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REVIEW ON *CAREYA ARBOREA* ROXB

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ABSTRACT

Careya arborea Roxb. belongs to the family Lecythidaceae is found in many places of the world. It is known as "Kumbhi" in Ayurveda. This is the oldest remedy known to mankind in herbal medicines. India is known worldwide for its Ayurvedic treatment. Medicinal herbs have curative properties due to presence of various complex chemical substance of different composition, which are found as secondary plant metabolites in one or more parts of these plants. The pharmacological activity depends upon the chemical constituents in the plants, so to isolate proper chemical constituents an exact identification of the drug should be done by Pharmacognostical characters. Hence this review provides an entire overlook on Pharmacognosy, chemical constituents, ethnopharmacologial action and pharmacological actions of *Careya arborea* Roxb.

KEY WORDS: *Careya arborea* Roxb, Lecythidaceae, Pharmacognosy, chemical constituents, pharmacological actions

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INTRODUCTION

India is perhaps the largest producer of medicinal herbs and is rightly called the "Botanical Garden of The World"[1] .The word medicinal plant often leads to the thought of some miraculous and supernatural cures. In India, medicinal plants have played a significant role in the development of our ancient materia medica[2] . The word Lecythidaceae means large tropical trees bearing large fruits with woody skins[3] . Lecythidaceae is a family of tropical trees, and consists of about 20 different genera and 450 different species. The family is centered in the wet regions of Tropical South America, with some genera in Africa and Asia. The Planchonioideae, Lecythidoideae, Foetidioideae, Napoleonaeoideae are the different sub families under Lecythidaceae. There are number of genera under each subfamily such as Planchonioideae consists of *Abdulmajidia ,Barringtonia, Careya ,Chydenanthus, Petersianthus ,Planchonia ;*Lecythidoideae has *Allantoma ,Grias ,Gustavia ,Cariniana ,Bertholletia Corythophora Couratari ,Couroupita ,Eschweilera , Lecythis* ,Foetidioideae has *Foetidia and* Napoleonaeoideae consists of *Asteranthos ,Crateranthus,Napoleonaea*[4,5] .

The Careya genera has 3 species they are *Careya sphaerica* Roxb, *Careya herbacea* Robx., *Careya arborea* Roxb[6,7] . *Careya arborea* ka-RAY-ah - named for Rev. Carey of Serampore ar-BOR-ee-uh -- meaning, tree-like[8] . It is reported to be useful in tumours, cough, bronchitis, toothache, wounds, dyspepsia, colic, haemorrhoids, intestinal worms, dysentery, leucoderma, epilepsy, abscesses, ulcers and eruptive fever particularly smallpox and . antipruritic[9, 10, 11.] The chief constituents found in the of *C. arborea* Roxb. are lupeol, β-sitosterol, betulin, betulinic acid, 1-[5-(1,3-benzodioxol-5-yl)-1-oxo-2,4-pentadienyl] piperidine (bark)[12,13] . Various parts of the tree is known as padmaka in Ayurvedic system of medicine are reputed in Indian medicine[14] .

PLANT DESCRIPTION

Careya arborea Roxb.

Synonym- *Careya coccinea* sensu Alston, Planchonia carseya (F. Muell.) R. Knuth.

Family- Lecythidaceae[15, 16] .

Vernacular names

English**:** Carey's Myrtle Bloom, Ceylon Oak, Patana Oak, Wild Guava.

Hindi**:** Hariyal, Katabhi, Khumbi, Vakambha.

Kannada**:** Aalagavvele, Doddaale, Garva hannu, Gaula mara, Gonji, Hennu matthi, Kaulumara, Kumbha.

Konkani**:** Kumbiyo, Kumbyarooku.

Malayalam**:** Aalam, Paer, Peelam, Pera, Veyruh.

Marati**:** Kuba, Kumbha, Kumbhasala, Kumbhika, Kumbya.

Sanskrit: Bhadrendrani, Bhoodaadima, Girikarnika, Kaidarya, Kalindi, Katabhi, Katambara, Kinihi, Kshudrashyama, Kumbhi, Madhurenu, Mahakatabhi, Mahashaundi, Mahashvetha, Nabhika, Seethakatabhi, Shathapada, Shaundi, Tamil**:** Aveema maram, Aymaa, Kambili, Karekku, Kumbi, Pailo maram, Peithaandri, Pela, Pootta tannim maram, Pudatthanri, Thaanri.

Telugu**:** Araya, Budada naedi, Buddaburija, Budda dharmi, Duddippa, Gandhava, Govadi, Kumbhi.

Tulu**:** Daddaal[17] .

Classification

Kingdom: Plantae

Clade:Angiosperms

Clade: Eudicots

Clade:Asterids

Order: Ericales

Family:Lecythidaceae
Genus:*Careya*
Species: *C. arborea*[3]

Distribution
This species occurs in Tropical Asia. It found in moist deciduous and semievergreen forests throughout India upto 1600m altitude[18]. It is widely distributed in India, Sri Lanka, Malaya Peninsula, occasionally planted in gardens and along roadsides. In Karnataka it is distributed in Belgaum, Bellary, Chikmagalur, Chitradurga, Coorg, Hassan, Mysore, North Kanara, Shimoga, South Kanara districts[19].

Botanical correlation
Kumbhika is correlated to *Pistia stratiotes* Linn. Which in saivala.
Jalakumbhi is correlated to *Eichhomial crassipes* Solms[20].

Properties and action
Rasa(Taste): Katu, Kashaya, Tikta
Guna(Quality): Laghu
Vipaka(Metabolism)-Katu
Virya(Potency)-Ushan
Prabhav(Impact)- Vatakaphanashak[21].
Karma: Stambhana
Rogaharalva: Kasa, Pradara[20].

Ayurvedic formulations

1. Tvak of kumbhi is used to alleviate jvara and kandu in visphota and masurika.
2. Lepa of tvak is used in sotha and vrana and kvatha of tvak is used in vrana praksalana (wound healing).
3. In case of Sarpavisa, tvak svarasa is given as intake and lepa of it is bandaged around the bitten area[20].

Ayurveda uses
Plant pacifies vitiated kapha, tumor, cough, bronchitis, worms, diarrhea, leukoderma, epilepsy and ulcers[22].

Careya arborea Roxb available Brands

Brand	*Manufacturers*
Habb-E-Kabid Naushadri	Hamdard laboratories Waqf, Pakistan
Hamdard Ghutti	Hamdard laboratories Waqf Pakistan
Kumbhajatu tab.(Med har vati)[23]	Ayurved Rasashala
Obenyl Tablet[24]	*Charaka pharmaceuticals*

***Careya arborea* Roxb. Indications & Contra-indications**

The Indications of *Careya arborea* Roxb. are Dyspepsia, Diarrhoea, Colic, Epilepsy, Leucoderma, ulcerous, Wounds, Tumors, Snake Bite, Fistula, Dysentry, Abscesses, Cough.
The Indications of Bark of *Careya arborea* Roxb. are Colic, Flatulence, Cold, Cough, Constipation, Eruptive Fevers, Stomachache.
The Indications of Decoction (bark) of *Careya arborea* Roxb. are Indigestion, Dysentery.
No Contra Indication information is available for *Careya arborea* Roxb[25].

MORPHOLOGY

This tree can be identified by its thick dark-grey bark, large showy flowers and the leaves which turn red in winter. Characteristics- it is a deciduous tree, about 9-18m high. Leaves – They are simple, glabrous and broadly obovate; found in clusters at the ends of branches. Flowers- these are yellowish white; borne in thick, hard terminal spikes. Fruits- They are large, green, fleshy. Glabrous and rounded. Seeds- several seeds are embedded in the fleshy pulp of the fruit. Bark- It is fissured and dark grey. Wood- It is medium coarse-textured, hard, heavy and strong. The sapwood is white while heartwood is reddish. Flowering- The tree flowers in the month of april-may .Fruiting- The fruits ripen in the month of june-july. Natural reproduction- The tree reproduces through seeds and coppice. Seeds dispersal takes place with the commencement of the rain[26].

Ethnopharmacological Actions

Bark: - astringent, juice of bark is demulcent, emollient embrocations, is applied to wound in snake bite and infusion of the same is given internally[27], Demulcent (in cough and cold), antipyretic and antipruritic (in eruptive fever), anthelmintic, antidiarrhoeal[28]. It is traditionally used in the treatment of tumours, bronchitis, epileptic fits, astringents, antidote to snake-venom and skin disease[29]. It is also used as remedy for diarrhea[30] (Sikarwar et al., 1994). *Careya arborea* is used as a fish poison is reported[31]
Leaves: - made into a pulp and used as poultice 3 to 4 times a day rapidly heals obstinate ulcers[32].
Fruits: - used as decoction to promote digestion, the fruits are aromatic, astringent and demulcent and promote digestion[33].

PHARMACOGNOSTICAL STUDIES

Transverse section of bark showed distinct cork, cortex and secondary phloem. The cork cells were multi-layered (8 - 16), thick walled, by 2 - 3 layers of phellogen and then by phelloderm.Cortex was extensive, parenchymatous with rectangular to polygonal cells. Cortical cells were multilayered while some cells were golden yellow in colour with yellowish contents. Secondary phloem was made up of fibres, phloem parenchyma, medullary rays and vessels. The fibres were round in shape. They formed round patch inside the section. Medullary rays were 1 - 2 seriate. Calcium oxalate crystals were present in, cells of cortex and phloem parenchyma in secondary phloem. Starch grains were very few[34].
The Microscopic characteristic of powdered bark showed, blackish brown thick walled, rectangular to oval shaped cork cells, the fibres were lignified having very thick wall. They were long, slender and of 38 - 66 m in length. Calcium oxalate crystals were tetragonal prism type having 10 - 15 m in size. Starch grains were very few, simple, up to 5 m in diameter. The parenchymatous cells were rectangular to polygonal in shape[35].

Physical evaluation parameters

The physical evaluation parameters C. *arborea* bark revealed total ash (12%), sulphated ash (9.49%), water soluble ash (2%), acid insoluble ash (0.9%), water soluble extractive value (16%), alcohol soluble extractive value (7.2%) and loss on drying (14%)[34].

CHEMICAL CONSTITUENTS

The plant has been extensively investigated and a number of chemical constituents from the barks, leave and seeds of the plant have previously reported from various parts such as-

Seeds- triterpenoids[36] ,careyagenol D, triterpene and careyagenol E, a triterpenoid sapogenol from the seeds of *Careya arborea* Roxb[37]; flavonoids[38], coumarin[39,40], tannins[41] is reported from seed. Seeds contain terpenoid sapogenol,sterols[28].

Leaves- a new triterpene ester careaborin-I is isolated from the leaves of Careya *arborea* Roxb[39]; careyagenolide and triterpenoid sapogenols are isolated from the leaves of *Careya arborea* Roxb[37,42], leaf extract of *Careya arborea* Roxb. Is used as an indicator in acid base titration[43]. Leaves also contain a triterpene ester, beta-amyrin, hexacosanol, taraxerol, beta sitosterol, quercitin and taraxeryl acetate[28]. Terpenoids from leaves[44] are reported.

Root bark- metformin like compound was found to be the active hypoglycemic principle in *Careya arborea* root bark[45].

Stem Bark-The qualitative chemical tests revealed the presence of terpenoids, flavonoids, alkaloids, saponins and tannins in the bark of *C. arborea* Roxb.[43]. Careya arborea contains betulin and betulinic acid, active against a variety of parasites and viruses[46]. Structure of few chemical compounds are in the figure-I.

The preliminary phytochemical screening revealed the presence of triterpenoids, flavonoids, coumarin saponins and tannins[47]. The phytochemical tests with the methanol extract of *Careya arborea* indicated the presence of tannins, triterpenoids, flavonoid, saponins and steroids. Therefore, the presence of triterpenoids in methanol extract of *Careya arborea* may be responsible for the CNS activity[48].

PHARMACOLOGICAL ACTIVITIES

Hepatoprotective and in vivo antioxidant effects

The Methanol Extract of *Careya arborea* Roxb (MECA) stem bark is evaluated for it's hepatoprotective and antioxidant effect in Wistar albino rats. The hepatotoxicity was induced by carbon tetrachloride (30 CCl4, 1 mL/ Kg b.w. in liquid paraffin 3 doses (i.p.) at 72 h interval). The MECA at the doses of 50, 100 and 200 mg/ Kg and silymarin 25 mg/ Kg were administered to the CCl4 treated rats. Analytical parameters like serum transaminase (GOT, GPT), Alkaline Phosphates (ALP), bilirubin, uric acid and total protein were measured in the rats induced hepatotoxicity by CCl4. .The effects of the extract on Lipid Peroxidation (LPO), enzymatic antioxidant (Superoxide Dismutase (SOD) and Catalase (CAT)), and nonenzymatic antioxidant (Glutathione (GSH), vitamin C and vitamin E) were estimated. The MECA and silymarin produced 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 C, vitamin E and protein in a dose dependent manner. From these results, it was suggested that MECA possess potent hepatoprotective and antioxidant properties[49].

Antimicrobial and antioxidant activities

The evaluation of the antimicrobial and antioxidant activities of methanol ex-tract of *Careya arborea* (MECA) stem barks (Myrtaceae) in various *in-vitro* systems. Antimicrobial activi-ties of MECA were carried out using disc diffusion methods with Gram positive and Gram negative bacte-ria and some fungal species. MECA showed broad-spectrum antimicrobial activity against all tested mi-croorganisms. Antioxidant and free radical scavenging activities of MECA was assessed by using 1,1-diphenyl-2-picryl-hydrazyl radical (DPPH), superoxide anion radical, nitric oxide radical and hydroxyl radi-cal scavenging assays. The antioxidant activity of MECA increased in a concentration dependent manner. The results indicates that the MECA can be a potential source of natural antimicrobial and antioxidant agents[50].

CNS activity

The methanol extract of barks of *Careya arborea* was used to investigate central nervous system (CNS) activity in Swiss albino mice and Wistar albino rats. General behavior, exploratory behavior, muscle relaxant activity and phenobarbitone sodium–induced sleeping time were studied. Methanol extract of barks at 100 and 200 mg/kg caused a significant reduction in the spontaneous activity (general behavioral profile), remarkable decrease in exploratory behavioral pattern, a reduction in muscle relaxant activity, and also significantly potentiated phenobarbitone sodium–induced sleeping time. The results suggest that methanol extract of *Careya arborea* exhibit CNS depressant activity in tested animal models[51].

Antileishmanial activity

Bioguided-fractionation of the methanol extract of the leaves of *Careya arborea* led to isolation of a triterpenoid saponin, designated arborenin, and characterized as 3-O-beta-D-glucopyranosyl(1-->2)-beta-D-glucopyranosyl-2 alpha,3beta-dihydroxy-taraxast-20-en-28-oic acid, together with desacylescin III. The structures were determined on the basis of extensive 2D NMR spectroscopic analysis. The number of live promastigotes, which was counted by MTT reduction, was inhibited by the isolated compound in a dose-dependent manner Thus triterpenoid saponin showed significant invitro antileishmanial activity against Leishmania donovani (strain AG 83)[52].

Antitumour and anti oxidant

The methanol extract of bark was evaluated for the anticancer potentials against Dalton's lymphoma ascites (DLA)-induced ascitic and solid tumors. The methanol extract of its bark given orally to mice at the dose of 250 or 500 mg/kg body weight for 10 days caused significant reduction in percent increase in body weight, packed cell volume, and viable tumor cell count when compared to the mice of the DLA control group. Restoration of hematological and biochemical parameters towards normal was also observed. Histological observations of liver and kidney also indicated repair of tissue damage caused by tumor inoculation. The extract at the dose of 5 or 25 mg/kg body weight given i.p. daily for 14 days significantly reduced the solid tumor volume induced by DLA cells[53].

Antidiarrhoeal

The methanol extract of the Careya arborea Roxb. bark significantly reduced castor oil-induced diarrhoea in mice. This effect supports the local traditional use of the plant against diarrhea[54]

Analgesics

Isolation of the bark of *Careya arborea* afforded piperine-an alkaloid chemically known as 1-5-(1,3-benzodioxol-5-yl)-1-oxo-2,4-pentadienylpiperidine.. At oral doses of 10, 20 and 30 mg/kg body weight, piperine exhibited inhibition of acetic acid induced writhing in mice respectively. At doses of 20 and 30 mg/kg body weight, the compound also showed prolongation of tail flicking time of mice 30 min after the treatments determined by the radiant heat method. Thus the isolated alkaloid was found to possess significant central and peripheral analgesic activity[55].

Cytotoxic and antioxidant activity

The successive chloroform and ethyl acetate extracts and crude 50% methanol bark extract were evaluated for Cytotoxic and antioxidant activity. The extracts exhibited potent cytotoxicity against cancerous RD, HEp-2 and HeLa cell lines. They were found to be safe against the normal Vero cell line. The methanol and aqueous extracts possessed strong antioxidant activity against many oxidants in the in vitro antioxidant screening. The results shows strong cytotoxic and antioxidant properties, which are due to high total phenol content present in the plant[56].

Anticoagulant activity

Methanolic extract of *Careya arborea* bark was evaluated for Anticoagulant activity by the assay of activated partial thromboplastin time (aPTT), Prothrombin time (PT) and Thrombin time (TT). Bark extract caused significant increase in aPTT, PT and TT at all doses were almost equivalent to the response of warfarin. Prolongation in PT may be due to decrease in coagu-lation factors like V, VII and X involved in extrinsic pathway, while prolongation of aPTT may be due to decrease in coagulation factors such as VIII, IX , XI, XII and prekallikrein involve in intrinsic pathway[57,58].

Antioxidant Activity

The total phenolic, flavonoid content and antioxidant activity of petroleum ether,aqueous and alcoholic extract of the stem bark of *Careya arborea was determined*. Aqueous extract and alcoholic extract showed high presence of phenolic and flavonoid content and hence possessed greater antioxidant activity. Pet. ether extract containing very less amount of phenol and flavonoids, did not showed any antioxidant activity. Thus results suggest that antioxidant activity is due to presence of phenolic and flavonoid content and also supports to cure various diseases[59].

CONCLUSION

There is need of the Pharmacognostical work on different parts of the plant and a very little work has been done on the biological activity and medicinal applications of the isolated compounds and hence extensive investigation is needed to exploit their therapeutic utility to combat diseases. A drug-development programme should be undertaken to develop modern drugs with the compounds isolated from *Careya arborea*. Only few therapeutically and industrially useful preparations and compounds have also been marketed, which generates enough encouragement among the scientists in exploring more information about this medicinal plant. An extensive research and development work should be undertaken on *Careya arborea* and its products for their better economic and therapeutic utilization.

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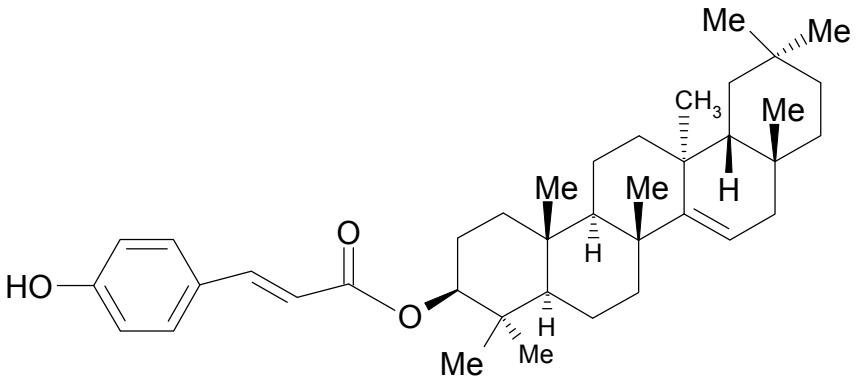
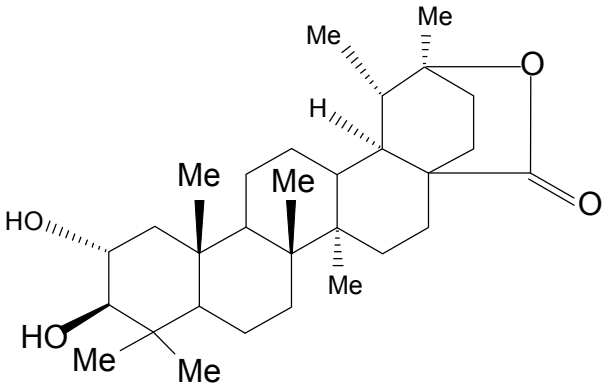
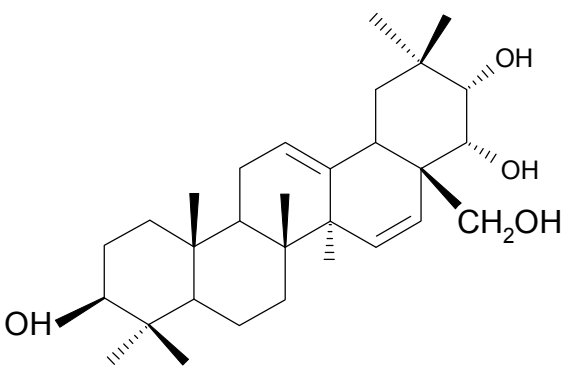


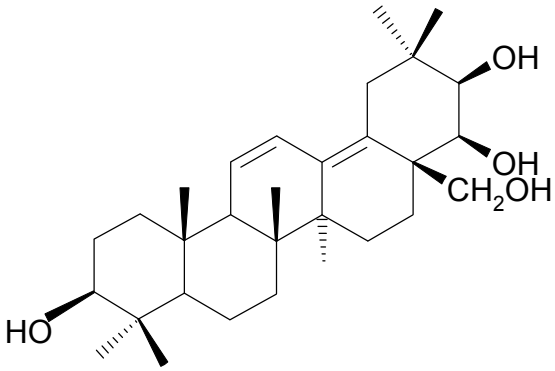
Careyaborin-I



Careyagenolide



Careyagenol D



careyagenol E

Figure 1: Structure of some isolated chemical compounds

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