alata

1. **Antifungal activity [12]**

   The plant's leaves were harvested and sundried to examine their efficacy scientifically. This study found that ethanolic leaf extracts had substantial dose-dependent antifungal efficacy against pathogenic fungus clinical isolates. However, the MIC value for 100mg strength in Trichophyton mentagrophytes is 13mm, 13mm in Trichophyton verricosum, and no growth on S. Tricosa. To summarize, the assertion stated by folk practitioners that *Cassia alata* is a strong antifungal is valid and scientifically proven.

2. **Antibacterial activity [13]**

   The goal of this study is to see if the stem of *C. alata* exhibits antibacterial action against Staphylococcus aureus. The stems of *c. alata* were removed using an ultrasound-assisted extraction method. The ethanolic extract of *C. alata* stems has a substantial inhibitory effect on Staphylococcus aureus.

3. **Anticancer activity [14]**

   GC-MS analysis was used to identify the phytochemical components. CME was employed to investigate the antiproliferative and apoptotic capabilities of human colon cancer HT-115 cells. This impact could be attributed to the presence of Phyto-active macromolecules in CME, such as cyclotrisiloxan, beta-sitosterol, and alpha-tocopherol, as validated by GC-MS. Finally, bioactive chemicals found in CME may suppress HT-115 colon cancer cell proliferation by inhibiting the protumorigenic immunological axis and stimulating the mitochondria-dependent apoptotic pathway without causing necrosis.

4. **Antidiabetic activity [15]**

   The study's purpose was to see if a *C. alata* extract could lower blood sugar levels in diabetic mice produced by streptozotocin (STZ). To induce type 2 diabetes, streptozotocin (STZ; 65 mg/kg) was given intravenously. *C. alata* endophytic extract exhibited

beneficial pharmacological effects and can be utilized to control diabetes and associated consequences.

5. **Anti-inflammatory activity** [16]

   Only a few studies have looked into the role of anti-inflammation on skin. HPLC was used to assess the rhein content of *C. alata* leaf extract. The anti-inflammatory effects of rhein and *C. alata* leaves extract on tert-butyl hydroperoxide-induced oxidative stress were studied in HaCaT cells. These data suggest that rhein and *C. alata* leaves extract may reduce inflammation by lowering TNF- and IL-8 levels as a result of reduced ROS levels. These findings suggest that *C. alata* leaves could be used as an anti-inflammatory agent. As a result, additional research is required.

6. **Antiviral activity [17]**

   The study found that *Cassia alata* has antiviral activity against DENV, however the mechanism of action is yet unknown. We investigate C's mode of action. Meanwhile, the toxicity was determined using the MTT assay. The inhibition after infection was 96.04% and 99.16%. In comparison to those fractions, *Cassia alata* ethanol extract inhibits DENV at all stages of virus replication the most. *Cassia alata* ethanol extract inhibits DENV at all stages of virus replication, with an average inhibition of more than 95%. The strongest inhibitors are ethyl acetate and hexane, with an average inhibition of 100%.

7. **Anthelmintic activity [18]**

   It is critical to quantify the plant's pharmacological characteristics, particularly in the management of worm infestations. The antihelmintic effects of an endophytic extract of *Cassia alata* were tested in mice using albendazole as the reference medication. The extract paralyzed worms at the same time as Albendazole and was more effective at greater concentrations of 50mg/ml. This plant has significant anthelmintic activity that is dose-dependent, and it may be useful as a cost-effective and safe anthelmintic alternative.

8. **Hepatoprotective activity [19]**

   The hepatoprotective efficacy of *Cassia alata* infusion (ICA) against Paracetamol-induced liver damage in albino rats was investigated. Infusion pre-treatment (ICA) reduced hepatic damage biochemical markers such as serum glutamate pyruvate transaminase (SGPT), serum oxaloacetate transaminase (SGOT), alkaline phosphatase (ALP), total bilirubin, and gamma glutamate transpeptidase (GGTP). Histopathological examinations demonstrated that pre-treatment with ICA protected the mice from the liver damage caused by paracetamol. The findings suggest that the leaves of *C.alata* have Hepatoprotective action. This property may be linked to the flavonoids found in *C. alata* leaves.

9. **Antiulcer activity [20]**

   The antiulcer activity of an ethanolic extract of *Cassia alata* leaves (ECA) was studied in experimental rats using pylorus ligation and ethanol-induced ulcer models. The ulcer index was determined as a common parameter in both models. At doses of 150 and 300mg/kg, ethanolic extract of *Cassia alata* significantly inhibited the stomach lesions caused by pylorus ligation induced ulcer and ethanol induced gastric ulcer. When compared to the control, the extract (150mg/kg and 300mg/kg) reduced stomach volume, free acidity, and ulcer index significantly (p0.05). The current investigation suggests that ECA may have anti-ulcer action in both models. These findings may imply that the extract has anti-ulcerogenic as well as ulcer healing effects, which could be attributed to its anti-secretory action**.**

Conclusion

Historically, Asian nations have employed the *C. alata* plant as a herbal remedy. This study revealed that many components of the Cassia plant, including the roots, stem, leaves, and seeds, are traditionally used to cure a wide range of illnesses. Additionally, the extract contains significant antioxidant, antidiabetic, anticancer and antibacterial properties that support good health. As a result of this study, it is hypothesised that the *Cassia alata* plant provides a plentiful source of compounds with therapeutic properties.

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