



IJPPR

INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH
An official Publication of Human Journals

ISSN 2349-7203



Human Journals

Review Article

June 2021 Vol.:21, Issue:3

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Careya arborea: A Review



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Submitted: 22 May 2021

Accepted: 29 May 2021

Published: 30 June 2021

Keywords: *Careya arborea*, Pharmacological activity,
Morphology

ABSTRACT

Plants have been used for diagnosis, treatment, and prevention of various ailments since the dawn of humanity on this planet. *C. arborea*, a member of the Lecythydaceae family, is one of the most widely used plants. It's a tree with large yellowish flowers that are sessile and large green berry-like fruits with a persistent style and calyx. Cough and cold, infertility, postpartum jaundice, masses, blood dysentery, scorpion sting, intestine sores, bed sores, ear pain, snake bite, inflammation, ulcer, spermatorrhoea, and wounds have all been treated with it in the past.



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INTRODUCTION:

Careya arborea Roxb. also known as wild guava, is a medium-sized deciduous tree with a dark grey colour and thin strips of exfoliating bark. It's commonly available in India, Sri Lanka, Malaysia, and the Philippines. The Lecythidaceae family includes large tropical trees with woody skins that bear large fruits (wikipedia.org). The Lecythidaceae family of tropical trees includes about 20 genera and 450 species. The family is mostly found in the wetter parts of tropical South America, with a few genera also found in Africa and Asia. Tumors, bronchitis, epileptic episodes, and skin disorders are all treated with stem bark. It's also used to treat diarrhoea, dysentery with bloody stools, and ear pain.[1-3]

Geographical source:

A deciduous tree found throughout India up to an altitude of 1,500m and in Andaman Islands. It is planted in gardens and roadsides for its large conspicuous leaves and showy flowers and fruits.

Morphology:

Careya arborea is medium sized deciduous tree with height about 20 m. with handsome spreading crown and is propagated by seed. It is the only Malesian species, which is found almost throughout the range of the genus, but in Peninsular Malaysia, it is found in the northwest and occurs rarely.

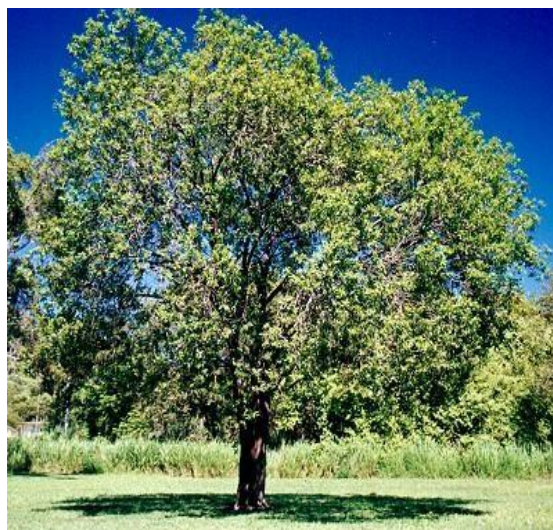


Figure No. 1: *Careya arborea* tree

It can be cultivated from seeds, roots and stumps in cropping years. The trees prefer a well-drained soil which may be both alluvial soils and loams. It also occurs on lateritic soils and trees requires sunny locations and do not perform well in shade. Additionally, the tree also prefers a well-drained, sandy or even rocky soil. In India the annual diameter increment can be up to 0.5 cm, but growth of coppice is faster, 0.6-0.9cm in diameter for 8-year-old coppice shoots. This tree is highly fire resistant and seeds are slightly poisonous whereas fruit is edible.

Stem Bark of *Careya arborea*:



Figure No. 2: Stem Bark of *Careya arborea*

The outside bark is fissured and dark grey, whilst the inner bark is red and fibrous. The bark is irregular, gritty, and stony, with shallow fractures and small flakes that exfoliate with no odour but astringent taste.

Leaves of *Careya arborea*:



Figure No. 3: *Careya arborea* leaves

Petiole is 0-1.8 cm long, robust and margined thickly arranged at the terminals of branches, penninerved, and non-dotted with red colour when young; lateral nerves 10-12 pairs, parallel, prominent, intercostae reticulate, prominent, tertiary veins oblique; lateral nerves 10-12 pairs, parallel, prominent, intercostae reticulate, prominent, tertiary veins oblique. The colourful leaves (turns red in cold season) and rapid growth features of the tree is suitable for growing it as ornamental plant.

Flower of *Careya arborea*:



Figure No. 4: Flower of *Careya arborea*

Usually, without anthers, anthers versatile, dehiscing longitudinally. Inflorescence is terminal and raceme. It blossoms during March-April. Flowers are large showy bisexual, yellowish green with red purple stamens, unpleasant odour, arranged in 1-10 flowered inflorescences, calyx and petals are free and 4-4 in number, many stamens, inferior ovary, multilocular with plenty of ovules arranged in 2 series, style is one. Filaments equalling or slightly exceeding the petals, connate into a tube at the base, the innermost and outermost rows.

Seeds of *Careya arborea*:



Figure No. 5: Seeds of *Careya arborea*

The dark brown seeds are 1.5-2 cm long and 1 cm broad, indehiscent, and exalbuminous. Seeds are wrinkled and range in shape from oval to ellipsoid with firm testa. They have a nice odour as well as astringent flavour (Anonyms).

Fruits of *Careya arborea*:



Figure No. 6: Fruits of *Careya arborea*

Fruit is drupe, 5-7.5 cm in diameter, greenish in colour, globose to depressed globose, crowned by sepals and style and containing several seeds. Fruits get matured in May. There is large embryo in seeds and obsolete cotyledons residing in fleshy pulp. The seedlings have hypogeal germination in which seed contain only swollen hypocotyls cotyledons are missing.

Microscopy

The outermost cork in the stem is 3 to 4 layers thick; the cork cambium is 1 to 2 discontinuous layers thick; the cortex is collencymatous and interspersed with cortical vascular groups. Sclerenchymatous bundle sheath surrounds and scatters cortical vascular groups of various shapes and sizes. Vascular bundles show amphicrival arrangement. The majority of cortical cells are hollow; endodermis is prominent, and pericyclic is present in sclerenchyma patches. Phloem consists of phloem components in concentric groups consisting of companion cells, sieve channels, and phloem parenchyma, accompanied by 4 to 5 layers of vascular cambium. Cork cells, parenchymatous cells, secondary phloem components, and cortical tissue fragments are often found in the stem bark of *C. arborea*. [4]

Classification:

Kingdom - Plantae

Division- Angiospermae

Order - Ericales

Family - Lecythidaceae

Genus - Careya

Species- arborea

Vernacular names:

English: Wild Guava, Hindi: Kumbhi, Marathi: Kumbha, Bengali: Kumbhi, Tamil: Aima,

Sanskrit: Bhadrendrani, Bhoodaadima, Girikarnika.

Uses:

Part used	Uses
Whole plant	Astringent, demulcent, antipyretic, antipruritic, in cough, cold and eruptive fevers Smallpox Snake bite
Fruits	Cold and cough Digestion promoter
Flowers	Aphrodisiac Acrid, cures 'Kapha', demulcent in cough and cold Tonic Vaginal ruptures Fever Colic and loose motions Cold and Cough
Calyx	Filaria
Seeds	Colic and loose motions
Leaves	Fever and swellings Ulcers and skin diseases
Twig	Leech repellent
Gum exudates	Jaundice after delivery Tongue ulcers

Stem bark	Constipation Diarrhoea Skin diseases Dysentery In asthma, dental diseases and snake bite
Stem sap	Menorrhagic
Root	Astringent
Bark	Washing and cleaning abscesses, boils, ulcers and diarrhoea Ear pain Skin diseases Antipyretic, antipruritic and eruptive fever Smallpox and stomach disorders Wound healing and body pain Astringent and demulcent Cough and Cold Alexiteric, anthelmintic and in urinary discharges Rheumatic pain and diarrhoea Eye complaints Abortifacient Asthma, dental diseases and snake bite Tumors, dyspepsia, bronchitis and colic Coarse fibre for cordage ropes, cloth sacking and saddle making

Pharmacological actions of *Careya arborea* Roxb.:

Plant part	Type of extract	Pharmacology
Trunk bark	90 and 10% methanolic extract	No sedation and analgesia in mice No effect on B.P and respiration in cats No direct action/ antagonism on the isolated intestine of rabbit and guinea pig, isolated uterus of guinea pig, frog rectus abdominis muscle and isolated frog heart [5]
Whole plant (excluding root)	50% ethanolic extract	No activity when screened for antibacterial/ antifungal/ antiprotozoal/ antiviral/ hypoglycaemic/ anticancer and diuretic activities Phenols Tannins [6] Effect on respiration, nictating membrane, CVS and CNS of experimental animals; isolated guinea pig ileum and rat uterus [7]
Stem bark	Petroleum ether extract α -spinasterol, α -	α - spinasterol, α - spinasterone α -spinasterol, Δ^{22} - stigmastenol Triterpenoids: Barringtonenol C,

	spinasterone	Barringtogenol D, 16 desoxy barringtogenol [8]
Leaves	Petroleum ether extract	Taraxerol Careyagenolide, maslinic acid, 2 α hydroxy ursolic acid n-hexacosanol, α –spinasterol, taraxerol, taraxeryl acetate, β -sitosterol, ellagic acid and quercitin
	Ethanollic extract	Triterpene ester- careaborin Tannins Absence of saponins, alkaloids and flavonoids
Leaves (Forming feed of livestock in Northeastern hill region)		Crude protein, ether extract, crude fibre, ash, nitrogen free extract, organic matter Nitrogen Energy as fodder 902.4Kcal/Kg, metabolizable energy 1543.4 Kcal/Kg and digestible energy 1789.6 Kcal/Kg
Bark		Sterols and terpenes, Absence of alkaloids, saponins and flavonoids [9] Saponins and tannins Pyroligenous acid and other components. Presence of steroids, terpenoids, alkaloids, flavonoids and saponins

PHARMACOLOGICAL REPORTS:

Antitumor activity:

An anticancer capacity of a methanol extract of stem bark was assessed in Dalton's lymphoma ascites mediated ascetic and solid tumours. The bark extract, given orally to mice at doses of 250 or 500 mg/kg for 10 days, resulted in a significant decrease in tumorigenic index. MTT assay was used to determine the cytotoxicity of ethanolic leaf extract of *C. arborea* based on inhibition of Vero cell line. The extract's antitumor activity against the Vero cell line was 63.47 percent, suggesting a lower inhibition in normal cells and antitumor and antiproliferative activity against tumour cells at this concentration.[10]

Anti-inflammatory activity:

Dextran, carrageenan, and inflammatory mediators (histamine and serotonin) mediated paw oedema, cotton pellet, and granuloma models were used to investigate the effects of *C. arborea* methanol extract on acute and chronic phases of inflammation. In acetic acid induced writhing and hot plate samples, the extract's analgesic effect was assessed. The antiedema effect of methanolic extract of *C. arborea* was compared with indomethacin 10 mg/kg orally.

Administration of 200 mg/kg b.w. of methanol extract and 10 mg/kg b.w. of indomethacin significantly decreased the formation of granuloma tissue by cotton pellet method. In addition to inducing analgesic effects in rat and mouse models, the extract of *C. arborea* decreased peritoneal leukocyte migration in mice. One of the six lupine-type triterpenes isolated from the bark of *C. arborea*, coumaroyl lupendioic acid, exhibited higher COX-2 selectivity than the reference drug (celecoxib) At equivalent doses, coumaroyl lupendioic acid greatly decreased carrageenan-induced inflammation and also showed a greater effect than betulinic acid. Carrageenan-induced pro-inflammatory mediators were also inhibited.[11]

Anticonvulsant activity:

At 150 and 300 mg/kg b.w. of its petroleum ether, chloroform, methanol, and aqueous extract, the anticonvulsant efficacy of *C. arborea* bark was tested against maximal electroshock seizures and pentylenetetrazol induced seizures. The methanolic and aqueous extracts of *C. arborea* bark had a major ($p < 0.01$) anticonvulsant effect at 300 mg/kg b.w. p.o. in both models, reducing the period of hind limb extension (extensor phase), clonus, and also the duration of stupor phase, as compared to the control. Seizure scores were also reduced when *C. arborea* bark extracts were used.

Antimicrobial and antioxidant activities:

Disc diffusion processes were used to evaluate the antimicrobial activity of a methanol extract of *C. arborea* bark with Gram positive, Gram negative, and fungal organisms. The extract had broad antimicrobial activity against all microorganisms examined. DPPH, superoxide anion radical, nitric oxide radical, and hydroxide radical scavenging analyses were used to assess the antioxidant and free radical scavenging activities of bark extract. *C. arborea* extract was found to be more effective in a concentration-dependent process. The results showed that the methanol extract of *C. arborea* had the potential of natural antimicrobial and antioxidant agents. Ethyl acetate, ethanolic and hexane extract of *C. arborea* fruit were evaluated for antibacterial effect against Gram negative and Gram positive organisms namely *Escherichia coli*, *Salmonella typhimurium*, *Listeria monocytogenes*, *Staphylococcus aureus* and *Staphylococcus epidermidis*. The total phenolic, flavonoid content and antioxidant activity of petroleum ether, aqueous and alcoholic extract of the bark of *C. arborea* was determined using Folin-Ciocalteu method and aluminium chloride method. The antioxidant activities were determined by DPPH method. Both aqueous extract and alcoholic extract showed the presence of phenolic and flavonoid content and had greater

antioxidant activity, while petroleum ether extract contained very little amount of phenol and flavonoids and did not showed any antioxidant activity. The results indicated that the plant is good source of antioxidants and support their use in different diseases.[12]

Antiulcer activity:

The ethanol extract of *C. arborea* bark was checked for the anti-ulcer activity against different models such as ethanol induced, cold restraint stress induced and Pylorus ligation induced models. The ethanol extract of *C. arborea* leaves was examined for its gastroprotective effect in different gastric ulcer models. The extract displayed significant inhibition of ulcer index. Marked decrease occurred in the level of H^+K^+ ATPase, acid output and volume of gastric juice. At the same time, the level of gastric wall mucus was increased. The results indicated that *C. arborea* has significant gastro-protective activity, perhaps due to its free radical scavenging activity and confirm the folklore claim. [13]

Analgesic activity

The present of piperine an alkaloid chemically known as 1-[5(1, 3-benzodioxol-5-yl)-1-oxo-2,4- pentadienyl]piperidine, which was found to have important central and peripheral analgesic activity. At oral doses 10, 20 and 30 mg/kg b.w. piperine showed 41%, 45% and 53% inhibition of acetic acid induced writhing in mice respectively. Moreover, at doses of 20 and 30 mg/kg b.w., the piperine exhibited 31.8 % and 52.4% prolongation of tail flicking time of mice 30 min after the treatments determined by the radiant heat method. [14]

Antileishmanial activity

The butanolic fraction of methanol extract of *C. arborea* leaves resulted in the isolation of a triterpenoid saponin, arborenin, characterized as 3-O- β -D-glucopyranosyl (1-2)- β -Dglucopyranosyl-2a, 3b-dihydroxy-taraxast-20-en-28-oic acid, and desacylescine III. The results showed *in vitro* antileishmanial activity against *Leishmania donovani* (strain AG 83).[15]

Hepatoprotective and *In vivo* antioxidant effects

The hepatoprotective and antioxidant effects of methanol extract of *C. arborea* bark in Wistar albino rats. The hepatotoxicity was induced by carbon tetrachloride. At the doses of 50, 100 and 200 mg/kg b.w. of methanol extract and silymarin 25 mg/kg was administered to rats. Systematic parameters like Alkaline Phosphatases (ALP), bilirubin, uric acid, serum

transaminase (GOT, GPT), and total protein were measured in experimental animals. The results of the extract on lipid peroxidation, enzymatic antioxidant (Superoxide dismutase (SOD) and catalase (CAT), and nonenzymatic antioxidant (GSH), Vitamin E and Vitamin C were evaluated. The methanolic extract of *C. arborea* bark and silymarin made significant ($p < 0.05$) hepatoprotective effect by decreasing the activity of serum enzymes, bilirubin, uric acid and lipid peroxidation and significantly ($p < 0.05$) increased the levels of SOD, CAT, GSH, vitamin E and vitamin C protein in a dose dependent manner.

Wound healing activity:

The effect of *C. arborea* extract on wound healing activity in rats was studied. The effect was investigated using a variety of wound healing models, including an incision wound model, a burn wound model, an excision wound model, and a dead space wound model. The concentrate was applied topically in concentrations of 5% and 10%. In an excision wound model, the two concentrates significantly enhanced wound healing. Breaking strength increased with the extract in the incision wound model. *C. arborea* extract showed a high degree of twisted compression and a shorter epithelisation time. The extract demonstrated injury mending activity in a dead space wound model. In each of the models, *C. arborea* illustrated wound healing activity in a dose-dependent manner.

CNS activity:

Methanol extract of *C. arborea* has activity in the central nervous system. *arborea* bark was studied in Swiss albino mice and wistar albino rats. The effects of phenobarbitone sodium on general behaviour profiles including exploratory behaviour, muscle relaxant activity, and phenobarbitone sodium-induced sleeping time were investigated. The findings revealed that a methanol extract of *C. arborea* bark extract showed CNS depressant activity in tested animal models at doses of 100 and 200 mg/kg, resulting in a substantial reduction in spontaneous activity.[16]

Antifertility activity:

C. arborea root has been used as an oral contraceptive in the past. *C. arborea* is cooked in water for 5-6 hours before being condensed into a semisolid material. To prevent pregnancy, women in assam take this substance orally for 15 days, beginning on the fourth day of menstruation. *C. arborea* root extract was used in a study. *arborea* did not cause acute toxicity in mice when given orally, but it did have a strong but reversible antifertility impact.

Adult female albino mice were given the root extract at a dosage of 500 mg/kg b.w. once a day for 14 days resulted in a decrease in the number of mature graffian follicles, a decrease in the number of corpora lutea, and corpus degeneration. Presence of cystic follicles was also evident in some of the root extract treated animals.

Available formulations of *C. arborea*:

Various formulations containing *C. arborea* as one of the active components are available in market e.g. Hamdard Ghutti® (Hamdard Laboratories (Waqf) Pakistan), a pediatric preparation used to evacuate bowl and treat constipation of newborn and infants, Jigrine® (Hamdard Laboratories (Waqf) Pakistan), a polyherbal formulation used to treat liver ailments, Habb-e-Kabid Naushadri® (Hamdard Laboratories (Waqf) Pakistan), an effective product for about all types of liver disorders, Kumbhajatu® (Ayurveda Rasashala, Pune, India), a good formulation to treat hyperlipidemia and Obenyl® (Charak Pharmaceuticals), used as appetite suppressant to treat obesity.

CONCLUSION:

Use of herbal medicinal plants has been distinctive in our lives right from the primitive period till today and provided us with the data on the use of plants or plant products as therapeutic agents in treating various ailments by virtue of their phytoconstituents.

Careya arborea Roxb. is an important medicinal plant. Extensive literature survey revealed its phytochemical constituents and pharmacological potential as an important traditional drug. The drug is enriched with flavonoids, tannins, terpenoids and sterols. The plant exhibits many pharmacological activities like antimicrobial, antioxidant, antitumor, analgesic, hepatoprotective, antidiarrhoeal, anticoagulant and diuretic properties. However, a systematic phytochemical investigation is required to standardize the drug with reference to the presence of flavonoids with suitable marker compounds. A systematic phytochemical work is under progress in Authors' laboratory.

ACKNOWLEDGMENTS:

The authors of this review article are thankful to the Principal, Government College of Pharmacy, Karad for allowing us to present this paper. We are also thankful to AICTE for providing research fellowship to complete our research work and convert our research work into the publications.

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