

## Review Article

**Barringtonia acutangula: A Traditional Medicinal Plant**

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**ABSTRACT**

*Barringtonia acutangula* L. family *Lecythidaceae* is a popular medicinal plant used traditionally for its broad spectrum medicinal properties. *Barringtonia acutangula* was commonly used in India by tribal people for the treatment of liver disorders, diarrhoeal diseases, eye diseases, splenic disorders and worm infestation. In Tamil, it is known as Samutraphalam. It is one of the useful traditional medicinal plant in India and used in various Ayurvedic formulations for the treatment of various diseases. *Barringtonia acutangula* Linn is a plant traditionally used for the cure and treatment of many ailments like hemolytic disease (various diseases of blood), abdominal colic, lumbar pain, syphilis, blennorrhoea, febrifuge, malarial and diabetes. All parts of the plant like root, leaves, fruit, seed and bark are used for their potential medicinal properties. In this review, we have explored the pharmacological properties of *Barringtonia acutangula* and compiled its vast pharmacological applications to comprehend and synthesize the subject of its potential image of multipurpose traditional medicinal agent. We highlighted the updated information particularly on the various pharmacological and medicinal properties of *Barringtonia acutangula*.

**Keywords:** *Barringtonia acutangula*, Samudraphala, Indian Oak, Antibacterial agent.

**INTRODUCTION**

Plants are invaluable sources of pharmaceutical products and plants are recognized for their ability to produce a wealth of secondary metabolites and mankind has used many species for centuries to treat a variety of diseases.<sup>1</sup> Medicinal plants were used by people of ancient cultures without knowledge of their active ingredients. There is an ever increasing need to limit toxic clinical drugs.<sup>2</sup> Plants produce a diverse range of bioactive molecules making them a rich source of different types of medicines.<sup>3</sup> Over 50% of all modern clinical drugs are of natural product origin and natural products play a vital role in modern drug development in the pharmaceutical industry.<sup>4</sup>

*Barringtonia acutangula* Linn. (Family-Lecythidaceae) popularly known as *Samudraphal* (Indian Oak in English) is an important medicinal plant of India. It is an evergreen tree of 9-12 m in height common in the sub-Himalayan tracts from the Ganges eastwards to Assam, and in Madhya Pradesh, extending into peninsular India.<sup>5</sup> *Barringtonia acutangula* L. is a plant traditionally used for the cure and treatment of many ailments. In Ayurveda, its root, leaves and fruits are used in the treatment of jaundice, liver disorders, stomach disorders, leprosy and splenic disorders since many centuries.<sup>6</sup> It is used in the folklore in vitiated conditions of kapha and pitta, leprosy, arthralgia, dysmenorrhea, plumbago, skin disease, diarrhea, inflammation, flatulence, haemorrhoids as an anthelmintic.<sup>7</sup> Various parts of *Barringtonia acutangula* have been used as a medicine for curing various ailments like hemiplegia, pain in joints, eye diseases, stomach disorders, cough, dyspnoea, leprosy, intermittent fever, splenic disorders and poisoning.<sup>8</sup> In this review, we have attempted to summarize the details available on potency

of *Barringtonia acutangula* to explore its therapeutic prospective.

**TAXONOMICAL CLASSIFICATION<sup>9</sup>**

Kingdom: Plantae  
 Division : Magnoliophyta  
 Class : Magnoliopsida  
 Order : Ericales  
 Family : Lecythidaceae  
 Genus : *Barringtonia*  
 Species : *acutangula*

**Family**

Botanical – leythidaceae  
 Ayurvedic – hijjal kul

**Synonyms**

Sansk. : Hijjala, Vidula
Assam. : Hindole
Beng. : Hijjala
Guj. : Samudraphala
Hindi. : Hijjala, Samudraphala
Eng. : Indian Oak
Kan. : Nerruganegal, Holegonvamara
Mal. : Manjal Kadamba, Manjal Kadam
Mar. : Samudraphala
Ori. : Kijolo
Punj. : Samuderphal
Tam. : Samudrapullarni, Samutrapalam
Tel. : Kanapu, Kadaps
Urdu. : Hijjal



## Parts used

The roots, leaves, fruits and seeds of *Barringtonia acutangula* are used for the therapeutic purpose. Powders from the stem bark, seed and root bark utilized for treating various diseases.<sup>10</sup>

## Botanical description

*Barringtonia acutangula* is an evergreen tree with Simple, alternate leaves, 40cm long pendulous racemes, 1.5cm across, fragrant and dark scarlet flowers with 4 lobed ovate calyx and 2 celled ovary. It has Ellipsoid to ovoid Berry, 1.5 x 0.6cm, fibrous, truncate at both ends, crowned by small persistent calyx. The berry bears one ovoid black seed.<sup>8</sup>



Figure 1: *Barringtonia acutangula* plant

## PHYTOCHEMICAL CONSTITUENT

Wood of *Barringtonia acutangula* Gaertn a new hexahydroxy triterpene, now named tanganol, is isolated besides  $\beta$ - and  $\gamma$ -sistosterols, barringtonogenic acid and an unknown triterpene carboxylic acid.<sup>11</sup> Nine triterpene saponins is actually documented that has acutangulosides A-F along with acutanguloside DF methyl esters and a one triterpene aglycone which were separated a water extract of the bark of *Barringtonia acutangula*.<sup>12</sup> A new triterpene acid, barrigenic acid, was isolated from the fruits.<sup>13</sup> Three monodesmosidic glucuronide saponins of barringtonenol C, named barringtonosides A, B and C have been isolated as their methyl esters from the dried seeds of *Barringtonia acutangula*.<sup>14</sup> The bark contains 3,3'-dimethoxy ellagic acid, dihydromyrticetin, gallic acid, bartogenic acid and Stigmasterol.<sup>15</sup> Leaves were reported to possess steroidal compounds such as barringtonogenic acid, tangulic and acutangulic acids while the fruits yielded saponins based on barringtonenol B, C and D. Bark contained tannin (16%) and heartwood contained barringtonogenic acid, barringtonenol E and a new triterpene diacid, barrinic acid.<sup>16</sup>

## PHARMACOLOGICAL ACTIVITIES

### Antibacterial activity

*Barringtonia acutangula* is usually confirmed to be a highly effective anti-bacterial agent. Aqueous, ethanolic,

petroleum ether and chloroform extracts of *Barringtonia acutangula* was evaluated against *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Enterococcus faecalis* and *Escherichia coli* the major urinary tract infection causing pathogens. The results showed that the Ethanol (95%) extract of *Barringtonia acutangula* exhibited broader spectrum of inhibition followed by chloroform, petroleum ether and aqueous extracts against the urinary tract pathogens under test.<sup>17</sup> Crude extracts and VLC fractions from the stem bark of *Barringtonia acutangula* were screened for their antibacterial activities against two Gram-positive bacteria and two Gram-negative bacteria using a microdilution titre assay. Petroleum ether extract showed good activity against all test organisms.<sup>18</sup> The Leaves extracts of *Barringtonia acutangula* was screened for *In Vitro* antibacterial potential in Petroleum ether, Ethyl acetate and Ethanol against *Pseudomonas aeruginosa*, *Klebsiella pneumonia*, *Salmonella typhi* and *Salmonella paratyphi*. The Ethanolic extract of the leaves of *Barringtonia acutangula* showed maximum antibacterial potential followed by Ethyl acetate extract and Petroleum ether extract when tested by Agar Disc Diffusion Method.<sup>19</sup>

### Antitumour activity

The ethanolic leaf extract of *Barringtonia acutangula* has anticancer activity as it inhibited the HepG2 cell growth.<sup>20</sup> The cytotoxic effect of fungal endophyte isolated from *Barringtonia acutangula* was tested by the MTT assay which showed the effect of its secondary metabolites on the cell viability in HT29, human colon cancer cell line. The fungal extract from endophytic fungi EFB01 & EFB02 showed 52% and 40% cyto-toxicity respectively when compared to the metabolite from EFB01.<sup>21</sup>

The free-radical scavenging and cytotoxicity of the plant by NO assay and MTT assay indicated in the ethyl acetate extract of *B. acutangula* against Colo320 cells. Further, DNA fragmentation assay attributed the cytotoxicity of the plant extract to apoptosis. Hence, it is suggested that *Barringtonia acutangula* have anti-cancer potential.<sup>22</sup>

### Antioxidant potential

The antioxidant study of hydroalcoholic extract of plant *Barringtonia acutangula* Linn root (EBA) revealed that the hepatic antioxidant enzyme levels (SOD, CAT and GPx) are significantly decreased in STZ induced diabetic rats with high degree of lipid peroxidation at both test doses (250 mg/kg b.w./p.o. and 500mg/kg b.w./p.o.).<sup>23</sup> Methanolic extract of leaves of *B. acutangula* showed the promising potential by *In vitro* antioxidant assays (DPPH - radical scavenging and reducing power activity).<sup>24</sup>

### Hypoglycemic activity

Aqueous, methanol and chloroform extracts of *B. acutangula* fruit was evaluated for hypoglycemic effect in OGTT and streptozotocin induced hyperglycemic rats. The aqueous extract of *B. acutangula* whole fruit at a dose of 400 mg/kg showed significant antihyperglycemic action.<sup>25</sup> In an another study, the crude aqueous ethanolic extract

from roots of *B. acutangula* treatment at 250 and 500 mg/kg b.w/p.o. were found to reduce the blood glucose levels, significantly in both normal and glucose fed hyperglycemic rats.<sup>26</sup>

### **Central nervous system depressant activity**

The ethanolic extract of *B. acutangula* leaves causes a maximum inhibition of neuronal activity in the central nervous system leads to its depressant activity. The ethanolic extracts of *Barringtonia acutangula* leaves possesses significant CNS depressant activity by performing sodium pentobarbitone induced sleeping time assay, locomotor activity assay, rota rod test and exploratory activity (y-maze test and hole boardtest). The ethanolic extracts of *B. acutangula* leaves caused a dose dependent reduction in motor activity in mice.<sup>27</sup>

### **Hepatoprotective effect**

The methanol extract of *B. acutangula* leaves exhibited significant hepatoprotective activity at a dose 250 mg/kg in carbon tetrachloride ( $CCl_4$ ) with liquid paraffin (1:1) induced hepatic injury in rats *in vivo* and *in vitro*.<sup>28</sup> In an another study, Oral pretreatment with aqueous extract (water, methanol, acetone, ethanol and petroleum ether) of the leaves of *Barringtonia acutangula* at the doses of 200mg/kg and 400mg/ kg, po showed significant hepatoprotective activity against  $CCl_4$  induced hepatotoxicity by decreasing the activities of serum marker enzymes and bilirubin and increasing the protein content in a dose dependent manner.<sup>29</sup>

### **Antifungal activity**

*B. acutangula* has showed potential antifungal activity. The leaf extracts (n-hexane, chloroform, ethyl acetate and ethanol) of *B. acutangula* were subjected to antifungal activity against *Candida albicans*, *Aspergillus flavus*, *Aspergillus fumigatus* and *Aspergillus niger* using Minimum Inhibitory Concentration (MIC) method. The n-Hexane extract inhibited growth of pathogenic fungi at a lesser concentration followed by aqueous, ethanol, chloroform and ethyl acetate.<sup>30</sup>

### **Anti-nociceptive and anti-inflammatory activity**

*Barringtonia acutangula* roots possess significant central and peripheral anti-nociceptive as well as anti-inflammatory activity. Ethanolic extract of root of *B. acutangula* was evaluated at two doses of 250 mg/kg and 500 mg/kg body weight in mice and rats by using models like Hot Plate and Acetic Acid Writhing tests for anti-nociceptive activity and Carrageenan Induced Rat Paw Edema (acute model) and Cotton Pellet Induced Granuloma (chronic model) for anti-inflammatory activity respectively. Both the activities have shown significant result in dose dependent manner.<sup>31</sup>

### **Anthelmintic activity**

Ethanolic extract of leaves of plant *Barringtonia acutangula* was evaluated to explore the anthelmintic activity on adult Indian earthworms (*Pheretima postuma*)

at the dose of 100 mg/Kg. This dose of extract has shown significant anthelmintic activity comparable to standard drug Piperazine citrate.<sup>32</sup>

### **Antidiarrheal activity**

The ethanolic leaf extract of *Barringtonia acutangula* showed significant antidiarrheal activity on Castor oil induced diarrheal model in rats.<sup>33</sup> Methanol extracts of *B. acutangula* leaves and seeds possess good antidiarrheal activity. The extracts (200 and 400 mg/kg; p.o.) were tested using castor oil- and magnesium sulphate-induced diarrheal models evaluate antidiarrheal activity. The extracts also showed significant inhibition of defecation in both diarrheal models.<sup>34</sup>

### **CONCLUSION**

Medicinal Plants form the backbone of traditional medicine. Herbal medicine based on the premise, that plant contains natural substance that can promote health and alleviate illness. Ethnopharmacological studies on such herbs/medicinally important plant continue to interest investigators throughout the world. Plants are invaluable sources of pharmaceutical products and plants are recognized for their ability to produce a wealth of secondary metabolites and mankind has used many species for centuries to treat a variety of diseases. Different parts of *Barringtonia acutangula* such as leaves, fruit, roots and axillary bud have been used traditionally to treat pains in body, eye ailments, abdominal disturbances, blood impurities, cold, and asthma, diseases of liver, spleen and for diabetes. The root and leaves of *Barringtonia acutangula* possess hypolipidemic, antibacterial and antifungal activity respectively in various animal studies. The preliminary investigation revealed the presence of terpenoids, steroids, tannins, saponins, Flavonoids and glycosides. Though *Barringtonia acutangula* has various medicinal applications, but it is the need of hour to explore its medicinal values at molecular level with help of various biotechnological tools and techniques. More reports for this plant could likely to expose a number of the additional characteristic features hidden within it.

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