Medicinal plant: *Garcinia* spp.

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**Abstract**— *Garcinia* is a tropical fruit tree with promising pharmacological properties. This review presents an overview of the bioactive compounds derivative from *Garcinia* fruits and their biological activities for promoting human health as food and medicine.

**Keywords**— Medicinal plant, *Garcinia* spp., Therapeutic properties, phytochemical properties.

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**I. INTRODUCTION**

Plants are considered as the great reservoir of structurally diverse bioactive molecules such as phenolics, terpenoids, carotenoids, anthocyanins and flavonoids which are having therapeutic values and are useful in the treatment of various ailments. Now-a-days these bioactive molecules are widely used in the food, pharmaceutical and cosmetics industries (Hosakatte et al., 2018).

*Garcinia* is a polygamous tropical tree or shrub under Clusiaceae family. It consists of 250 species, out of which about 30 species are indigenous to India. *Garcinia pedunculata* (Amlavethasa), *G. cowa*, and *G.Morella* (Indian gamboge) are grown in North-Eastern parts of India and Andaman Islands (Negi et al.,2008; Sharma and Devi,2015; Murthy et al., 2020). *Garcinia* are rich source of nutrients, minerals, vitamins, and dietary fibers. It has the folklore claims such as rejuvenator, cardio tonic, asthma, obesity and arthritis. The mature fruit is eaten cooked or raw and also for pickle preparation.

*Garcinia pedunculata* is an evergreen tree. The tree is endemic to the south eastern regions of Asia such as parts of Myanmar and North-Eastern parts of India. The tree has a fluted trunk with short spreading branches. Leaves are lanceolate with prominent mid ribs. Male flowers are light green in sparsely flowered panicles, the female flowers are solitary. The fruit is round with a diameter ranging between 8cm and 12cm. It has a juicy interior with edible arils. The mature *G. pedunculata* fruit is greenish yellow and is consumed as a vegetable.

**II. MEDICINAL PROPERTIES OF GARCINIA**

The fruits of *Garcinia* have been used since ancient times in traditional medicinal practices. These species provide a rich natural source of bioactive compounds with relevant therapeutic properties and anti-inflammatory effects, for the treatment of skin disorders, wounds, ulcers, dysentery, pain, infections, fever, cough, bronchitis, asthma, rheumatoid arthritis, obesity and having antioxidant, antiaflatoxigenic anti-inflammatory, leishmanicidal, and antiprotozoal activities (Joseph et al.,2005; Ali et al.,2017 ;Espirito et al.,2020).

**III. PHYTOCHEMICAL PROPERTIES OF SOME SPECIES OF GARCINIA**

*Garcinia* are rich sources of fiber, total phenols, and natural antioxidants with high amount of ascorbic acids .Extracts of the pericarp, epicarp, and seeds of *Garcinia* have demonstrated the phytochemicals such as pedunculol, garcinol, cambogin 3 and hydroxyl citric acid. Bennet and Lee (1989) and Rao et al.(1974;1980) have isolated the bioactive compounds namely benzoquinones, triterpenes and anthocyanins. Garcinol, being rich in derivatives of poly-isoprenylated benzenophenones, polyphenols, bioflavonoids (kolaviron, volkensiflavone, fukugetin) and xanthones (Sarma et al.,2016). Xanthones are the major class of phenolic compounds in *Garcinia* species, followed by benzophenones and biflavonoids. Xanthones have demonstrated effects against human cervical cancer, lung cancer cells, and hepatocellular carcinomas (Vo et al., 2015). These compounds have been associated with biological activities such as free-radical scavenging,
antiulcer effects, cytotoxicity, inhibition of nitric oxide synthase, chemoprevention of cancer, induction of apoptosis, anti-HIV, and trypanocidal effects (Hung et al., 2015; Fu et al., 2017). These compounds exhibiting a wide range of pharmacological activities such as antimicrobial, antioxidant, antitumour-promoting, cytotoxic, etc. (Jayaprakasha et al., 2006; Mundugaru et al., 2014; Adegoke et al., 1998; Asano et al., 1996; Bakana et al., 1987; Inuma et al., 1996; Mackeen et al., 2000; Fu et al., 2014; Minami et al., 1994; 1995; 1996; Islam et al., 2015; Paul et al., 2017). Crude extracts as well as partially purified compounds from different parts of some species of *Garcinia* plants have shown potential antibacterial activities against *Bacillus cereus*, *Bacillus coagulans*, *Bacillus subtilis*, *Staphylococcus aureus* and *Escherichia coli*.

**Some prominent *Garcinia* species** are known to have good medicinal value and fruit extract has traditionally very well known for treatments of various diseases (Deore et al., 2011).

*G. pedunculata* was estimated to contain moisture 88.20%, protein 0.50%, β carotene 45.00mg/100 g, vitamins (thiamine 0.03, riboflavin 0.02, and ascorbic acid14.83mg/100 g, resp.), minerals (sodium 1.80, potassium106.00, calcium 18.00, magnesium 23.00, iron 0.08, zinc0.15, copper 0.12, and phosphorus 17.00mg/100 g), phenolics(19.45mg gallic acid/100 g), and flavonoids (18.33mg rutin/g). The dried fruit rinds and pericarp of *G. pedunculata* have been reported to contain some benzophenones, pedenculol, hydroxy citric acid, gallocatechin, myricetin, quercetin, and fisetin. The fruit extract is reported to possess a variety of pharmacological benefits including antimicrobial, anti-inflammatory, hepatoprotective, and cardioprotective properties (Kagung et al., 2010; Mundugaru et al., 2014, 2016; Ali et al., 2017). The aqueous extract of *Garcinia pedunculata* exhibited significant neuroprotection against AICl3 induced neurotoxicity (Mundugaru et al., 2016, 2017).

In traditional system of medicine the leaves of *G. lancifolia* are used as stomachic and diuretic. The acidic fruits are used to prepare juice, pickle and curries. *G. lancifolia* is used as stomachic, diuretic and its fruit is used to cure dysentery and diarrhoea. The bark of *G. lanceolata* has also been reported to contain prominent antibacterial and anthelmintic potential (Chowdhury and Handique, 2012; Bora et al., 2014a; 2014b). The phytochemical analysis of different extracts of *G. lancifolia* leaf, stem and fruit revealed the presence of tannins, saponins, flavonoids, terpenoids, alkaloids and cardiac glycosides. The high phenolic content was observed in the methanol extract of leaf followed by methanol extract of stem and dichloromethane extract of leaf.

Antimicrobial and free radical scavenging xanthones from the latex of *G. cowa* (Mahabusarakam et al., 2005; Na Pattalung et al., 1994; Auranwiwat et al., 2014), and antimalarial xanthones (Likhitwitayawud et al., 1998) from the stem bark of *G. cowa* have been reported. A polyisoprenylated benzophenone known as garcinol isolated from stem bark of *G. huillensis* has been shown to possess chemotherapeutic activity against Gram-positive and Gram-negative cocci.

Alpha-mangostin, rubraxanthone and xanthochymol isolated from *G. mangostana*, *G. dioica* and *G. subelliptica*, respectively, showed strong antibacterial activity (Inuma et al., 1996).

Crude extracts of leaves, fruits, root, stem and trunk bark of *G. atroviridis* exhibited antibacterial (Mackeen et al., 2000).

**IV. INDUSTRIAL RELEVANCE**

This traditional medicines are assuming greater important because of its effective, safer, locally available and no side effects and more reliable medicine than synthetically produced drugs. *Garcinia* extracts can be utilized as nutraceuticals and as food biopreservatives which could be developed into value added products or medicine (Acuna et al., 2012; Biswas et al., 2017). To produce potentially more active and safer drugs the plant-derived compounds should be isolated which could improve the economy of pharmaceutical industries.

**V. CONCLUSION**

Though the fruits of *G. cowa* and *G. pedunculata* are underutilized, recent year the interests in research activities in the fields of chemistry and pharmacology has arisen in exploiting on the fruit species. The advanced technology for isolation of the bioactive compounds from plants is very important as it could help in structural modifications of the synthetic products from the fruits. Based on the mechanism and mode of action of these plants it is confirmed the curative and therapeutic effectiveness of the plant. Hence, much research effort on crop improvement and physiologically active components is needed.

**REFERENCES**
Novel prenylated xanthones with antioxidant property from 
Garcinia species. Molecules. 2015; 20(6): 13990–14002.
doi: 10.3390/molecules200613990.

Bastos PR. Medicinal potential of Garcinia species and 
their compounds. Molecules. 2020;25: 4513; doi:10.3390/ 
molecules25194513

[15] Fu WW, Tan HS, Xu HX. Research progress of chemistry 
and anti-cancer activities of natural products from Chinese 
Garcinia plants. Yao Xue Xue Bao. 2014; 49(2):106-74.

[16] Hosakatte N, Dandin V, Dalawai D, Park SY, Paek K. 
Bioactive compounds from Garcinia fruits of high 
economic value for food and health. Phytochem. Spr. 
Nature, 2018; 1: 1-28.

[17] Hung WL, Liu CM, Lai CS, Ho CT, Pan MH. Inhibitory 
effect of garcinol against 12-O-tetradecanoylphorbol13-
acetate-induced skin inflammation and tumorigenesis in 
mice. Journal of Functional Foods. 2015; 18: 432-444.

[18] Islam,MZ, Hoque MM, Asif-Ul-Alam SM, Monalisa K. 
Chemical composition, antioxidant capacities and storage 
stability of Citrus macropera and Garcinia pedunculata 
fruits. Emirates Journal of Food and Agriculture. 2015; 
27(3): 275-282.

[19] Jayaprakash G, Negi PS, Jena BS.Anti-oxidative and 
antimutagenic activities of the extracts from the rinds of 
Garcinia pedunculata. Innov Food Sci Emerg Technol. 
2006;7: 246-50.

[20] Joseph GS, Jayaprakash G, Selvi AT, Jena BS, 
Sakariah KK. Antiinflammatogenic and antioxidant 
activities of Garcinia extracts. Int J Food Microbiol. 
2005;101(2):153-60. doi: 10.1016/j.ijfoodmicro.2004.11.001.

[21] Kaguyung R, Gajurel PR, Rethy P. Singh B. 
Ethonomedical plants used for gastrointestinal diseases by 
Adi tribes of Deheng-Debang Biosphere Reserve in 
Arunchal Pradesh. Indian J Tradit Know. 2010; 9: 496-
501.

[22] Likhithiwatayawud K, Padungcharoen T, Krungrai J.. 
Antimalarial xanthones from Garcinia cowa. Planta 
Medica1998; 64:70-72.

[23] Mackeen MM, Ali AM, Lajis NH, Kawazu K, Hassan 
Z, Amran M, Habsah M, Mooi LY, Mohamed SM., 
Antimicrobial, antioxidant, antitumour-promoting and 
cytotoxic activities of different plant part extracts of 
Garcinia atroviridis griff. ex T. anders. J 
Ethnopharmacol. 2000;72(3): 395-402. doi: 
10.1016/s0378-8741(00)00245-2.

[24] Mahabusarakam W, Chairerk P, Taylor WC. Xanthones 
from Garcinia cowa Roxb. Latex. Phytochemistry. 2005; 
66(10):1148-53. doi: 10.1016/j. phytochem. 2005.02.025.

[25] Minami H, Kinoshita M, Fukuyama Y, Kodama M, 
Yoshizawa T, Sugita M, Nakagawa K, Tago H. 
Antioxidant xanthones from Garcinia subelliptica. 
Phytochemistry. 1994; 36(2):501-506

[26] Minami H, Kuyawaya A, Yoshizawa T, Fukuyama Y. 
Novel prenylated xanthones with antioxidant property from
the wood of *Garcinia subelliptica* Chem. Pharm. Bull. 1996; 44:2103-2106

[28] Minami H, Takahashi E, Fukuyama Y, Kodama M, Yoshizawa T, Nakagawa K. Novel xanthones with superoxide scavenging activity from *Garcinia subelliptica*. Chem Pharmacol Bull 1995;43:347–349.

[29] Mudoi T, Deka DC, Devi R. *In vitro* antioxidant activity of *Garcinia pedunculata*, an indigenous fruit of North Eastern (NE) region of India. International Journal of Pharm Tech Research. 2012; 4(1): 334-342.

[30] Mundugaru R, Joy F, Shrindhi R, Das L, Sudhakara, Ravishankar B.. Anti-inflammatory activity of aqueous extract of fruits of *Garcinia pedunculata* in experimental animals. Am J Pharma Tech Res. 2014; 4: 3.

[31] Mundugaru R, Udaykumar P, Senthilkumar S, Bhat S. Cardioprotective activity of fruit of *garcinia pedunculata* on isoprenaline-induced myocardial infarction in rat. Bangladesh Journal of Pharmacology.2016; 11(1): 231-235.

[32] Mundugaru, R., Varadharajan, MC., and Basavaiah R. 2014. Hepatoprotective activity of fruit extract of *Garcinia pedunculata*. Bangladesh Journal of Pharmacology. 9(4): 483-487.

[33] Mundugaru R, Narayana SKK, Ballal SR, Thomas J, Rajakrishnan R,.Neuroprotective activity of *Garcinia pedunculata* roxb ex buch ham fruit extract against aluminium chloride induced neurotoxicity in mice. Indian J. Pharm. Educ. Res. 2016; 50: 435-441.

[34] Mundugaru R, Sivanesan SK, Udaykumar P, Joy F, Narayana SKK, Rajakrishnan L, Al Farhan AH, Jacob T, Rajagopal R, Hisham SM. Quality standardization and nephroprotective effect of *Garcinia pedunculata* Roxb. fruit extract. Indian J. Pharm. Educ. 2017; 51: 713-721

[35] Mundugaru R, Udaykumar P, Kumar S, Narayana SKK, Jacob T, AlFarhan AH, Rajakrishnan L. Protective effect of *Garcinia pedunculata* fruit rind in acetic acid induced ulcerative colitis. Farmacia. 2019; 67: 160-166.

[36] Murthy HN, Dalawai D, Dewir YH, Ibrahim A. Phytochemicals and Biological Activities of *Garcinia morella* (Gaertn.) Desr.: A Review. Molecules. 2020; 25(23): 5690. doi: 10.3390/molecules25235690.

[37] Na Pattalung P, Thongtheeraparp W, Wiriyachitra P, Taylor WC. Xanthone of *Garcinia cowa*. Planta Medica.1994; 60(4):365-368.

[38] Negi PS, Jayaprakasha GK, Jena BS. Antimicrobial activity of the extracts from the fruit rinds of *Garcinia cowa* and *Garcinia pedunculata* against food borne pathogens and spoilage bacteria. LWT-Food Sci. Technol. 2008; 41: 1857-1861.

[39] Paul S, Ali MY, Rumpa NE, Tanvir EM,Hossen MS,Saha M, Bhoumik NC,Gan SH, Khalil MI. Assessment of toxicity and beneficiary effects of *Garcinia pedunculata* on the hematological, biochemical, and histological homeostasis in rats. Evid. Based Complementary Altern. Med. 2017; Article ID 4686104 [https://doi.org/10.1155/2017/4686104]

[40] Policegoudra RS, Saikia S , Das J , Chattopadhayay P , Singh L, Veer V. Phenolic content, antioxidant activity, antibacterial activity and phytochemical composition of *Garcinia lancifolia*. Indian Journal of Pharmaceutical Sciences. 2012; 74(3): 268-271.

[41] Rao AVR, Venkataswamy G, Yemul SS. Xanthochymol and iso xanthochymol two novel polyisoprenylated benzenophones from *Garcinia xanthochymus*. Indian J Chem.1980; 19B: 627-33.

[42] Rao AVR, Sarma MR, Venkataaraman K,Yemul SS. A benzophenone and xanthone with unusual hydroxylation patterns from the heartwood of *Garcinia pedunculata*. Phytochemistry. 1974; 13: 1241-1244.

[43] Ravi M, Febin J, Shrindhi R, Lipika D, Sudhakara B, Ravishankar B. Anti-inflammatory activity of aqueous extract of fruits of *Garcinia pedunculata* in experimental animals. Am. J. Pharma. Tech. Res. 2014; 4; 3-6

[44] Sahu A, Das B, Chatterjee A. Polyisoprenylated benzenophones from *Garcinia pedunculata*. Phytochemistry. 1989; 28( 4);1233-1235.

[45] Sarma R, Das M, Mudoi T, Sharma KK, Kotoky JA, Devi R. Evaluation of antioxidant and antifungal activities of polyphenol-rich extracts of dried pulp of *Garcinia pedunculata* Roxb. and *Garcinia morella* Gaertn. (Clusiaceae) Tropical Journal of Pharmaceutical Research, 2016, 15(1): 133-140. doi.org/10.4314/tjpr.v15i1.19.

[46] Sarma R, Kumari S, Elancheran R, Deori M, Devi R. Polyphenol rich extract of *Garcinia pedunculata* fruit attenuates the hyperlipidemia induced by high fat diet. Front Pharm. 2016; 7:294

[47] Sharma R , Devi R. Ethnopharmacological survey of *Garcinia pedunculata* Roxb. Fruit extract in six different districts of Assam, India. International Journal of Pharmaceutical Science.2015; 4(1): 20-28.

[48] Vo HT, Ngo NT, Bui TQ, Pham HD, Nguyen LD. Geranylated tetra oxygenated xanthones from the pericarp of *Garcinia pedunculata*. Phytochem. Lett. 2015; 13: 119-122.