Biological Activities and Medicinal Properties of *Couroupita guianensis*.


Department of Biotechnology, Krishna University, Machilipatnam-520001, A.P. India.

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Abstract

*Couroupita guianensis* is also called as “Cannonball tree” or “Sal tree” or “Ayauma tree”. The tree has spread widely all over the world. The tree has a enormous medicinal values since most of the parts like leaves, flower, fruit and stem are used as medicine to cure various diseases. In this present review, we try to give the existing information on phytochemical constituents, medicinal uses and other biological activities of *Couroupita guianensis*. This plant is very important in traditional veterinary medicine because it is used commercial since a very long time ago. During the last few decades it has been observed that there are numerous reports on anti inflammatory activity, anti ulcer activity and anti cancer activity of this plant. It is enriched with a number of compounds such as oils, keto steroids, glycosides, couroupitine, indirubin, isatin and phenolic substances. The extract of various parts of *couroupita guianensis* showed significant pharmacological activities so it is necessary to perform further investigation to isolate such pharmacological active compounds which can be used in production of novel drugs for various diseases.

Key words: *couroupita guianensis*, veterinary medicine, Pharmacological activity, Phytochemical constituents.

Introduction

Plants are the basic source of knowledge of modern medicine. Almost all the parts of the plant, namely leaves, flowers, fruits, roots, stem and seeds are known to have various medicinal properties. The trend of using natural products has increased and the active plant extracts are frequently screened for new drug discoveries. The medicinal plants mostly find application in pharmaceutical, cosmetic, agricultural and food industry. The use of the medicinal herbs for curing disease has been documented in history of all civilizations. Man in the pre-historic era was probably not aware about the health hazards associated with irrational therapy. Plant products can be used as a part of food or botanical portions and powder have been used with varying success to cure and prevent diseases throughout the history. Ayurveda currently utilizes as many as 1000 single drugs and over 8000 compound formulations recognized merit. One important plant that is used in traditional medicine is *Couroupita guianensis* is a tree belonging to the family Lecythidaceae. It is native to South India and Malaysia and is commonly known as Nagalinga pushpam in Tamil. Various part of the tree have been reported to contain oils, keto steroids, glycosides, couroupitine, indirubin, isatin and phenolic substances. *Couroupita guianensis* (Cannon ball) is a large deciduous tropical tree 90’ tall and indigenous to the Amazon rainforest. The leaves, up to 6” long, are simple with serrate margin; it flowers in racemes; the yellow, reddish and pink with stunning fragrant. Flowers are large 3” to 5” waxy aromatic smelling growing directly on the bark of the trunk (cauliflory). Fruits are large globose woody looking like big rusty cannonballs hanging in clusters, like balls on a string. The fruit contains small seeds in a white, unpleasant smelling edible jelly. The hard shells are used to make containers and utensils.

*Couroupita guianensis* has showed a broad spectrum of antibacterial and antifungal activities. The leaves of *Couroupita guianensis* possess the herbal hand wash formulation and yeided an aliphat triterpene, it is used as an anti-depressant using in rats. The leaves and flowers of *Couroupita guianensis* has showed the significant anti-oxidant activity. The phenolic compounds of *Couroupita guianensis* are active in curing the kidney and stomach problems and also helpful as anti-inflammatory in action. The biological function of flavonoids, apart from their antioxidant properties, include protection against allergies, inflammation, platelet aggregation, microbes, ulcers, heptatotoxins, viruses and tumors. It is known that one of the active constituents of the medicinal plant *couroupita guianensis*, namely isatin, is known to exert cytotoxic activity against certain cancer cell lines, being a potential source of new chemotherapeutic agents. In a study performed using extracts of *Couroupita guianensis* against human promlyocytic leukemia (HL60) cells, isatin showed antioxidant activity and was cytotoxic to the HL60 cells due to induction of apoptosis, a natural cell death. These results suggest that isatin can be further evaluated to be used as a prophylactic agent to prevent the free radical- induced cancer and as a chemotherapeutic agent.
Scientific Characters

Botany

Couropita guianensis is a large evergreen tree growing to a height of 20 meters. Leaves are alternate, oblong-obovate, up to 20 centimeters long, entire to slightly serrate and hairy on the veins beneath. Inflorescence is racemose, arising from the trunk and other large branches. Flowers are reddish with a yellow tinge on the outside, fragrant, with stamens borne on an overarching androphore. Fruit is a large, reddish-brown globose, 15 to 24 centimeters, with a woody capsule, and each containing 200 to 300 seeds. Pollination is done by bees and bats. The tree bears, also directly on the trunk and main branches, large globose woody fruits; they look like big rusty cannonballs hanging in clusters, like balls on a string. The fruit contains small seeds in a white, unpleasant smelling edible jelly, which are exposed when the upper half of the fruit goes off like a cover. The long dangling fruity branches give the tree an unkempt appearance. (7).

Scientific name: Couroupita guianensis Aubl.
Common names:
- English: Cannon ball tree
- Hindi: Shivaling Ayahuma
- Spanish: Coco de mono; Abrico de Macaco

Botanical classification:
- Kingdom: Plantae-Plants
- Subkingdom: Tracheobionta-Vascular plants
- Superdivision: Spermatophyta-Seed plants
- Division: Magnoliophyta-Flowering plants
- Class: Magnoliopsida-Dicotyledons
- Subclass: Dilleniidae
- Order: Lecythidales
- Family: Lecythidaceae-Brazil-nut family
- Genus: Couroupita Aubl.-Cannonball Tree
- Species: Couroupita guianensis Aubl.-Cannonball Tree
(National Plant Database. 2004.) (8).

Distribution:
- As ornamental trees along highways and in parks.
- Native to tropical northern South America, especially the Amazon rainforest, and the southern Caribbean.
- Also occurs in India, where it is probably native, and Thailand.

Constituents:
- Flowers yield an alipathic hydrocarbon and stigmasterol.
- Flowers yielded alkaloids, phenolics and flavonoids.
- Yielded active principles isatin and indirubin (vital to its antimicrobial activity).
- Phytochemical screening yielded flavonoids: 2',4'-dihydroxy-6'-methoxy-3',5'-dimethylchalcone, 7-hydroxy-5-methoxy-6,8-dimethylflavanone and the phenolic acid 4-hydroxybenzoic acid.

Properties:
- Considered antibiotic, antifungal, antiseptic, and analgesic.

Parts used:
- Juice, leaves, fruit.

Uses

Edibility:
- Fruits are edible, but only occasionally eaten because of the unpleasant odor of the white flesh.

Folkloric:
- No known medicinal use in the Philippines.
- Elsewhere, used to treat colds and stomachaches.
- Juice from leaves used for skin diseases.

Shamans of South America used tree parts for malaria.
Fruit pulp used to disinfect wounds.
Young leaves used for toothache.

Propagation
- Seeds.Due to recalcitrant nature of the seeds, they have a short viable life, can not be dried well and can not withstand low temperatures.

Culture
- Full sun / partial shade, moist soil, needs high humidity.
- Very susceptible to frost. Plant in frost free locations.

Others:
- Fragrance: Fragrant flowers can be used to scent perfumes and cosmetics.
- Wood: (1) Hard shells of the fruit sometimes used as containers and utensils. (2) Wood used for making incense.(7).

Biological Activities:
1. Antimicrobial activites: The methanol and aqueous extract of the C. guianensis leaf were screened against six human pathogenic bacteria and four fungal pathogens to check antibacterial and antifungal activities by well diffusion method which showed valuable zone of inhibition. The specific zone of inhibition against various types of pathogenic bacteria and fungus was shown in table 3 and 4. Methanol extract was better than the aqueous extract against bacteria as well as fungal pathogens. The zone of inhibition against bacterial pathogens ranged
between 31 – 12mm in methanol extract and 30 – 12mm in aqueous extract. The maximum activity (31mm) was recorded from 200mg of methanol extract of *C. guianensis* against Salmonella typhi followed by 29mm against E.coli and minimum (12mm) against Streptococcus aureus at 50mg level whereas, the aqueous extract showed the maximum activity (30mm) was recorded from 200mg of leaf extract against E.coli and minimum (12mm) by 50mg of extract against the above bacteria. Leuconostoc lactis, Pseudomonas aeruginosa and Strepto coccus pyogenes did not showed the any activity against both the extract. The zone of inhibition against fungal pathogens ranged between 19 - 8mm in methanol extract and their was no activity in aqueous extract. The maximum activity (19mm) was recorded from 200mg of methanol extract against Aspergillus niger and minimum (8mm) by Rhizopus indicus at 50 mg level.(9).

2. **Anti ulcer activity:** Elumalai et al reported the anti ulcer activity in ethanolic extract of *couroupita guianensis* at a dose of 150 and 300mg/kg produced significant inhibition of the gastric lesions induced by pylorus ligation induced ulcer and ethanol induced gastric ulcer. Ethanol induced gastric lesion formation may be due to stasis in gastric blood flow which contributes to the development of the hemorrhage and narcotic aspects of tissue injury. (10).

3. **Anti inflammatory Activity:** Pinheiro et al reported the anti inflammatory activity in the ethanol extract of *couroupita guianensis* that the extract fractions significantly reduced the time that the animal spent licking the formalin-injected paw in first and second phases. Only the higher doses (30 and 100 mg/kg) were able to inhibit the leukocyte migration into the peritoneal cavity after carrageenan injection. At the same time the 100 mg/kg dose almost abolished the cell migration. The results show that *Couroupita guianensis* fractions have anti-inflammatory effect, partly due to a reduction on cell migration and an inhibition on cytokines and inflammatory mediators production. (11).

4. **Antioxidant activity:** Sanjay Prahalad Umachigi reported the alcoholic extract of *couroupita guianensis* significantly stimulated the wound concentration this due to the presence of stigmasterol and flavonoids in the extract. The results indicated that *Couroupita guianensis* accelerates the wound healing process by decreasing the surface area of the wound and increasing the tensile strength. (12).

5. **Antinoceptive:** CEE (crude ethanol extract) and fractions significantly inhibited the number of contortions induced by acetic acid. All fractions showed antinociceptive activity in the tail flick model, being the hexane and ethyl acetate the most potent and long acting fractions. In the hot plate method the highest effect observed was at the dose of 100mg/kg from all fractions. Administration of naloxone inhibited the antinociceptive effect of fractions. Pre-treatment of mice with atropine reduced the antinociceptive activity of CEE and its fractions, the exception being the dichloromethane fraction. Mecamylamine did not inhibited the effect of dichloromethane fraction. L-NAMe reduced the anti-hyperalgesic effect of all fractions, but the most prominent effect was observed in the antinociceptive activity caused by CEE and butanol fraction.(13).

6. **Anthelmintic:** Study tested the activity of chloroform, acetone and ethanolic flower extracts of CG for anthelmintic activity against adult earth worm, Pheritima posthuma. The alcholic extract was the most effect in an activity comparable with Piperazine citrate.

7. **Skin Fibroblast Proliferation / Antioxidant:** Study of hydroalcoholic extract strongly indicated antioxidant activity attributed to phenolic content. Also, significant stimulation of HSF proliferation and absorption of UV radiation was noted.(7).

8. **Antioxidant and anticancer activities:** The flowers of *couroupita guianensis* consists of compound isatin. The derivatives of this compound is known to have cytotoxicity against human carcinoma cell lines. This compound therefore, has a potential to be used as a chemotherapeutic agent against cancer. Isatin started the apoptosis process with fragmentation of DNA. Cleavage of DNA at the inter nucleosomal linker sites yielding DNA fragments is regarded as a biochemical hallmark of apoptosis. Apoptosis induced by isatin was confirmed by flow cytometry to further elucidate the extent and causes of apoptosis. isatin was isolated from the floral parts of cannon ball tree and it exhibited antioxidant activity and cytotoxicity against HL60 cells. (14)

**Conclusion:**

The extensive literature survey revealed that *Couroupita guianensis* is an important medicinal plant with diverse pharmacological uses. The cannon ball tree possesses antibiotic, antiseptic, and analgesic qualities. The antimicrobial activity of the different extracts of this cannon ball tree was assessed against various human pathogenic bacteria. Plant based antimicrobial have enormous therapeutic potential as they can serve the human with lesser side effects and boon for the development of chemotherapy. There is growing interest in correlating the phytochemical constituents of a medicinal plant with its pharmacological activities.

**References:**


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