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A REVIEW ON BARRINGTONIA ACUTANGULA (L.) GAERTN: MEDICINAL VALUES, CHEMICAL CHARACTERISTICS AND BIOLOGICAL ACTIVITIES

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ABSTRACT

Barringtonia acutangula (L.) Gaertn. (Family: Lecythidaceae) known as Samudraphal in Hindi, is a medium-sized tree found throughout India. This plant is used by the traditional healers for treatment of various illnesses. The Indian Medicine Systems like Ayurveda and Siddha have mentioned the medicinal value of *B. acutangula* especially for the treatment of jaundice, liver disorders and stomach disorders. There are numerous research reports mentioning the wide range of biological activities for this plant. The present study has been taken up to review in detail about the plant with reference to its folklore uses, medicinal values, chemical properties and biological activities, as this will be highly helpful for the young researchers and students.

KEY WORDS: *Barringtonia acutangula*. Samudraphal. Ethnomedicinal Value. Biological activities.

INTRODUCTION

Barringtonia acutangula (L.) Gaertn belongs to the family Lecythidaceae popularly known as Samudraphal (Indian Oak in English). Lecythidaceae is a large family native to tropical South America and Madagascar, with 250-300 species of woody plants having Biological and Medicinal value. *Barringtonia acutangula* is an evergreen tree of 9-12 m in height common in the sub-Himalayan tracts from the Ganges eastwards to Assam and extending into peninsular India.

Barringtonia acutangula has simple, alternate leaves, 40 cm long pendulous racemes, 1.5 cm across, fragrant and dark scarlet flowers with 4 lobed ovate calyx and 2 celled ovary. The plant has ellipsoid to ovoid Berry, fibrous, truncate at both ends, crowned by small persistent calyx. The berry bears one ovoid black seed [1,2]. *B. acutangula* is one of the plants traditionally used for the cure and treatment of many ailments (Figure 1.). In Ayurveda, its root, leaves and fruits are used in the treatment of jaundice, liver disorders, stomach disorders and splenic disorders for many centuries [3,4].

Taxonomical Classification [5] :

Kingdom	:	Plantae
Division	:	Magnoliophyta
Class	:	Magnoliopsida
Order	:	Ericales
Family	:	Lecythidaceae
Genus	:	Barringtonia
Species	:	acutangula
Botanical Name	:	<i>Barringtonia acutangula</i> Linn.
Synonyms	:	<i>Barringtonia rubra</i> Baill., <i>Butonica acutangula</i> (L.) Lam. <i>Caryophyllus acutangulus</i> (L.) Stokes, <i>Eugenia acutangula</i> L.

Vernacular Names: Vidula- Sanscrit,
Samudraphal- Hindi, Indian Oak-English, Adampu -
Malayalam, Samudrapalam- Tamil

Distribution [5] :

The plant is widely cultivated throughout India, Southeast Asia, Australia and Africa.

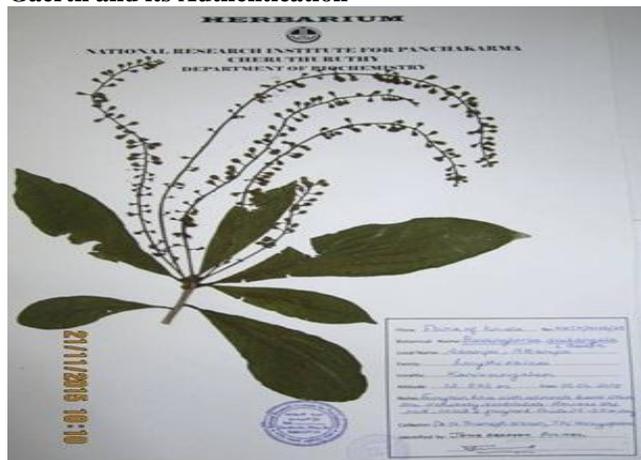
Parts Used [5] :

The roots, leaves, fruits and seeds are used for therapeutic purpose.

Folklore Uses [6-11] :

Traditionally, various parts of *B. acutangula* like root, seed, bark and leaf are used as carminative, expectorant, bitter tonic, emetic and also in the treatment of diarrhea and gonorrhoea. Seeds and leaves are useful in treatment of colic, intestinal worms, wounds, ulcers, skin diseases and hallucinations.

Juice of the leaves is given in diarrhea and dysentery. Roots are cooling, aperient and expectorant, stimulating and emetic; supposed to be similar to Chincona in its properties. The fruit is astringent to the bowels, lactagogue, vulnerary, anthelmintic; useful in biliousness, bronchitis, sore eyes, gleet, lumber pain, nasal catarrh and hallucinations. Seeds are carminative and emetic; with juice of ginger used in catarrh of the nose and respiratory passages; applied to chest to relieve pain and cold; to the abdomen to relieve colic and flatulence. Seeds are also reported to relieve seminal weakness and gonorrhoea. The bark is given as astringent in diarrhoea and blennorrhoea, and as a febrifuge in malaria.

Figure 1. Herbarium of *Barringtonia acutangula* (L.) Gaertn and its Authentication**Pharmacognostical Characteristics [12, 13] :**

The microscopy and macroscopy characteristics of *B. acutangula* leaf have been reported by Padmavati *et al.*, 2012. Leaf constants such as vein islet number, veinlet termination number, palisade ratio and stomatal index were reported. The transverse section of the leaf showed a dorsiventral nature. The lamina of the leaf had three distinct regions viz, adaxial epidermis, abaxial epidermis and mesophyll. The adaxial epidermis is single layered with squarish cells covered by a distinct cuticle. The abaxial epidermis is also single layered with rectangular cells having prominent peg like outgrowths. The mesophyll is differentiated into palisade and spongy parenchyma. The

lateral vein has a small group of xylem elements and a few phloem elements. The vascular strand is en-sheathed by thick sclerenchymatous tissue which extends into adaxial and abaxial pillars. The epidermal layer has anomocytic type of stomata. The midrib has prominent adaxial hump and wide semicircular abaxial part.

The organoleptic evaluation of the leaf powder and powder microscopy comprising the details of trichomes, epidermal fragments, starch grains, fibers of petiole and fibers of lamina were reported by Padmavathy *et al.*, 2012.

Chemical Constituents [14-18] :

Leaves contain a trihydroxy triterpene monocarboxylic acid, acutangulic acid, and other organic acids such as barringtonic, tangulic and oleanolic acids; saponins and sapogenins, acutangol A and acutangol B, three triterpenoid sapogenols, barringtonols, B, C D and E, two triterpenoid acid sapogenins, stigmaterol glycoside, β -sitosterol and β -amyrin.

Fruits contain barringtonol D, C and B, saponins and barrigenic acid. Seeds contain triterpenoid glycosides, barringtonin. Bark contains tannins and a small amount of sapogenin. Wood contains a triterpenoid dicarboxylic acid, barringtonic acid and other triterpenoids, barrigenic acid and hexa-hydroxytriterpene, tanginol. Branch wood contains barringtonol E and triterpenic acid, barrinic acid.

Physico-chemical Characteristics [12] :

Physico chemical analysis showed the leaf of *B. acutangula* has 6.0 % of total ash and also contains high concentration of sulphated ash. Water and alcohol soluble extractive of leaf was reported to be 26.39 % and 36.89 % respectively.

Phytochemical Characteristics [12,13,19] :

Barringtonia leaf is found to contain mainly steroids, flavonols, and phenolic acids. The presence of terpenoids, flavonoids, glycosides, phenols, tannins, saponins in ethanolic extract of Leaf and presence of terpenoids, tannins and saponins in ethyl acetate extract have been reported. The quantitative studies reported the total phenolic content as 79.71 $\mu\text{g/ml}$ and total flavonoid content as 109.52 $\mu\text{g/ml}$ for methanolic extract of leaf. Total flavonol and Total tannin content is found to be 91.18 $\mu\text{g/ml}$ and 105.41 $\mu\text{g/ml}$ for leaf methanolic extract.

Biological Activities:**Antidiabetic Activity [20, 21]**

The antidiabetic activity of ethanolic extract of *B. acutangula* Leaf was reported by Palanivel *et al.*, 2013. The study showed that the oral administration of leaf extract in alloxan induced Wistar albino diabetic rats at the dosage of 250 and 500 mg/kg b.wt caused significant hypoglycemic activity and it was dose dependent manner. The study also showed significant decrease of serum Cholesterol, Triglyceride, Creatinine and Urea levels. The histopathology study in the experiment also evidenced the improvement and restoration of pancreatic cells proving

safety of the leaf extract at the prescribed dosage. The hypoglycemic activity of aqueous, methanol and chloroform extracts of *B. acutangula* Fruit was demonstrated in the streptozotocin induced hyperglycemic Wistar rats by Khatib and Patil, 2011. The histology study on pancreas also evidenced the regeneration of Beta cells in the extract treated groups.

Antioxidant properties [19, 22, 23]

The antioxidant activity of petroleum ether, chloroform and methanol extracts of *B. acutangula* leaf was reported by Kathirvel *et al.*, 2012. The *in vitro* studies such as DPPH radical scavenging activity and Reducing power assays conducted for proving antioxidant activity had reported for better activity of methanolic extract of leaf over other solvent extracts. The stem bark extract of plant was reported for DPPH radical scavenging activity by Mohan and Kumar, 2014. The *in vitro* antioxidant activity of ethanolic extract of *B. acutangula* Flower conducted by Sandhaarani *et al.*, 2014 had proved the same in DPPH assay and reducing power assay.

CNS Depressant Activity [24]

The ethyl alcohol extract of *B. acutangula* leaf was tested for Central Nervous System Depressant activity through conducting Sodium pentobarbitone induced sleeping time assay, Locomotor activity assay, Rota rod test and Exploratory activity (Y- maze test). The extract at three different doses viz., 100, 200 and 400 mg/kg. b.wt were used in the experiment and showed the maximum inhibition of neural activity in the central nervous system leading to depressant activity.

Anthelmintic Activity [25]

The anthelmintic activity of *B. acutangula* was demonstrated by Padmavathi *et al.*, 2011. The study was conducted using ethanolic extract *B. acutangula* leaf at four different concentrations such as 10, 25, 50 and 100 mg/ml and showed significant activity when compared with standard Piperazine citrate.

Antimicrobial Activity [22]

The antimicrobial activity study conducted by Mohan and Kumar, 2014 using ethanolic extract of *B. acutangula* stem bark had proved its activity at 30 and 50 µg/ml concentration against Gram positive and Gram negative bacteria viz *Staphylococcus aureus*, *Bacillus cereus*, *Salmonella typhi* and *Escherichia coli*.

Hepatoprotective Activity [26]

Methanolic extract of *Barringtonia acutangula* was tested in carbon tetrachloride –induced hepatic damage in Wistar albino rats by Mishra *et al.*, 2011. The study showed that the extract has significant hepatoprotective activity at the dose of 250 mg/kg b. wt. It was reported that the elevated liver marker enzyme levels in the CCl₄ induced rats were brought to the closed normal level and the efficacy was comparable with standard drug Silymarin.

Hypolipidemic Study [27]

The experiment was conducted in normal and streptozotocin induced diabetic albino rats. The study showed that hydro-alcoholic extract of *B. acutangula* root had significant hypolipidemic activity. The experiment depicted the decreased levels of lipid profile parameters such as Triglycerides, High Density Lipoprotein, Low Density Lipoprotein and Cholesterol in the extract treated groups (250 and 500 mg/kg b.wt) when compared with untreated disease control group.

Anti -diarrheal Activity [28]

Methanolic extracts of *B. acutangula* leaves and seeds showed significant antidiarrheal activity. The experiment was conducted at 200 and 400 mg / kg b.wt. (oral administration) using castor oil and magnesium sulphate induced diarrheal models. In an another study the ethanolic extract of *B. acutangula* showed significant anti-diarrheal activity on castor oil induced diarrheal model in rats.

Anti-inflammatory activity [29, 30]

B. acutangula roots showed significant central and peripheral anti-nociceptive as well as anti-inflammatory activity. The ethanolic root extract of plant at 250 and 500 mg/ kg b.wt in mice and rats by using model like Hot Plate and Acetic acid Writhing tests for anti-nociceptive activity and Carrageenan induced Rat Paw Edema and Cotton Pellet Induced Granuloma for anti - inflammatory activity respectively.

CONCLUSION

The herbal medicines occupy distinct position right from the primitive period to present day. Therapeutically, important drugs have been developed from plant sources which are being used in traditional system of medicines. The present study has carried out the literature review on *Barringtonia acutangula* L. Gaertn, one of the important medicinal plants widely mentioned in Indian System of Medicines like Ayurveda and Siddha. The literature has brought out the details of the plant with reference to its taxonomy, distribution, plant parts and their folklore uses, chemical constituents, medicinal properties and other biological activities. This will give the overall idea of the plant and the same will be highly beneficial to the young researchers and students.

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CONFLICT OF INTEREST: Nil

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