



## ETHNOPHARMACO-BOTANICAL REVIEW OF AN AYURVEDIC PLANT SHAAKA (SAAGON) - *TECTONA GRANDIS*.LINN

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### ABSTRACT

*Tectona grandis* is a tall tree from south-east Asia and is widely cultivated for its durable wood and is the source of a high quality hardwood known as teak. The timber is used for ship decking, flooring, furniture and construction. Several Phyto-constituents like alkaloids, glycosides, saponins, steroids, flavonoids, proteins have been isolated from different parts of the plant. Teak has traditionally been used in Southeast Asia for medicine, commonly for its astringent and diuretic properties, against swelling and in gynaecological disorders. Its traditional use for diabetes has been supported by laboratory tests in which extracts of the bark have been shown to lower insulin resistance in mice. Here is an effort to review the details of the drug such as morphology, distribution, ethno botanical claims and pharmacological activities.

**Key words:** *Phyto-constituents, Diuretic, gynaecological disorders,*

## INTRODUCTION

Shaaka (*Tectona grandis*) is probably the most widely cultivated high value hardwood in the world belongs to family Verbenaceae, also known as Teak and is native to India and Myanmar and South- East Asian countries. It is occasionally cultivated in tropical countries as an ornamental for its large leaves and spreading flower clusters. Shaaka is a well-known for its high grade timber. Although it is known less for its medicinal properties and uses, but in India different plant parts are in use as medicine since generations and has a folk reputation among the Indian herbs as a hypoglycaemic agent and in gynaecological disorders. Teak is well known for durability and insect resistance

from olden times. It is a most famous timber in the world and is renowned for its dimensional stability, extreme durability and hardness which also resist decay even when unprotected by paints and preservatives. Teak is a major exotic species found in tropical regions. It is now one of the most important species of tropical plantation forestry. The whole plant is medicinally important and many reports claim to cure several diseases according to Indian traditional system of medicines. Extracts from various parts of teak shows expectorant, antibacterial, cytotoxic, anti-inflammatory, anthelmintic properties and is also used against bronchitis, biliousness, bronchitis, hyperacidity, dysentery, diabetes, leprosy etc<sup>1,2</sup>.

<b>Taxonomical classification:</b> <sup>3</sup>	
Kingdom :	Plantae – Plants
Subkingdom :	Tracheobionta – Vascular plants
Super division :	Spermatophyta – Seed plants
Division :	Magnoliophyta – Flowering plants
Class :	Magnoliopsida – Dicotyledons
Subclass :	Asteridae
Order :	Lamiales
Family :	Verbenaceae – Verbena family
Genus :	<i>Tectona</i> L. f. – <i>tectona</i>
Species :	<i>grandis</i> L. f. – <i>teak</i>
Botanical Name:	<i>Tectona grandis</i> .linn

Table No.1

## SYNONYMS: <sup>4,5</sup>

Shaaka,	Bhuumisaha,	Dwaaradaaru,	Varadaaru,
Kharachhada,	Saagawaan,	Saagauna,	Atipatraka,
Grahadruma,	Halimaka.	Krkachapatra,	Jyeshதாகashtha,
Mahisaka,	Sthirasaara		

VERNACULAR NAMES:	
English	: Indian Teak, Teak.
Hindi	: Sagwan, Sagauna, Sagu, Sagun, Sakhu.
Bengali	: Segunngachh, Segun.
Gujarati	: Sagwan, Sag, Saga, Sagach,
Kannada	: Tegu, Sagawani, Thega, Jadi, Tega, Tyagadamara, Tekka-maram
Malyalam	: Thekku, Tekka-maram, Tekku, Tekka.
Punjabi	: Sagwan, Sagun.
Tamil	: Tekku, Tekkumaram, Tek, Kalindi.
Telgu	: Teku, Pedda, Tek, Peddateku, teku-manu, Adaviteku, Teechekka.
Assam	: Chingjagu sagun.
Oriya	: Saguana, Sagan, Sagun, Singuru.
Persian	: Saj, Sal.
Sind	: Loheru.
Urdu	: Sagwan

Table no.2

## BOTANICAL DESCRIPTION<sup>6</sup>

*Tectona grandis* is a large deciduous tree growing up to 20 meters or more. Branchlets are quadangled. Leaves are large, elliptic or obovate, 20 to 30 cm. long, acute or acuminate, usually wedge-shaped at the base, with entire margins, the upper surface rough and without hairs and the lower surface densely covered with grey or yellowish hairs. Flowers are numerous, short-stalked, and arranged in large, terminal, much-branched panicles 0.3 to 0.9 m.long. Calyx in flower

3mm.long, stellately tomentose, semiglobose-campanulate, the lobes 5 or 6, spreading, subequal, 1.2 mm.long, in fruit enlarged to 2.5 cm. or even more long, bladder-like, enclosing the fruit, ovoid, more or less crumpled, reticulately veined. Corolla is white, glabrous, 5-6 lobed, tube about 2mm. long, limb 6 mm. across when expanded, with spreading subequal lobes. Fruit is about 1.3 cm. in diameter, subglobose, somewhat 4-lobed, the pericarp soft with dense felted stellate hairs, endocarp bony.



Fig. 1 Shaaka Tree



Fig. 2 Shaaka Flowers



Fig. 3 Shaaka Leaves



Fig. 4 Shaaka Fruits

#### DISTRIBUTION:<sup>7</sup>

*Tectona grandis* is native to south and southeast Asia, mainly India, Sri Lanka, Indonesia, Malaysia, Thailand, Myanmar and Bangladesh but is naturalized and cultivated in many countries in Africa and the Caribbean. Myanmar's teak forests account for nearly half of the world's naturally occurring teak. Planted in various parts of the Philippines, especially parts of Mindanao and the Sulu Archipelago. Now this is established in the southern part of the Archipelago.

#### CHEMICAL CONSTITUENTS:<sup>8,9,10</sup>

*T. grandis* reported for several classes of phytochemicals like alkaloids, glycosides, saponins, steroids, flavonoids, proteins and carbohydrates have been reported in *Tectona grandis*. Secondary metabolites such as tectoquinone, 5-

hydroxylapachol, tectol, betulinic acid, betulinic aldehyde, squalene, lapachol were extracted from the plant. **Heartwood** contains a resin, tectoquinone. Exhibits cracks and cavities lined with white crystalline deposit consisting of hydrocalcic orthophosphate with 11.4 % ammonio-magnesium phosphate. Contains a higher percentage of carbon and hydrogen, and together with its calcium, phosphate and silica content, may account for the hardness of the wood. **Leaves** contain 6% tannin, dry weight. Phytochemical screening of methanol and water extracts yielded carbohydrates, reducing sugars, alkaloids, glycosides, flavonoids, sterols, and saponins. Acetovanillone, E-isofuraldehyde, Evofolin, syringaresinol, medioresinol, balaphonin, lariciresinol, zhebeiresinol, 1-hydroxypinoresinol together with two new compounds Tectonoelin A and Tectonoelin B were extracted from the leaves of *Tectona grandis*.

AYURVEDIC PROPERTIES: <sup>11</sup>	
Rasa (Taste)	: Kashaya (Astringent)
Guna (Quality)	: Laghu (Light for digestion), Ruksha (Produces dryness)
Vipaka (Post digestion effects)	: Katu (Pungent)
Veerya (Potency)	: Sheeta (cold)
Doshaghanata (Effect on Dosha)	: Kaphapittashamaka (mitigates kapha & pitta)
	Vaataashaamak (mitigates vata) - seeds
	Pittashamaka (mitigates pitta) - bark

Table no.3

Karma	
<i>Shothahara</i>	: Removes inflammation
<i>Kushtaghna</i>	: Avoids skin diseases
<i>Dahaprashamana</i>	: pacifies burning sensation
<i>Raktastambhana</i>	: Styptic
<i>Vedanasthapana</i>	: Relieves pain
<i>Keshy</i>	: Hair growth promoter
<i>Mootrala</i>	: Diuretic
<i>Garbhasthapana</i>	: Anti Abortifacient
<i>Pramehaghna</i>	: Anti diabetic
<i>Shramaapahanam</i>	: Relieves tiredness
<i>Medohara</i>	: Anti obesity

Table no.4

**Parts used:** Leaves, bark, fruit, roots.

**Doses:** Powder- 3-6 gm  
Decoction- 50-100 ml.

IMPORTANCE OF SHAAKA AVAILABLE IN VARIOUS TEXTS OF AYURVEDA ARE  
TABULATED HERE:<sup>12, 13,14,15,16</sup>

Name of Text/ Nighantu	Varga(Class)	Ayurvedic actions (Pharmacological Activites)	Reference Shalokas
Raja Nighantu	प्रभद्रादिवर्गः	Bark considered astringent, Reduces burning sensation, useful in tiredness.	शाकस्तु सारकः प्रोक्तः पित्तदाहश्रमापहः । कफघ्नं मधुरं रुच्यं कषायं शाकवल्कलम् ॥
Kaideva Nighantu	औषधि वर्ग	Flowers useful in diabetes. Plant cures Leprosy, protects foetus.	शाकः कषायः शिशिरो रक्तपित्तप्रसादनः । कुष्ठश्लेष्मानिलहरो गर्भसन्धानस्थैर्यकृतः ॥ शाकपुष्पं प्रमेहघ्नं रुक्षं तुवरतिक्रमम् । कफपित्तहरं वातकोपनं विशदं लघु ॥
Shodhal Nighantu	मूत्राघात	Root and seeds	शर्कराऽऽजपयः पीता शाकवृक्षस्य मूलिका ।



	चिकित्सा	considered diuretic, Reduces burning sensation.	मूत्ररोधं तथा दाहं नाशयत्यतिवेगतः ॥
Madanapal Nighantu	वटादिवर्गः	Plant pacifies Kapha-vata, Purifies blood, Protects foetus.	शाकः खरच्छदो भूमिसहो दीर्घच्छदो मतः । शाकः श्लेष्मानिलास्रघ्नो गर्भसन्धानदो हिमः ॥
Bhavaparkash Nighantu	वटादिवर्गः	Plant is useful in bleeding disorders.	भूमिसहो द्वारदारुर्वरदारुः खरच्छदः । भूमिसहस्तु शिशिरो रक्तपित्तप्रसादनः ॥
Charaka Samhita	ग्रहणीदोष चिकित्सा	Fruits useful in IBS(Irritable bowel syndrome)	वचामतिविषां पाठां सप्तपर्ण रसाञ्जनम् ।..... ...जम्बाम्रबिल्वमध्यानि निम्बशाकफलानि च ।

**Table no.5**

**ETHNOBOTANICAL CLAIMS:** 17, 18, 19, 20, 21

The leaves are cooling, haemostatic, depurative, anti-inflammatory and vulnerary. They are useful in inflammations, leprosy, skin diseases, pruritus, stomatitis, indolent ulcers, haemorrhages and haemoptysis. Decoction of fresh or dried leaves used for menstrual disorders, haemorrhages in general, haemoptysis, used as a gargle for sore throat, Decoction of fallen yellow leaves used for anaemia. Leaves contain about 6% tannin and a dye; also used for thatching. Oily product obtained by distillation of wood chips applied to eczema.

Bark: is used as astringent, constipation, anthelmintic and depurative. It is used in bronchitis, hyperacidity, dysentery, verminosis, burning sensation, diabetes, difficult labour, leprosy and skin diseases. The stem bark is powdered and mixed with water, given to women at the time of delivery to reduce hip pain.

Wood: Acrid, cooling, laxative, sedative to gravid uterus, useful in treatment of piles, leukoderma and

dysentery. Oil extracted from the wood is best for headache, biliousness, burning pains particularly over a region of liver. Roots: are useful in anuria and retention of urine. Paste of powdered wood applied for acute dermatitis; especially, that due to contact with caustic oleoresin of *Anacardium occidentale*. The charred wood in poppy juice, reduced to a smooth paste, is used for eyelid swelling and believed to strengthen the sight.

Flowers: are acrid, bitter dry and cures bronchitis, biliousness, urinary discharge. According to Unani system of medicine, oil extracted from the flowers is useful in scabies, and promotes the hair growth.

**TOXICITY:** <sup>22</sup>

*T. grandis* causes contact dermatitis from handling of sawdust of the tree lumber. Epidemiological study of occupational contact eczema in a furniture factory describes teak as a fairly potent sensitizer and contains primary irritants. Half of the employees heavily exposed to teak dust suffered from eczema and/or severe itching; 8% with slight exposure manifested skin symptoms.

## ECONOMIC IMPORTANCE:<sup>23</sup>

In India, leaves are used in the preparation jackfruit dumpling. In Java, Indonesia, leaves are used in the preparation of gudeg, a dish of young jackfruit, providing the dish with a dark brown color. Both the root-bark and young leaves yield a yellowish-brown or reddish coloring matter, which is used for paper, clothes and matting. In the West Indies, young leaves are similarly used for dyeing. Wood is very durable, resistant to fungi. Used for poles, beams, trusses, columns, roofs, doors, window frames, flooring, planking, panelling, and staircases, and other constructional work. It is one of the best timbers for furniture and cabinet-making, wagon and railway carriages. Due to its better shape-retention ability, teak is popular in marine constructions and is a class by itself for boat- and ship building, particularly for decking. On account of its resistance to chemicals, teak articles are used in chemical laboratories; suitable for casks and vats for shipping corrosive liquids and for storing vegetable oils, fruit syrups, chutneys etc. Teak is employed for sound – boards of musical instruments, keys etc. and for different grades of plywood. Wood waste in the form of wood- shavings and sawdust is used for chip-boards, fibreboards, and plastic boards.

## PESTS AND DISEASES

The main attack on the stems is by the insect *Calothermes tectonae*. At first sign of attack, trees should be felled and burned, because no effective insecticide is known. Other plantation pests are *Eutectona machaeralis* (teak skeletonizer) and woodborers *Xyleutes ceramicus* in Thailand and *Xyleborus destruens* in Indonesia. Leaf-eating caterpillars such as *Hyblaea puera* and *Pyrausta machaeralis* may defoliate branches. Termites such as *Neotermes tectonae* may damage the trees, although many provenances show a high

resistance. Seeds can be infested by larvae of Lepidoptera and Coleoptera (longhorn beetles). A bacterial wilt caused by *Pseudomonas solanacearum* often attacks 6-month to 2-year-old seedlings. To control, choose a nursery site with good drainage and avoid root injury during weeding and transplanting. Fungi such as *Corticium salmonicolor* can cause disease. Crowns are often infested by semi-parasitic mistletoes, such as *Loranthus* spp. and *Dendrophthoe falcata*, which cause severe retardation; lopping affected branches controls them.

## RESEARCHES:

### i) Antibacterial, Cytotoxic and Antioxidant Activity<sup>24</sup>

The study was meant to characterize pharmacological potential of different extracts from leaf, bark and wood of teak. Antibacterial activity of all extracts from *Tectona grandis* were checked against *Staphylococcus aureus* (ATCC 25923), *Klebsiella pneumoniae* (ATCC 700603), hospital strains of *Salmonella para-typhi* and *Proteus mirabilis* by disc diffusion assay. Chloroform extract of leaf showed inhibition to growth of *S. aureus* (14 mm) and *K. pneumoniae* (8 mm). Cytotoxic potential of extracts were checked by MTT assay and chloroform extract of bark exhibited very high activity against chick embryo fibroblast (CEF) and human embryonic kidney (HEK 293) cells with 87 % and 95.3 % inhibition respectively. Antioxidant activity of extracts was checked with DPPH and ABTS+ free radical. Ethyl acetate extract of wood showed very high activity with 98.6 % inhibition against DPPH and ABTS+ free radicals. The value was higher than standard compounds used for the study.

### ii) Diuretic Activity<sup>25</sup>

Aqueous extract of *Tectona grandis* was selected for scientific base of its diuretic evaluation. LD50 value of

aqueous extract of *Tectona grandis* was above 2000 mg/kg body weight. Adult male wistar rats 150-200 g was used for diuretic studies using aqueous extract of *Tectona grandis* administered orally. A five groups consisted of 6 rats were placed in a metabolic cages and treated with Hydrochlorothiazide as a standard and three different doses (100, 200 & 400 mg/kg) of aqueous extract of *Tectona grandis*. The urine excreted over a period was measured at every 2, 4, 6, 8 and 24 hrs. for single rat was collected and measured. Urinary Na<sup>+</sup>, K<sup>+</sup> and Cl<sup>-</sup> contents for each group after 24 hours were analyzed by Auto analyser. The present study has indicated that the aqueous extract of *Tectona grandis* in three doses showed diuresis at different time interval and there was significant increase in urinary Na<sup>+</sup>, and Cl<sup>-</sup> excretion.

#### iii) Antinociceptive Activity<sup>26</sup>

Male Swiss albino mice (25-30 g) were divided into five groups containing six animals each. ATG (100, 200 & 400 mg/kg, p.o.), Indomethacine (10 mg/kg, p.o.). All the drug treatments were given 1 hour before i.p. injection of 0.6 % (v/v) acetic acid, at a dose of 10 ml/kg. Writhing is a syndrome characterized by a wave of contraction of the abdominal musculature followed by a wave of contraction of hind limbs. The hind limbs contractions that occurred over a period of 10 min were counted. A reduction in time of writhing initiation & number of writhing as compared to the vehicle treated group was considered as evidence for the analgesia. *Tectona grandis* significantly reduced writhings and stretchings induced by 0.6% acetic acid at a dose of 10 ml/kg. The significant protective effect was dose dependent with 39.08% (P<0.001), 54.31% (P<0.001) and 67.51 (P<0.001) reduction observed for 100, 200 and 400 mg/kg respectively. Indomethacine (100 mg/kg) had 73.60% (P < 0.001) inhibition.

#### iv) Hair growth activity<sup>27</sup>

The seeds of *Tectona grandis* Linn are traditionally acclaimed as hair tonic in the Indian system of medicine. Studies were therefore undertaken in order to evaluate petroleum ether extract of *T. grandis* seeds for its effect on hair growth in albino mice. The 5% and 10% extracts incorporated into simple ointment base were applied topically on shaved denuded skin of albino mice. The time required for initiation of hair growth as well as completion of hair growth cycle was recorded. Minoxidil 2% solution was applied topically and served as positive control. The result of treatment with minoxidil 2% is 49% hair in anagenic phase. Hair growth initiation time was significantly reduced to half on treatment with the extracts compared to control animals. The treatment was successful in bringing a greater number of hair follicles (64% and 51%) in anagenic phase than standard minoxidil (49%). The results of treatment with 5% and 10% petroleum ether extracts were comparable to the positive control minoxidil.

#### v) Anti-ulcer Activity<sup>28</sup>

Lapachol, a naphthaquinone isolated from the roots of *Tectona grandis* given at a dose of 5 mg/ kg twice daily for 3 days was found to have an anti-ulcerogenic effect on subsequently induced experimental gastric and duodenal ulcers in rats and guinea-pigs. Its action appears to be associated with an effect on the protein content of gastric juice, and it reversed aspirin-induced changes in peptic activity, protein and sialic acid.

#### vi) Antihyperglycemic activity<sup>29</sup>

The present study was carried out to evaluate the anti-hyperglycemic effect of *T. grandis* Linn. bark extract in control and alloxan-diabetic rats. Oral administration of the bark suspension of *T. grandis* (2.5 and 5 g/kg body wt.) for 30 days resulted in a significant reduction in blood glucose (from 250 ± 6.5 to 50 ± 2.5 mg/dL). Thus, the present study clearly



shows that the *T. grandis* Linn. bark extract exerts anti-hyperglycemic activity.

#### vii) Antipyretic Activity<sup>30</sup>

The methanolic extract of root of *Tectona grandis* was tested on yeast-induced pyrexia in Wister Albino rats. The root extract at oral doses of 250mg/kg and 500mg/kg has been used to investigate the Antipyretic potential of root extract. Both doses showed significant reduction in body temperature on yeast induced pyrexia when compared to standard (paracetamol 100mg/kg).

#### DISCUSSION & CONCLUSION:

*Tectona grandis*, is a medicinal plant with versatile nature, apart from possessing high value of hardwood, it is also the unique source of various types of compounds having diverse chemical structure. The extract of the different parts of the plant shows various activities like antibacterial, antioxidant, antifungal, anti-inflammatory, anti-asthmatic, analgesic, diuretic, hypoglycaemic, antidiabetic, antipyretic, anti-ulcer, antinociceptive, anti-metastatic and hair growth activity. In Ayurveda this plant is not much highlighted for its medicinal values and people are less aware towards its medicinal importance too. Hence there is a need to further highlight and discovered pharmacological effects on Ayurvedic background.

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