

A Review Article on *Oroxylum indicum*: A Versatile Medicinal Tree

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Abstract

Oroxylum indicum, commonly known as the Indian trumpet tree or Shyonaka, is a medicinal plant belonging to the Bignoniaceae family. It is widely used in traditional medicine systems, such as Ayurveda, for treating various ailments including neurodegenerative diseases, cardiovascular conditions, arthritis, hepatitis, malignancies, diarrhea, fever, and jaundice. The plant's therapeutic properties are primarily attributed to its rich content of bioactive flavonoids, which exhibit notable anti-cancer, anti-inflammatory, and analgesic effects. Found predominantly in tropical regions, like India, China, Japan, Sri Lanka, and Malaysia, different parts of the plant, including the root and stem bark, have been studied for their pharmacognostic and physicochemical properties. Research indicates that these parts possess similar chemical profiles, making stem bark a viable substitute for root bark when necessary. Recent studies have also focused on the seeds of *Oroxylum indicum*, exploring their potential in diabetes management through physicochemical and phytochemical evaluations, including HPTLC analysis. Overall, *Oroxylum indicum* holds significant promise for developing therapeutic agents targeting a range of health conditions, supported by traditional usage and scientific validation.

Keywords: *Oroxylum*, *Oroxylum indicum*, shyonaka, anti-cancer, anti-inflammatory, ayurveda

INTRODUCTION

Oroxylum indicum, part of the Bignoniaceae family, is also known by several names including *Bignonia indica*. Commonly referred to as Sonapatha or Shyonak in Hindi, this semi-deciduous tree typically grows to a height of 18–20 meters. It features a trunk of about 40 cm in diameter, with a bark that is light brown or grayish-brown, pliable, and porous, marked by cork-like lenticels. The internal bark is golden-yellow, further contributing to its name Sonapatha [1–3].

Plants contain a wide variety of bioactive substances, including phenolic compounds, which contribute

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to the potential discovery of new medicinal compounds. A significant portion of top-selling drugs is derived from natural sources, highlighting the scope for exploration in bioactive substances. However, only a small fraction of biologically derived compounds has been studied. The spice industry and scientific research have shown increasing interest in plants, like *Oroxylum indicum*, known for its potent biological characteristics and appealing appearance [1–4].

This is a tree, that is part of the “dasamula” family of trees used in various Ayurvedic medicines for health issues. Every part of the tree has healing properties. It is astringent, bitter, and helps with digestion, while also easing fever, cough, and respiratory issues. It can treat diarrhea, stomachache,

dehydration, nausea, and loss of appetite, as well as conditions like arthritis, tuberculosis, skin issues, swelling, and urinary-genital problems [5]. The leaves help with stomach pain, gas, sores, and an enlarged spleen. The soft fruit is good for digestion, appetite, and can eliminate hemorrhoids and parasites. The fully developed fruits help with throat pain, heart problems, worm infections, stomach issues, and bronchial inflammation [6]. This tree is noted for its many medicinal benefits, including anticancer [7, 8], antiulcer [9], antidiysenteric [10], antimicrobial, and anti-inflammatory effects [11].

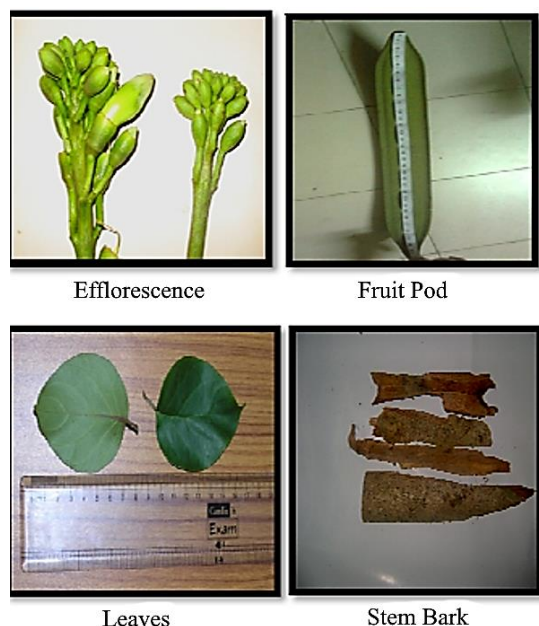


Figure 1. Parts of *Oroxylum indicum* plant [12].

Oroxylum indicum, known as “Sonapatha,” is an important herb in Ayurvedic medicine and has been used for over a thousand years [13]. It can be used alone or in various combinations in traditional Ayurvedic treatments. This herb is a key ingredient in well-known Ayurvedic mixtures like Chyavanprash and Dashmularistha [1]. The bark and root have antiallergic properties and help treat conditions like allergies, liver issues, asthma, throat pain, and diarrhea [3, 14]. The fruits of *Oroxylum indicum* are beneficial for heart and throat diseases, piles, bronchitis, improving appetite, and leukoderma (Figure 1) [1, 15–19].

TAXONOMICAL CLASSIFICATION

- *Kingdom*: Plantae.
- *Division*: Magnoliophyta.
- *Class*: Magnoliophyta.
- *Order*: Lamiales.
- *Family*: Bignoniaceae.
- *Genus*: *Oroxylum*.
- *Species*: *Indicum*.

According to Ayurveda, it includes [20–22] Gunna (Properties) – Laghu (light), Tikshna (sharp) and Ruksha (arid). Rasa (flavour) – Madhur (sweet), Tikta (bitter), Virya (strength) – Ushan (hot).

SYNONYMS

- *Sansk*: Prthsuimba. Katvanga.
- *Hindi*: Sonapatha. Syonak. Tentoo.
- *Eng*: Indian trumpet flower.

- *Beng*: Sonagachh.
- *Guj*: Tentoo.
- *Punj*: Tatpaling. Talyarphali.
- *Mar*: Tentoo.
- *Tamil*: Peruyaagai.

BOTANICAL DESCRIPTION

This species is a deciduous tree that typically grows to a height of approximately 12 meters. A distinctive feature of this tree is its thick leaf stems which, upon drying and falling, accumulate at the base of the trunk in a manner that resembles a pile of broken bones. The tree is known for its nocturnal blooming cycle, with flowers specifically adapted for pollination by bats (Figure 2).

Key Physical Characteristics Include

- *Foliage and Bark*: The tree features brownish bark and leaves spanning 2 to 4 inches. with individual leaflets reaching 5 inches in length and 3 to 4 inches in width. These leaflets are characterized by their pointed edges.
- *Flowers*: Borne on stalks approximately one foot long, the blossoms exhibit a purple coloration.
- *Fruit and Seeds*: The tree produces substantial, dangling seed pods that can measure between 1 and 3 feet in length and 2 to 4 inches in width. These curved fruits are often described as looking like large bird wings or hanging blades in the dark.
- *Seed Morphology*: The seeds are flat and circular, measuring roughly 3 inches by 2 inches, and are equipped with thin, papery wings.

The reproductive cycle is tied to the seasons, with flowering occurring during the rainy months and fruit ripening for harvest between December and March [1–3, 14]. (http://en.wikipedia.org/wiki/oroxylum_indicum; Kirtikar & Basu, 2001; *Ayurvedic Pharmacopoeia of India*).



Figure 2. Botanical parts of *Oroxylum indicum* [23].

MICROSCOPIC DESCRIPTION

Microscopic examination of the roots of *Oroxylum indicum* reveals that the root cork consists of 30 to 35 layers of polyhedral cork cells, with the outer layer being woody and comprised of lignified cells, while the inner layer is non-lignified. The cortex is broad, made up of slender-walled parenchymatous cells containing calcium oxalate crystals and stone cells. The phloem is extensive, featuring 25 to 30 layers of thin-walled phloem parenchyma cells arranged radially, with medullary rays that are bi-to tetra-seriate. This cross-section contains cork, cortex, phloem, and medullary rays, showcasing significant variations in cell structure and composition.

GEOGRAPHICAL DISTRIBUTION

The deciduous *O. indicum* tree is found mostly in the Indian subcontinent, while it can also be found on places like Bhutan, southern China, and Malaysia. It is located throughout India, especially in the foothills of the Himalayas, the Eastern and Western Ghats, and Northeast India. It flourishes in a variety of environments, especially humid wooded areas and at elevations up to 1200 m. The actinomycete *Pseudo nocardia oroxyli* is linked to the root habitat of this tree, which is also found in Sri Lanka, Indonesia, Laos, Myanmar, the Philippines, Thailand, and Vietnam. It is frequently found close to riverbanks and mountain slopes [24, 25].

VERNACULAR NAMES

Sonapatha, sometimes referred to as the Indian trumpet flower or the midnight horror, goes by several names in different languages: Shyonak, Patrorna, and Shallaka in Hindi; Mu hudie, or Butterfly tree, in Chinese; and Achi and Manduka-paramu in Tamil and Telugu, respectively. Broken Bones Plant and Tree of Damocles in English are two more moniker alternatives that emphasize the plant's broad recognition and varied cultural importance [18, 24, 26].

ETHNOBOTANY

The tree is frequently grown as an ornamental tree because of its distinctive appearance. In damp paddy fields, farmers also use its branches or sword-like fruit to kill crabs. To get rid of maggots from animal wounds, the bark is processed into a paste. The fruits and blossoms of the plant are eaten as vegetables in Thailand [24, 27].

ETHNOMEDICINAL USES OF *OROXYLUM INDICUM*

Oroxylum indicum has been used from prehistoric times, according to the Ayurvedic medical book, and its root bark and seeds are said to provide significant health advantages. Sharp, bitter, and astringent, the root bark helps with digestive problems like dysentery and diarrhea. It acts as an anti-inflammatory, digestive aid, and stimulant, among other therapeutic functions. In addition to helping with digestion, the seeds are used to treat high blood pressure and throat infections. Products made from this plant are consumed as food and sold in marketplaces in Malaysia, demonstrating the plant's cultural and economic importance in Ayurveda (Figure 3) [1, 15–18].



Figure 3. *Oroxylum indicum*: (a) tree, (b) leaves, (c) flowers, and (d) wood bark [28].

CHEMICAL CONSTITUENTS

Oroxylum indicum contains significant chemical components, particularly secondary metabolites. Documented compounds include flavonoids, glycosides, alkaloids, tannins, and terpenoids.

- Baicalein is highlighted as the major chemical compound found in *O. indicum*.
 - The leaves have been found to contain flavones and the glycosides scutellarein and baicalein. Leaves also have an anthraquinone, aloe-emodin [18, 29].
 - The leaves of Sonapatha had baicalein; baicalein-7-O-glucoside; baicalein 7-O-diglucoside; baicalein-7-O-glucuronide; chrysin; chrysin-diglucoside; chrysin-7-O-glucuronide; oroxylin-A; scutellarin; baicalein-6-O-glucuronide [30]. The leaf oil of Sonapatha revealed the existence of Ar-tumerone, methyl hexadecanoate, aurenan-2-one, and isopropyl butanoate (Figure 4) [29].

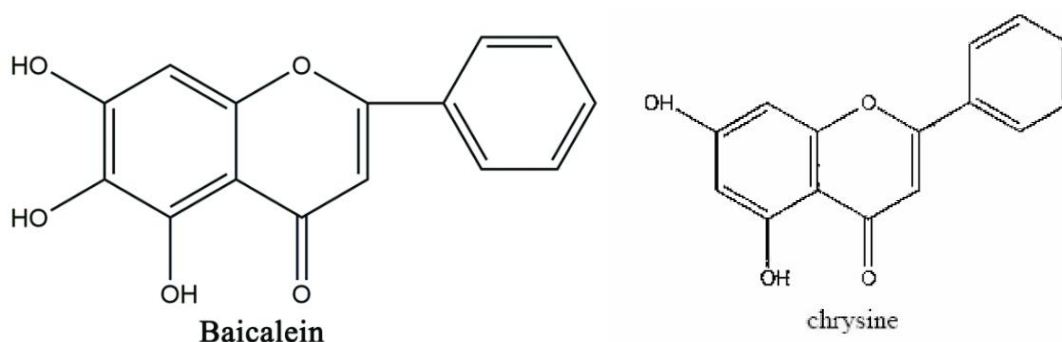


Figure 4. Chemical constituents of *Oroxylum indicum* [29, 30].

TRADITIONAL USES

The roots, bark, leaves, fruits, and seeds of *Oroxylum indicum* are said to have several medicinal qualities. The roots are used to treat ailments, like dropsy, asthma, and arthritis, because of its medicinal properties, which include anti-inflammatory and digestive assist effects [3, 4]. The leaves assist control bronchial inflammation and rheumatic discomfort, while the bark heals stomatitis and TB. Pharyngodynia and jaundice can be effectively treated with ripe fruits. In addition to improving fertility and acting as a laxative, seeds are also employed in Ayurvedic medicines. Bark infusion also treats stomach ulcers and related conditions [10, 26].

CURRENT STATUS OF RESEARCH ON *OROXYLUM INDICUM*

Research on the antioxidant actions of different plant parts has yet to identify which section exhibits the highest antioxidant feature. Studies have explored the antimicrobial agent, immunomodulating and stomach-protecting properties of root bark and stem, while anti-inflammatory effects have been tested on leaves and stem bark. Antimutagenic and antihepatotoxic research has focused on foliage and produce. Nonetheless, there remains an absence of understanding regarding the specific phytochemical components responsible for these biological functions (Table 1) [31].

Table 1. Phytochemical analysis of *Oroxylum indicum* [31].

S. N.	Phytochemical	<i>Oroxylum indicum</i>
1	Terpenoid	Negative
2	Phlabotannin	Positive
3	Flavonoids	Positive
4	Reducing sugar	Negative
5	Phenols and Tannins	Positive
6	Iodine Test	Negative
7	Mayer's Reagent	Negative
8	Wagner's Reagent	Negative
9	Keller-Killiani Test	Positive

PHARMACOLOGICAL ACTIVITIES

Sonapatha has shown various pharmacological activities such as anti-cancer, anti-inflammatory, anthelmintics, anti-oxidant, anti-hepatotoxic activities, etc.

Anti-Inflammatory Activities

Ethanol extracts from the stem bark and aqueous extracts from the leaves of *Oroxylum indicum* exhibit notable anti-inflammatory effects through mechanisms such as neutralizing free radicals and inhibiting proinflammatory cytokines like NF- κ B and TNF α . Additionally, extracts demonstrated efficacy in reducing inflammation in vivo and in vitro, with compounds, such as flavones (baicalein, scutellarein, and aloe-emodin), playing a significant role in these effects by blocking key enzymes like 5 lipoxygenase and cyclooxygenase and hindering arachidonic acid peroxidation [32, 33].

Anti-Cancer Activities

It has been discovered that *Oroxylum indicum* inhibits tumor cell migration and proliferation, especially through the action of baicalein, a flavonoid that has potent anti-tumor properties. Its stem bark ethanol extract has shown in vivo anti-cancer properties as well as anti-proliferative effects on Hep2 cell lines. Among several traditional botanicals tested against liver cancer in 2018, *Oroxylum indicum* showed the most potent anti-proliferative effect. Furthermore, some cancer cell lines, including as MDA-MB-435S, Hep3B, and PC-3, underwent apoptosis when exposed to both aqueous and methanol extracts from the stem bark [34–37].

Anti-Arthritic Activities

The root bark of *Oroxylum indicum* has shown significant anti-arthritic effects in vitro, with ethyl acetate and chloroform extracts exhibiting noteworthy properties in combatting adjuvant-induced arthritis. Various extracts were evaluated, confirming the considerable anti-arthritic potential of *Oroxylum indicum* root bark [12, 23, 28, 31, 37].

CONCLUSION

Oroxylum indicum is utilized in traditional and Ayurvedic medicine for treating numerous human illnesses. It has a broad spectrum of medicinal benefits, such as anti-inflammatory, anti-cancer, and antimicrobial effects, supported by various biological evaluations. The root bark and stem bark of this plant exhibit significant anti-inflammatory activity, with potential for substitution between the two. However, further clinical studies are needed to validate these claims.

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