



## A Review on Traditional Use and Phytopharmacological Potential of *Bischofia javanica* Blume

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### ABSTRACT

*Bischofia javanica* blume (Family-Euphorbiaceae), commonly known as bishoopwood is mainly used for its timber and traditionally used for the treatment of various diseases like cancer, inflammation, tuberculosis, diarrhoea, sore throat, burns and different allergic conditions. The bark, leaf, root and fruits are used to treat diphtheria, pharyngitis, tonsillitis, different skin diseases, nervous disorders and preparation of dye and wine; the shoot portion is used as anti tussive; seed oil is used for lubrication and surface coating. The present review focuses on the traditional use, active constituents, the seed oil content and pharmacological activity of this plant.

**Keywords:** *Bischofia javanica* blume, Euphorbiaceae, Pharmacognostical, Pharmacological activities, Seed oil, Traditional.

### INTRODUCTION

*Bischofia javanica* blume is a large deciduous tree with tall cylindrical trunk and a girth of 1.5-2.5m usually with a spreading crown. It belongs to the family Euphorbiaceae and is commonly known as Bishop wood found in the sub-Himalayan forests from Kumaun eastwards throughout eastern India. Only two species are found *Bischofia javanica* Blume and *B. Polycarpa*. *B. javanica* is grown as an ornamental tree. The plant is known by various names such as Bengali (kainjal); English (bishop wood, Java cedar); Filipino (tuai); French (bois de l'evêque); Hindi (bhillar, kaen, kot semla, paniala, pankain); Japanese (akagi); Javanese (gintungan); Lao (Sino-Tibetan) (foung fat, khom fat); Tamil (thondi); Thai (pradu-som, toem); Trade name (uriam); Vietnamese (nhoi).<sup>1,2</sup> The Leaves and buds of *Bischofia javanica* is used in tonsillitis and throat pain. The infusion of young shoot & leaves is taken orally against diphtheria in tribal area, such as in Mizoram, India. In Tamil Nadu (India), the stem bark is used to stimulate hair growth. In Western Mizoram (India), the plant is locally called Khuanghtli and its leaf juice is used for the treatment of sores.<sup>3</sup> The ground bark is used for abortion. In Assam (India) the decoction of tree bark is used for curing diarrhoea and dysentery. In Fiji, the leaf is eaten or the leaf decoction is imbibed to cure tonsillitis and the inner bark is used to treat urticaria. The fruits of *Bischofia javanica* are used for making wine and the seeds yield a drying oil which is useful in surface coating and lubrication, the leaves are used as astringent for toothache and for treatment of eye diseases.<sup>4</sup> *Bischofia javanica* has been reported for its antitussive activity, antileukemic activity, antimicrobial activity, anti-inflammatory activity and antinematodal activity. It is also ethnomedicinally used for the treatment of tuberculosis, ulcers, fracture, dislocation and other inflammatory conditions.



Figure 1: Fruits, leaves of *Bischofia javanica* blume

### Taxonomy of the plant

**Kingdom** : Plantae  
**Order** : Euphorbiales  
**Family** : Euphorbiaceae  
**Genus** : Bischofia  
**Species** : javanica  
**Synonym** : Bischofia polycarpa, Bischofia trifoliata (Roxb.) Hook.

**Common name** : Bishop tree, Toog tree

### Description of the plant

The plant is an evergreen or a semi evergreen tree. It grows to a height of 75 feet in places like Florida, Virgin island and Porto Rico, it grows to height of 40-50 feet and diameter of 2.3 m.

### Habitat

This rapidly growing evergreen or semi evergreen tree *B. javanica* occurs in humid valley forests. It is cultivated in plains, especially along stream banks, avenues, and in gardens, at elevations of less than 800 m. The young tree

is shade-resistant and prefers moist condition. It requires growing well in sandy soil that is thick and fertile. It grows up to an altitude of 1800 m. The species is usually found scattered in primary and old secondary dry and deciduous forest or monsoon forest. Occasionally plant can be in evergreen forest, swamp and teak forest. The plant requires an annual rainfall of 1250-2500 mm; also capable of growing in dry places provided access to ground water. It tends to be evergreen in moist localities and deciduous in dry areas. The type of soil needed by the plant is deep, loose soils such as sandy, rocky or loamy soils with sufficient water content, occasionally it is found on limestone. It can stand moderate shade and slight frost, but not drought.<sup>1-4</sup>

### Distribution

The genus is found in southern and south eastern Asia to Australia and Polynesia. They also occur in south western, central, eastern, and southern China. *Bischofia javanica* is widely distributed in the Pacific Islands, Malaysia, SE Asia, Southern China, possibly also in Tonga and Samoa including Taiwan, Southern Japan, Myanmar, and India. It is also found in New Caledonia, Tonga, Rarotonga, Fiji, Niue, Vanuatu, and Samoa. *B. javanica* is native to the Chinese provinces of Kwangtung, Fukien, Kweichow, Yunnan and Hupeh and may also be to Burma, India, the Andaman Islands, tropical Australia, Malaysia and Polynesia.<sup>1,2</sup>

### PHARMACOGNOSTICAL CHARACTERISTICS

*Bischofia javanica* blume is a large deciduous tree with tall cylindrical trunk. It is an evergreen tree up to 20m in length and 9-12m in height with a cylindrical bole, a girth of 1.5-2.5m and a spreading crown. This tree is found in the Sub-Himalayan forests from Kumaun eastwards throughout eastern India, in the Deccan peninsula throughout the eastern and western ghats.<sup>1</sup>

### Bark

The Bark is nearly smooth, greyish brown to brown, and thickness of 1 cm. The bark is dark brown colour in outside but reddish in inside. It contains a red milky sap that becomes a resinous semi-solid when dried.<sup>1</sup>

### Leaves

The leaves of the plants are green in colour with length of 4-8 inches. The leaves are alternate, 3-foliate (sometimes 5-foliate on luxuriant young shoots) common petiole 3-8 inch long. The leaflets are 3-6 inch by 1.53 inch, elliptic or ovate-oblong, acuminate, usually crenate, glabrous, terminal leaflet is much longer. The shape is elliptical, venation is pinnate. Leaf margin is found to be serrulate and arrangement is alternate.<sup>1,2</sup>

### Flowers

Small auxiliary flowers are borne on dioecious panicles in April to May and pendant. The flowers are greenish in colour, dioecious, apetalous in paniculate racemes. The male inflorescence is 8-13 cm long and pubescent to

glabrous, shortly pedicellate; corolla segment 5, obtuse, concave, concealing the anthers; stamens 5; anthers globular pistillode present in the form of a flate disc. Female flowers are pedicelled (longer than male flower), 15-17cm long; sepals ovate, caducous, styles are linear, entire ovary is 3 or 4-celled ovules 2 in each cell.<sup>1,2</sup>

### Fruits

The plant bear fruits in the month of August to October berry-like. The fruit is globose, baccate, fleshy, exuding a gummy juice when squeezed, brown when fully ripe, supported on a thickened pedicel, 6-13mm in diameter, containing oblong seeds 5 mm in length. The seeds are smooth, shining, fleshy, cotyledons are flat.<sup>2,4</sup>

### Wood

The wood of *Bischofia javanica* is red, moderately hard but rather rough grained; heart wood is small, darker; weight 40-50 lbs per ft. It is more durable in water and used for various purposes.<sup>1,2</sup>

### Reported Active Constituents of *Bischofia Javanica* Blume

#### Leaves

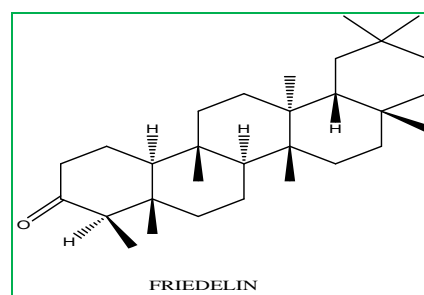
The leaves contain tartaric acid (8-10%), tannin and vitamin C (136/100g). They also contain ellagic acid, friedelin, friedelin-3 $\beta$ -ol, friedelin-3 $\alpha$ -ol and its acetate,  $\beta$ -sitosterol.<sup>2</sup>

#### Stem

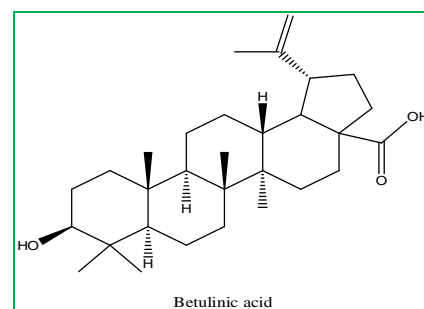
The stem contains friedelin and friedelin-3 $\beta$ -ol.<sup>1</sup>

#### Stem bark

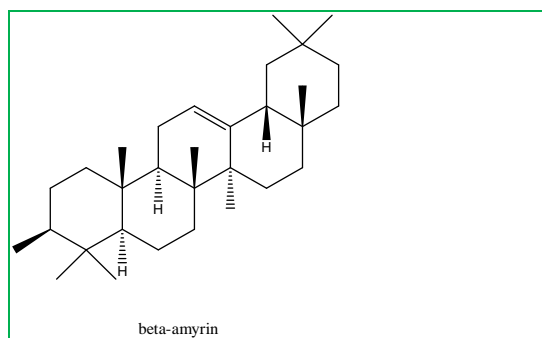
The stem bark of *Bischofia javanica* blume contains tannins. It also contains epi-friedelinol acetate, friedelin (A), betulinic acid (B) as its ester and  $\beta$ -sitosterol. The presence of alkaloids has been also reported.<sup>1,2</sup>



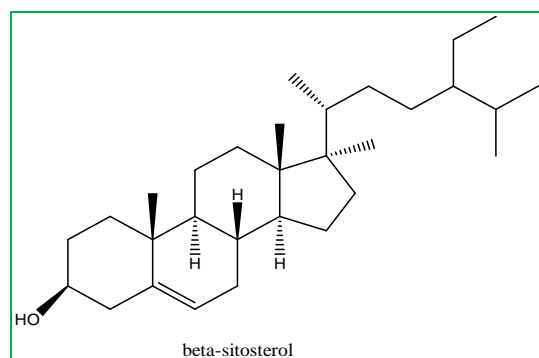
(A)



(B)



(C)



(D)

### Roots

The roots of the plant contains  $\beta$ -amyrin (C), urosolic acid and  $\beta$ -sitosterol (D).<sup>1,2</sup>

### Seeds

The seeds yield a drying oil of following physicochemical characteristics

**Table 1:** Physical and phytochemical properties of *bischofia javanica* seed

Chemical properties of seed	Value %
Yield	20.10
Moisture Content	5.93
Ash content	6.83
Carbohydrates Content	18.91
Protein Content	18.69
Fiber Content	5.32
Total Phenolics	0.59
Total tannin	9.65
Total alkaloids	0.22

Elemental analysis of oil (Table 2) shows that the seed oil is rich in phosphorous, calcium, magnesium, Iron and copper which gives support for use of this oil as medicinal and edible purposes. These mineral elements are very important in human nutrition. *Bischofia javanica* contains magnesium (610.0mg/100gm) and potassium (1.25mg/100gm). Calcium, potassium and magnesium are required for repair of worn out cells, strong bones and teeth in humans, building of red blood cells and for body mechanisms.

**Table 2:** Elemental composition of *bischofia javanica* seed

Metals	Amount (mg/100gm)
Calcium (Ca)	710
Phosphorous (P)	391.4
Potassium(K)	1.25
Sodium (Na)	0.08
Iron (Fe)	2.33
Zinc (Zn)	1.40
Copper (Cu)	2.43
Magnesium (Mg)	610.0

**Table 3:** Physico-chemical properties of extracted oil of *bischofia javanica* seed

Parameters	<i>Bischofia javanica</i> seed oil
State	Slight viscous liquid
Colour	Yellow
Odour	Agreeable
Refractive index (at 40°C)	1.4863
Specific gravity (at 25°C)	0.9256
Acid value (mgKOH/g)	6.59
Iodine value	178.3
Unsaponifiable Matter(%w/w)	0.48
Saponification Value (mgKOH/g)	289.3

**Table 4:** Fatty acid profile of *bischofia javanica* seed oil

Fatty Acids	Value %
Palmitic acid (C16:0)	16.58
Stearic acid (C18:0)	20.048
Oleic acid (C18:1)	12.623
Linoleic acid (C18:2)	48.925
Linolenic acid (C18:3)	1.145
Palmitic acid (C16:1)	0.40
Myristic acid (C14:0)	-

**Table 5:** Fatty acids and their values

Fatty acids	Value %
Saturated fatty acids	36.628
Mono-unsaturated Fatty acids, (MUFA)	13.02
Poly-unsaturated fatty acids, (PUFA)	50.06
Total Saturated fatty acids	36.628
Total Unsaturated fatty acids	63.08

Table 3 shows that the Iodine value of *Bischofia javanica* is (178.3), that lies in drying oil. Drying oils are used mainly in paints, varnishes, lacquers, and printer's ink. Saponification value of *Bischofia javanica* (Table 3) seed oil was 289.3, it suggests that the oils contain high molecular weight fatty acids and low level of impurities & unsaponifiable matter of oils are in range of (0.48 – 0.71)

shows less impurities in oils, so it can be used in soap making industries.

Table 5 shows that total unsaturated fatty acids are in range of 63.08% - 92.99%. Mono-unsaturated Fatty acids, (MUFA)% range from 13.02% to 75.74 % while Polyunsaturated fatty acids, (PUFA) % range from 17.2 to 76.08%. Unsaturated fatty acids (polyunsaturated) help to reduce cholesterol formation or deposition and hence to decrease the risks of atherosclerosis and other heart disease.<sup>5,6</sup>

### Traditional Uses

#### Fruits

The ripe fruits are sandy and sweet. It is also eatable by some tribes. These fruits are used for colouring cloths.<sup>6</sup> These fruits are used to making wine by the people of middle hill region of Sikkim.<sup>7</sup> Fruits infusion used as cold drinks in summer.<sup>8</sup>

#### Leaves

The leaf is used in the treatment of diarrhoea. It is also used as anti-tussive to relieve cough.<sup>9</sup> Chewing of raw leaves treat sore throat.<sup>10</sup> The leaves of this plant is ground with the leaves of *Adhatoda vasica* Nees and applied on the affected part of the skin to cure skin diseases.<sup>11</sup> The leaf juice is also used for cancerous wounds. The leaves are also used in burns and ulcers. It is used as astringent, diuretic and nocturnal emission.<sup>12</sup>

#### Young leaves and Buds

These are used in tonsillitis and for the treatment of throat pain. These young leaves are also taken orally in diphtheria and pharyngitis.<sup>13</sup>

#### Young shoots

These are taken orally in diphtheria and pharyngitis.<sup>13</sup>

#### Stem

The stem is used as firewood by. It is also used in the treatment of diarrhoea.<sup>14</sup>

#### Young stem

The young stem is eaten against stomach ache.<sup>15</sup>

#### Stem bark

The paste of stem bark is applied externally on the affected part to treat nervous disorder problems. Stem bark is also used for irregular menstruation and pain.<sup>16</sup> It is used to stimulate hair growth. It is mixed with coconut oil and applied over head.<sup>17</sup>

#### Bark

The Bark is used in the preparation of black colour dye and used in the treatment of tuberculosis, stomach ulcer, mouth ulcer.<sup>18</sup> It is also used to induce abortion. The grounded bark is mixed with water and the filtrate juice is used for abortification.<sup>19</sup> The bark juice is used to cure

diarrhoea. It is also used in burns.<sup>20</sup> A decoction of bark is taken internally in the treatment of cholera.<sup>21</sup>

#### Shoot

The shoot is used as Antitussive.<sup>8</sup>

#### Seeds

The Seeds are also used to prepare dye.<sup>19</sup>

#### Roots

The roots are traditionally used in Bangladesh for the treatment of diarrhoea. It is used as astringent, diuretic, nocturnal emission and also used to treat ulcers.<sup>22</sup> *Bischofia javanica* Blume, the whole plant is used as food, for preparing tools and fertilizers by the Rukai tribe in Wutai District of Pingtung country of Southern Taiwan.<sup>23,24</sup>

#### Other Uses

##### Useful timber

The bishop wood tree is used as timber wood in India, Burma, Taiwan, East Africa and South Africa. It is also used for construction of bridges, boats, wells, railway sleepers, buildings, furniture, carving and pencil making.<sup>25</sup>

##### Firewood

The stem of *Bischofia javanica* is used as firewood in Sikkim and Assam. It is used for charcoal production.<sup>25</sup>

##### Dye yielding

The bark and leaves of bishop wood are used to produce natural black dyes. The bark contains 16% tannin and yields a brown dye which is commonly used in Samoa for making designs on tapa cloth.<sup>25</sup>

### PHARMACOLOGICAL ACTIVITIES

#### Anti nematodal activity

Methanolic extract of *Bischofia javanica* leaves was found to be very strong activity at minimum effective dose (MED) of 0.7 mg/cotton ball (mg/bl.) against *Bursaphelenchus xylophilus* using cotton ball-fungal mat method.<sup>26</sup>

#### Antimicrobial activity

The ethanolic extract of the leaves has also been shown to possess antimicrobial activity.<sup>27</sup>

#### Antileukemic activity

Betulinic acid was isolated from the  $\text{CHCl}_3$  extract of the bark of *Bischofia javanica* and was evaluated for its inhibitory effects on DNA Topoisomerases (Topo) II activity. Betulinic acid was found to be catalytic inhibitor of Topo II activity with  $\text{IC}_{50}$  value of 56.12  $\mu\text{M}$  which was comparable to that of 52.38  $\mu\text{M}$  for a classic Topo II inhibitor, etoposide. It was suggested that betulinic acid is potent DNA Topo II inhibitor. The  $\text{ED}_{50}$  values of betulinic acid and etoposide were found to be 7.19 and 2.59  $\mu\text{M}$  against A549 cancer cell line.<sup>28</sup>



The leaves extract of *Bischofia javanica* blume was also found to be potent antileukemic activity on human cell lines.<sup>29</sup>

#### Antioxidant activity

The methanolic extract of leaves of *Bischofia javanica* blume has shown the potent free radical scavenging activities in the In-vitro methods like DPPH, Lipid peroxidation and OH radical scavenging activities in the concentration range of 20-320 µg/ml. It is due to presence of Friedelin 3- $\alpha$ -acetate (FA) and  $\beta$  amyryl.<sup>30</sup>

#### Anti inflammatory activity

It was reported that the triterpene urosolic acid and the steroid  $\beta$ -sitosterol present in *Bischofia javanica* exhibit cox-1 inhibitory activity.<sup>30</sup> It showed moderate inhibition in EPP induced ear oedema in male Sprague dowley rats. It was reported that the leaf extract exhibited anti-inflammatory effects against acute carageenan-induced paw edema, sub chronic cotton-pallete induced granuloma and Freund's adjuvant-induced arthritis in rats.<sup>31</sup>

#### Anti wrinkle, anti-aging and whitening effect on the skin

The leaf extract of *Bischofia javanica* with its hyaluronidase, collagenase and tyrosinase inhibitory activity is thought to be useful cosmeceutical ingredients as they have anti wrinkle, anti-aging and whitening effect on skin.<sup>32</sup>

#### Anti allergic activity

The leaf extract of *Bischofia javanica* is found to be have hyalluronidase inhibiting activity. Due to this inhibitory activity, it suppresses allergic conditions.<sup>32</sup>

#### Anti H.pyroli activity

The leaf extract of *Bischofia javanica* is found to be potent urease inhibitory activity. Hence it is thought to be useful as therapeutic agent in the treatment of H.pyroli-related disease.<sup>33</sup>

#### CONCLUSION

The present study shows the morphology, active constituents, traditional uses and different pharmacological activities of *Bischofia javanica* blume. It is a plant of great traditional medicinal importance. Detail phytochemical and pharmacological studies should be conducted to establish its traditional usage and attempt must be taken to isolate the characteristic bioactive compounds present in this plant.

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