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Review Article

Pharmacology of *Tectona grandis* Linn.: Short Review

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ABSTRACT

Tectona grandis Linn. (*T. grandis* Linn.) (Family - Verbenaceae) is one of the most famous timber plant in the world and is renowned for its, extreme durability, dimensional stability and hard which also resists decay even when unprotected by paints and preservatives. *T. grandis* Linn.is commonly called as teak and locally known as sagon, sagwan. It is moreover considered as a major constituent in many of the traditional medicines. A variety of interesting but limited compounds have been isolated and identified from *T. grandis* Linn. *T. grandis* Linn. was screened out for its various pharmacological activities. Overview pharmacological investigations on the *T. grandis* Linn. is presented in this review.

Key words: Teak, *Tectona grandis* Linn., ethnomedicinal plant, pharmacology activity.

INTRODUCTION

Plants are indispensible sources of medicine since time immemorial. Studies on natural products are aimed to determine medicinal values of plants by exploration of existing scientific knowledge, traditional uses and discovery of potential therapeutic agents. Phytochemicals are used as templates for lead optimization programs, which are intended to make safe and effective drugs. In the developed countries, 25% of the medicinal drugs are based on plants and their derivatives [1-3].

T. grandis Linn. (Family - Verbenaceae) is one of the most famous timbers in the world and is renowned for its dimensional stability, extreme durability and hard which also resists decay even when unprotected by paints and preservatives. This plant is commonly called as teak and locally known as sagon, sagwan (Table 1 and 2). It is one of the most important heart wood of the world over. Timber value of teak has been well known from decades [4,5].

DISTRIBUTION AND DESCRIPTION

Natural distribution of teak ranges from the Indian sub-continent through Myanmar and Thailand. It is common in deciduous forests and well-drained alluvial soils. India has one-third of the natural distribution. It is discontinuously distributed throughout Peninsular India in the states of Madhya Pradesh, Maharashtra, Tamil Nadu, Karnataka and Kerala. In Myanmar, the species is distributed throughout the country up. In Thailand, it occurs naturally in the watershed areas of Mae Khong, Salween and Chao Phya rivers. Teak has been introduced as a plantation species in as many as 36 tropical countries across tropical Asia, Africa and South and Central America [6,7].

T. grandis Linn. is a large, deciduous tree reaching over 30m in height in favorable conditions. Crown open with many small branches; the branch is often supported and may be fluted, up to 15m long below the first branches. Stem usually cylindrical but becoming fluted and slightly supported at base when mature and bark of stem is light brown or grey, distinctly fibrous with shallow, longitudinal fissures. The root system is superficial, often no deeper than 50cm, but roots may extend laterally up to 15m from the stem. The leaves are very large about 30X20cm but young leaves are up to 1m long, 4-sided, shiny above, hairy below, vein network clear, broadly ovate or oval with shortly pointed or blunt tip and taping base and leaves are shed for 3-4 months during the later half of the dry season, leaving the branchlets bare. Flowers are small, about 8mm across, mauve to white and arranged in large, flowering heads, about 45cm long; found on the topmost branches in the unshaded part of the crown. Fruit is a drupe with 4 chambers and these are round, hard and woody, enclosed in an inflated, bladder-like covering; pale green at first, then brown at maturity. Each fruit may contain 0 to 4 seeds. There are 1000-3500

Figure 1: Aerial parts of T. grandis Linn.

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Table 1: Taxonomy of *T. grandis* Linn.

Kingdom	Plantae
Super division	Angiosperms
Division	Eudicots
Class	Asterids
Order	Lamiales
Family	Verbenaceae
Genus	*Tectona*
Species	*Grandis*

Table 2: Common names for *T. grandis* Linn.

Regional language names	Common names
Kannada	Sagavani
Sanskrit	Saka
Hindi	Sagun, sagwan, saigun
English	Indian oak, teak tree, teak wood
Bengali	Segun
Malayalam	Jati
Tamil	Tek, tekku, tekkumaram
Myanmar	Kyun
Filipino	Dalanang, djati
French	Teck
German	Tiek
Indonesian	Deleg, jati, kulidawa
Malaysia	Jati
Javanese	Deleg, kulidawa
Lao (Sino-Tibetan)	Sak
Nepali	Saguan, teak
Spanish	Teca
Thai	Mai-sak, sak

Table 3: Detail summary of Pharmacological activities of *Tectona grandis* Linn.

Pharmacological activity	Parts/ Extract	Possible chemical constituents	Screening method employed
Antibacterial activity	Bark	5-hydroxy-1,4-naphthalenedione (Juglone)	Against *Listeria monocytogenes* and methicillin resistant *Staphylococcus aureus* (MRSA) by employing disc diffusion method [13]
Antibacterial activity	Bark	5-hydroxy-1,4-naphthalenedione (Juglone)	Inhibitory to oral pathogens, notably *Streptococcus mutans*, *Streptococcus sanguis*, *Porphyromonas gingivalis* and *Prevotella intermedia* by disc diffusion method [14]
Antibacterial activity	Leaf, bark and wood extracts		Against *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Salmonella paratyphi* and *Proteus mirabilis* by disc diffusion assay method [15]
Synergistic *in-vitro* antibacterial activity	Wood:Methanol extract		Methanol extract in combination with Tetracycline using 9 different Gram-positive and Gram-negative bacteria and those are associated with various forms of human infections by disc diffusion method [16]
Cytotoxic activity	Methanol extract of wood, hexane extract of leaf and chloroform extract of bark		*MTT* assay and Against chick embryo fibroblast (CEF) and human embryonic kidney cells assay [15]

Table 3: Detail summary of Pharmacological activities of *Tectona grandis* Linn.

Pharmacological activity	Parts/ Extract	Possible chemical constituents	Screening method employed
Cytotoxic activity	Root heart wood: petrol extract	Hydroxynaphthoquinone, 5-hydroxylapachol, lapachol, dehydro- a-lapachone, methylquinizarin and squalene	Against brine shrimps assay [17]
Anti-heamolytic anaemia activity	Leaf: ethanol extract		Phenylhydrazine induced anemia rat model [18]
Adverse cutaneous reaction activity	Wood dust		*In-vivo* cutaneous reaction method [19]
Hair growth activity	Seeds: petroleum ether extract		Hair growth activity on albino mice [20]
Antioxidant activity	Leaf, bark and wood of Hexane, chloroform, ethyl acetate and methanol extracts		*In-vitro* DPPH and ABTS free radical assays [15]
Antioxidant activity	Leaf		*In-vitro* Super oxide radical scavenging activity, Inhibition of H_2O_2 induced erythrocyte haemolysis method [21]
Antioxidant activity	Leaf		*In-vitro* nitric oxide scavenging activity [22]
Seed protein of teak as nutrient	Seed		Against enzymes and liver lipids estimation of albino rats [23]
Hypoglycemic activity	Bark		Dexamethasone-induced insulin resistance in mice model [24]
	Root: methanol extract		Alloxan induced diabetic model in albino rats [25]
	Bark		Alloxan induced diabetic model in albino rats [20]
Anthelmintic activity	Fruits: ethanol extract		*In-vitro* anthelmintic activity using earthworm *Pheritima posthuma* [26]
Anti-inflammatory activity	Flowers: methanol extract		Carrageenan induced rat inflammation model [26]
Analgesic activity	Flowers: methanol extract		Acetic acid induced writhing response and Eddy's hot-plate method [27]
Antifungal activity	Crude methanol extract	Phenolic acids: Tannic acid, gallic acid, Ferulic acid and caffeic acid	*In-vitro* Antifungal Activity Screening method [28]
Antifungal activity	Stem heartwood	Naphthoquinone derivative: 4',5'-dihydroxy-epiisocatalponol	*In-vitro* bioassays against Trametes versicolor [29]
Diuretic activity	Leaf: aqueous extract		Acute diuretic activity in Wistar rats [30]
Gastroprotective activity	Leaf: ethanol extract and active butanolic fraction	Verbascoside	Gastric protection in rats via inhibiting proton pump activity [31]

fruits/kg [6].

Traditional Uses: *T. grandis* Linn. is a pre-eminent tropical timber with sterling wood properties, having an average wood density of 650 kg/m^3. It is moreover considered as a major constituent in many of the traditional medicines [8]. The different extracts from various parts of teak shows expectorant, anti-inflammatory, anthelmintic properties. Traditionally, it is used against bronchitis, biliousness, hyperacidity, diabetes, leprosy, astringent, and helmintiasis. A wood powder paste has been used against bilious headache and swellings [9,10]. According to Ayurveda, the teak wood is acrid, cooling, laxative, sedative to gravid uterus and useful in treatment of piles, leucoderma and dysentery. It

allays thirst and possesses anthelmintic and expectorant properties [11]. *T. grandis* Linn. leaf extract are widely used in the folklore for the treatment of various kinds of wounds, especially burn wounds [12].

CONCLUSION

The use of herbal medicines is wide spread among the patients in treating varieties of diseases [32]. This review highlights the importance of different pharmacological activities of *T. grandis* Linn.. The number of studies on this plant is quite high although most of the studies have been done on the extract and isolation level. Enormous numbers of studies are to be done to bring its products to commercial exploitation. This short review may thus be an initiative for such studies.

REFERENCES

1. Balunas, M.J., Kinghorn, A.D., Drug discovery from medicinal plants. Life Sci, 78: 431-441, (2005).
2. Ramesh, B.N., Mahalakshmi, A.M., Mallappa, S.H., Towards a Better Understanding of an Updated Ethnopharmacology of *Celosia Argentea* L. Int J Pharm Pharm Sci, 5(3): 54-59, (2013).
3. Nahida, Ansari, S.H., Siddiqui, A.N., *Pistacia Lentiscus*: A Review On Phytochemistry And Pharmacological Properties, Int J Pharm Pharm Sci, 4(4): 16-20, (2012).
4. Keiding, H., Wellendorf, H., Lauridsen, E.B., Evaluation of an international series of teak rovenance trials. Danida Forest Seed Center. Humlebaek, Denmark, (1986).
5. Kjaer, E.D., Lauridsen, E.B., Wellendorf, H., Second evaluation of an international series of teak provenance trials. Danida Forest Seed Centre. Humlebaek, Denmark, (1995).
6. Indira, E.P., Mohanadas, K., Intrinsic and extrinsic factors affecting pollination and fruit productivity in teak (*Tectona grandis* L.f.). Indian J. Genetics & Plant Breeding, 62(3): 208–214, (2002).
7. Hedegart, T., Breeding systems, variation and genetic improvement of teak (*Tectona grandis* L.f.). Pp. 109–122 *in* Tropical trees: variation, breeding and conservation (J. Burley and B.T. Styles, eds.)., Academic Press, London, (1976).
8. Hedegart, T., Pollination of teak (*Tectona grandis* L.). Silvae Genet, 22: 124–128, (1973).
9. Varier, P.S., Indian Medicinal Plants: A compendium of 500 species. Vol 5. Orient Longman, Hyderabad, India,. pp. 245-248, (1996).
10. Khare, C.P., Indian Medicinal Plants: An Illustrated Dictionary. Springer Verlag. Heidelberg; pp. 649, (2007).
11. Singh, J., Bhuyan, T.C., Ahmed, A., Enthnobotanical studies on the Mishing tribes of Assam with special reference to food and medicinal plants. J Econ Taxon Bot Additional series, 12: 350-356, (1996).
12. Sumthong, P., Damveld, R.A., Choi, Y.H., Arentshorst, M., Ram, A.F., Vanden, et al., Activity of quinines frim teak (*Tectona grandis*) on fungal wall stess. Planta Medica, 72(10): 943-944, (2006).
13. Neamatallah, A., Yan, L., Dewar, S.J., Austin, B., An extract from teak (*Tectona grandis*) bark inhibited *Listeria monocytogenes* and methicillin resistant *Staphylococcus aureus*, Lett in Applied Microbio, 41: 94–96 (2005).
14. Didry, N., Dubreuil, L., Pinkas, M., Activity of anthraquinonic and naphthoquinonic compounds on oral bacteria. Pharmazie, 49: 681–683, (1994).
15. Mahesh, S.K., Jayakumaran, N.A., Antibacterial, Cytotoxic and Antioxidant Potential of Different Extracts from Leaf, Bark and Wood of *Tectona grandis*, Internat J Pharmaceut Scie and Drug Res, 2(2): 155-158 (2010).
16. Purushotham, K.G., Arun, P., Jayarani, J.J., Vasnthakumari, R., Sankar, L., Bijjam, R.R., Synergistic *In Vitro* Antibacterial Activity of *Tectona Grandis* Leaves With Tetracycline, Int J Pharm Tech Res, 2(1): 519-523, (2010).
17. Rafullah, M.K., Suleiman, M.M., 5-Hydroxylapachol: a cytotoxic agent from *Tectona grandis*, Phytochem, 50: 439-442, (1999).
18. Aboudoulatif, D., Messanvi, G., Ahoefa, V., Kwashie, E.G., Kodjo, A., Amegnona, A., et al. Effect of *Tectona grandis* on phenylhydrazine-induced anaemia in rats, Fitoterapia, 79: 332–336, (2008).
19. Chomiczewska-Skóra D. Adverse cutaneous reactions induced by exposure to woods. J Chem Ecol, 37(12): 1341-1348, (2011).
20. Varma, S.B., Jaybhaye, D.L, Antihyperglycemic activity of *Tectona grandis* Linn. bark extract on alloxan induced diabetes in rats. Nat Prod Res, 24(11): 1059-1068, (2010).
21. Rao, K.N.V., Aradhana, R., David, B., Chaitanya, R.S., Anil Kumar, A., *In-Vitro* Anti-Oxidant and Free Radical Scavenging Activity of Various Extracts of *Tectona grandis.* Linn Leaves, J Pharm Res, 4(2): 440-442, (2011).
22. Jagetia, G.C., Baliga, M.S., The evaluation of nitric oxide scavenging activity of certain Indian medicinal plants in vitro: a preliminary study. Naturwissenschaften, 71(11): 581-582, (1984).
23. Laskar, S., Ghosh-Majumdar, S., Basak, B., Maity, C.R., Influence of teak (*Tectona grandis*; family: Verbenaceae) seed protein on some enzymes and liver lipids of albino rats. Planta Med, 32(1): 71-75, (1977).
24. Mahesh, G., Vijay, N., Abhijit, T., Vinit, Z., Mukesh, T., Avinash, D., Effect of *Tectona grandis* Linn. on dexamethasone-induced insulin resistance in mice. J Ethnopharmacology, 122: 304–307, (2009).
25. Pooja, Vipin, S., Samanta, K.C., Hypoglycemic activity of methanolic extract of *Tectona grandis* Linn. Root in alloxan induced diabetic rats, J Applied Pharmac Sci, 1(04): 106-109, (2011).
26. Gururaj, M.P., Joshi, H., Bhat, I.K., Satyanarayana, D., Shastry, C.S., Anthelmentic activity of *Tectona Grandis* Linn. Fruits. Int Res J of pharmacy, 2(1): 219-221, (2011).

27. Ramachandran, S., Rajinikanth, B., Rajasekaran, A., Manisenthil, Kumar, K.T., Evaluation of anti-inflammatory and analgesic potential of methanol extract of *Tectona grandis* flowers. Asian Pac J Trop Biomed, S155-S158, (2011).
28. Shalini, Rachana, S., Antifungal Activity Screening and HPLC Analysis of Crude Extract From *Tectona Grandis, Shilajit, Valeriana Wallachi*, EJEAFChe, 8 (4):218-229, (2009).
29. Florence, B.N., Nadine, A., Didier, S., Gilles, C., Yves, L., Adjumane, A.K. et al., 4',5'-Dihydroxy-epiisocatalponol, a new naphthoquinone from *Tectona grandis* L. f. heartwood, and fungicidal activity. Intern Biodeterioration & Biodegradation, 74: 93-98, (2012).
30. Kore, K.J., Jadhav, P.J., Shete, R.V., Shetty, S.C., Diuretic activity of *Tectona grandis* leaves aqueous extract in wistar rats. Int J Pharmaceutical Res and development, 3(7): 141-146, (2011).
31. Neetu, S., Nivedita, S., Pratibha, S., Rolee, S., Rajendran, S.M., Rakesh, M., et al., Verbascoside isolated from *Tectona grandis* mediates gastric protection in rats via inhibiting proton pump activity, Fitoterapia, 81: 755-761 (2010).
32. Priyanka, S., Aksha, S., Meera, A., Suresh, C.J., A Review on antifertility efficacy of plants in males, Int J Pharm Bio Sci, 4(4):413-428 (2013).