

## Let's not Lose the Horror of Midnight Horror Tree

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### ABSTRACT

Midnight Horror tree or *Oroxylum indicum* (L.) Vent. is a highly valuable medicinal plant used widely in folk medicines of wide genre, ayurvedic formulations and has high demand in pharmaceutical industries. Unsustainable collection from its natural habitat, habitat destruction, and high demand of this valuable plant has threatened its existence placing it in endangered list of IUCN. The plant requires special attention for its conservation and also to fulfill the medicinal demand. Conservation of this species warrants its domestication in farming system through agroforestry and commercial plantation to satisfy its demand. This needs easy availability of quality planting material for its large scale and rapid propagation, which is viably possible with vegetative propagation through cutting and tissue culture. Ex situ and in situ conservation of this species will ensure our future generations also to be continuously horrified by this plant at midnight.

**Keywords:** *Oroxylum indicum*, Utilization, Folk medicine, Endangered, Conservation

### INTRODUCTION

*Oroxylum indicum* (L.) Vent. of Bignoniaceae family is commonly known as broken bones tree, Indian trumpet flower or Midnight horror tree is a multi-use medicinal tree, often grown ornamentally for its strange appearance (Harminder *et al.*, 2011; Rajurkar *et al.*, 2011; Sandesh *et al.*, 2018). Pods of the plant make noise which at night sounds horrible creating fear, so popularly known as the midnight horror tree. It is a medicinally as well as economically very important plant. It grows up to an altitude of 1200 m mostly in ravines or in damp and moist places of the forest. The plant is native to the India distributed in Himalayan foothills including peninsular and north east India with a part extending to Sri Lanka, Bhutan, Nepal, Cambodia, Taiwan, China, Indonesia, Laos, Myanmar, Philippines, Thailand, Vietnam and Malaysia (Bennet *et al.*, 1992; Jayram and Prasad, 2008; Deka *et al.*, 2013). It has an association with an actinomycete *Pseudonocardia oroxyli*, present in the soil surrounding the roots (Gu *et al.*, 2006; Singh and Singh, 2014). It is an important forest tree with commercial use in different commodities but very little effort has been made for its conservation. Thus, its conservation has become an immediate need (Sandesh *et al.*, 2018).

### Taxonomic Description and Botany

*Oroxylum indicum* (L.) Vent is a small to medium sized deciduous tree with soft light brown or greyish brown bark with corky lenticels (Dalal and Rai, 2004). The leaves are very large (90-180 cm long), 2-3 pinnate with 5 or more pairs of primary pinnae, rachis very stout, cylindrical, swollen at the junction of branches, leaflets 2-4 pairs ovate or elliptic, acuminate, glabrous. The large leaf stalks wither, fall off the tree and collected near the base of the trunk, appearing to look like a pile of broken limb bones. The tree is true vivipary (Sathe *et al.*, 2013). The flowers are reddish purple outside and pale, pinkish-yellow within, in large erect racemes (Khare, 2004). The tree is a night bloomer and flowers emit a strong, stinky odor to attract bats for pollination (Fujita and Tuttle, 1991). The tree has long fruit pods that are curved downward, hang down from the branches looking like the wings of a large bird or dangling sickles or sword at night. Fruits are flat capsules, 0.33-1 m long and 5-10 cm broad and sword shaped. Seeds are six cm long, winged all round except at the base (Kirtikar and Basu, 2001). Flowering season is monsoon and fruits mature during December to March (Prakash, 2005). Seed dispersal takes place from April to May. Each pod contains 500-600 compactly arranged seeds in two layers (Kulkarni *et al.*, 2013).

## Propagation

The plants easily propagate through seeds without any pre-sowing treatments (Mathew *et al.*, 2009; Rai and Sharma, 2017). The plants can also be vegetatively propagated through cuttings from hardwood using growth hormones like NAA and IBA (Sandesh *et al.*, 2018). Root suckers and bulbs are also reported as viable materials for large scale propagation of this plant (Singh and Singh, 2014).

## Pharmacological Properties

Different chemicals have been reported to be extracted from different plant organs of *Oroxylum indicum* with their composition and activities (Table 1, 2) by many workers *viz.*, Kupchan and Karim (1976), Dey *et al.* (1978), Theobald *et al.* (1981), Vasanth *et al.* (1990), Jiwajinda *et al.* (2002), Chen *et al.* (2003), Khare (2007), Yin *et al.* (2007) Zaveri *et al.* (2008), Choudhry *et al.* (2011) and Bhakti *et al.* (2015).

**Table 1: Chemical constituents of different plant parts**

Plant part	Chemical Constituents
Leaves	Flavones, glycosides, baicalein, scutellareinanthraquinone and aloe-emodin
Root and stem	Oroxylin A, baicalein, chrysin, pterocarpan, rhodioside, p-hydroxyphenylethanols and cyclohexanols
Root bark	Bhrysin, baicalein, oroxylin A, dihydrobaicalein, $\beta$ -sitosterol, iso-flavone and prunetin
Stem bark	Alkaloids, tannic acid, sitosterol and galactose
Seeds	Chrysin, baicalein, baicalein-7-O-glucoside, baicalein-7-O-diglucoside or Oroxylin B
Fruits	Oroxylin A, chrysin and ursolic acid and aloe-emodin

Total tannin, glycosides, phenol (dry weight basis) and phenolic acid (dry weight basis) have been reported in the plant as 10.63 % w/v, 12.95%

w/v, 1.436 mg/g and  $1.275 \pm 0.062$  mg/g, respectively (D' Mello *et al.*, 2012).

**Table 2: Activity of major constituents extracted from *Oroxylum indicum***

Flavonoid	Conc. ( $\mu\text{g/ml}$ )	Activity
Baicalein	8.0	Antioxidant, antimutagenic, anticarcinogenic, antiinflammatory
Chrysin	8.0	Antioxidant, nephroprotective, and immunomodulatory
Biochanin A	26.0	Antidiuretic, antimicrobial, antiarthritic, antioxidant
Ellagic acid	8.0	Antioxidant, hepatoprotective, and antifungal

Different parts of this plant have been found to exhibit antiinflammatory, antiulcer, anthelmintic, immunomodulatory antimicrobial, antioxidant, anticancer, antimutagenic, photocytotoxic, antiarthritic and immunostimulant along with ulcerative, colitis hepatoprotective, antiproliferative, antidiabetic, nephroprotective, antihyperlipidaemic, hypoglycemic, apoptosis and hypolipidemic activities (Deka *et al.*, 2013; Padgilwara *et al.*, 2014; Bhakti *et al.*, 2015). The plant is commonly used in ayurvedic formulations

like *Dasamularistha*, *Syonakaputapaka*, *Syonakasiddaghrta*, *Bhrhatpanca*, *Mulyadikvatha*, *Amartaista*, *Dantyadyarista*, *Awalwha*, *Brahmarasayana*, *Bruhatpancha*, *Chyawanaprasha*, *Narayanataila* and *Shyonakapatpak* (Yasodha *et al.*, 2004; Sastry *et al.*, 2011). The plant according to ayurveda contains:

- *Guna* (properties): *laghu* (light), *tikshan* (sharp) and *ruksha* (dry)
- *Rasa* (taste): *madhur* (sweet), *tikta* (bitter)
- *Virya* (potency): *ushan* (hot)

## **Utilization**

### **Ethnomedicine**

The root and its bark is carminative, diaphoretic, diuretic, astringent, acrid, bitter, pungent, coolant, aphrodisiac, anti-helminthic, anti-inflammatory, tonic, aphrodisiac and an appetizer. It is also used to treat bile problems, vomiting, cough, fever, bronchitis, diarrhoea, dysentery, asthma, leucoderma, diaphoretic, rheumatism and anal troubles (Prakash, 2005; Kunwar *et al.*, 2009; Mathew *et al.*, 2009; Ahad *et al.*, 2012; Joshi *et al.*, 2014). Paste prepared with sesame oil and the powdered bark of the root is given as digestive tonic. The seeds are purgative and taken orally to treat throat infections and hypertension (Singh *et al.*, 2002). The acrid and sweet fruits are used to treat stomach ache, piles, bronchitis, leucoderma, intestinal worms, heart problems, cough and throat diseases, and improve appetite (Drury, 2006). The root, bark, stem and leaf are prescribed against snake bite (Kirtikar and Basu, 2001). Leaves are reported to have analgesic and antimicrobial activity and used externally to treat enlarged spleen and headache (Singh *et al.*, 2002). Bark and seeds of the plant are used in fever, pneumonia, respiratory and stomach troubles by various indigenous communities (Rout *et al.*, 2009; Panghal *et al.*, 2010). Root decoction is also used to treat diarrhoea and dysentery. Seeds are consumed as a digestive tonic. Seed paste is applied to treat boils and wounds (Kunwar *et al.*, 2009). Dreaded disease like nasopharyngeal cancer has also been reported to be treated with the decoction of the plant's root bark (Mao, 2002).

### **Other uses**

The tree is often grown as an ornamental plant for its strange appearance. The sword like fruit or a branch of a plant is used by the farmers to kill crabs in paddy fields. Bark paste is applied to wounds of animals to kill maggots. The young shoots, leaves, fruits and flowers of the plant are consumed as vegetable and used as fodder for domestic animals (Nakahara *et al.*, 2002; Tiwari *et al.*, 2007).

### **Commercial Importance**

The plant is medicinally as well as economically very important. Materials used include the wood,

tannins and dyestuffs. Extracts of the plant are used in herbal tea formulations for mental health. Wood of the tree is used to make match boxes. Stem bark and fruits of the tree are used as mordant and yield dye (Jain *et al.*, 2003). The bark of the tree fetches around Rs 18-20/kg (Chauhan, 2006) and its extract fetches a price of Rs. 5,00,000 per kg in the international market (Gokhale and Bansal, 2006).

### **Conservation**

The plant is being used extensively in folk medicine and ayurveda as its all organs possess medicinal properties. It is over exploited through destructive and non-sustainable collection methods i.e., uprooting the whole plant (Yasodha *et al.*, 2004; Mathew *et al.*, 2009; Mishra and Kotwal, 2010; Mishra, 2011; Singh and Singh, 2014). The threat to the plant is also comes from increasing demand from pharmaceutical industries, shifting agriculture, low regeneration in the wild and deforestation (Mathew *et al.*, 2009; Mishra, 2011; Singh and Singh, 2014; Sandesh *et al.*, 2018). The requirement of this plant was reported as 1200 tons/year in India and still there is scarcity (Ved and Goraya, 2007). This has led to overexploitation of this plant threatening its existence, making it vulnerable and is now listed in IUCN Red Data Book as endangered (Ravi Kumar and Ved, 2000; Darshan and Ved, 2003; Sharad *et al.*, 2007; Jayram and Prasad, 2008; Mathew *et al.*, 2009; Najjar and Agnihotri, 2012; Saraf *et al.*, 2013; Singh and Singh, 2014; Rai and Sharma, 2017; Sandesh *et al.*, 2018).

The plant can only be conserved for posterity through domestication which will also fulfill the acute shortage in demand of this plant. The plant needs to be commercially planted for fulfilling the demand of folk medicine, ayurveda and pharmaceutical industries. This is only possible through production of large scale quality planting materials. Vegetative propagation through hard woods and root suckers can rapidly increase its population for industrial use (Singh and Singh, 2014; Sandesh *et al.*, 2018). *In vitro* propagation can also be another rapid way of production of large scale quality planting material. The plant can also be viably conserved through its integration in farming system by encouraging the small land holders through agro-forestry. Vegetative

propagation may be a viable method for its large scale propagation to establish plantations commercially and its integration in the farming system for its sustainable use. The plant can also be *ex situ* conserved in botanical gardens or elsewhere effectively through bulbs and then can be reintroduced in their natural habitat for its sustenance in the wild (Singh and Singh, 2014). Moreover, research is needed to genetically improve the tree for higher production of with medicinally active compounds (Croteau and Lewis, 2000).

## CONCLUSION

*Oroxylum indicum* has a variety of medicinal properties, which can be used in many ayurvedic formulations, and thus has an economic value and can be commercially exploited. Due to high medicinal value of this plant, there has been increasing pressure on the collection of this species. Quite less scientific work has been done on the possible medicinal applications of its constituent compounds and hence, extensive research is desirable to exploit its therapeutic utility. Many crude extracts are traditionally used as medicines, but its commercial use as modern medicine can only be possible after establishing bioactivity of its responsible constituents, mechanism of action and toxicity standardization. However, for sustainable utilization of the plant for its commercial exploitation, it needs to be popularized through its cultivation which requires standardized agronomic practices and available healthy planting materials. Bringing the plant into cultivation will not only increase the farmers' income, but also conserve the plant. Rapid multiplication and rehabilitation in its natural habitat is essential for conservation of this important medicinal species. A viable quick method of multiplication is through vegetative propagation *in vivo* or *in vitro*, while conserving the plant through *in situ* and *ex situ* methods as well.

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