

**Review Article****A Review on Favorable Approaches of *Swietenia macrophylla* Plant for the Human Ailments****Shivram Krishna and Harikesh Maurya***

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Keywords:*Swietenia macrophylla*, Mahogany, Saponin, Alkaloids, Flavonoids, Hypoglycemic.**Abstract**

Swietenia macrophylla king is herbaceous plant belonging to family Meliaceae was commonly known as Mahogany, found in the Caribbean countries, Central America, West Indies, Indonesia, Malaysia, and South America. It is a large tree with height up to 35 to 40 meters, and the diameter of the wooden trunk reaches up to 125 cm. The outer cover is blackish-brown, till maturation of plant then turned into grayish with the smooth surface, while the flowering condition occurs after the 7 years of maturation. *Swietenia macrophylla* king extract was evaluated for the hypoglycemic activity of seeds combined with endocarps extracts in hot water and methanol. The seeds have been developed attention in the world in recent years subsequent to the biotechnology research center for discovered various health benefits in the human body. Research scientists exposed the seed contains many natural nutrients and minerals may beneficial for human health condition. It contains three major active constituents i.e., Flavonoids, Saponins, and Bitter Alkaloids. This compound used for the treatment of different disease like analgesic, pyretic, inflammation, cancer, malaria, diabetes mellitus, hypertension, coughs and healing and improves the blood circulation in the living system.

Introduction

Swietenia macrophylla King belonging to family Meliaceae was commonly known as Mahogany is a slow-growing, tall, tropical tree reaching at height up to 35 to 40 meters. The trunk is enclosed with gray along with fractured bark and the crown is large, open, and rounded^[1]. Whereas the pole is straight, cylindrical, buttress, and can be up to 120 cm in diameter^[2].

Swietenia macrophylla is widely distributed in Belize, Bolivia, Brazil, Colombia, Costa Rica, Ecuador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Peru, Venezuela and Exotic distributed in Fiji, Haiti, India, Jamaica, Malaysia, Nigeria, Philippines, Puerto Rico, Sierra Leone, Solomon Islands, Sri Lanka, Tobago, and Trinidad^[3,4]. This review was intended to investigate the *Swietenia macrophylla* plant for its nutritious value and traditionally used in the management of human ailments^[5].

The antimicrobial activities of *Swietenia macrophylla* in numerous crude methanolic extract of leaf, seed, leaves, bark, and central-fruit-axis were widely reported and published in the journal^[6]. The antimicrobial activity of the leaf, seed and central fruit-axis extract was evaluated against gram-positive, gram-negative bacteria and fungi based on the zone of inhibition using well diffusion assay method^[7].

The crude extracts of *Swietenia macrophylla* were subjected to various phytochemical screening tests. The phytochemical tests exhibited the presences of common phytochemicals such as alkaloids, flavonoids, tannins, terpenoids, glycosides, saponin, volatile oils, amino acids, and proteins as major active constituents^[8,9].

The seed extract had the significant level of inhibitory effects on the growth of bacteria viz., *Staphylococcus aureus*, *E. coli*, and fungi viz., *Fusarium sp.*, *Helminthosporium sp.*, and *Alternaria sp.* The antimicrobial activity exhibited a linear relationship with extract concentrations. The seed extracts proved as potential activity against fungal growth^[10].

Geographical Investigation

A plant of the wet tropics where it is found at elevations upto 1500 meters but grows best below 600 meters. It grows best in areas where annual morning temperatures are inside the variety 20 to 30 °C but can be tolerate 11 to 39 °C. It prefers a yearly rainfall in the mean variety 2000 to 4000 mm but tolerates 1400 to 6000 mm^[11]. New trees need at least light shade and are fairly tolerant to dense shade, but conditions for optimum growth of older trees may required full overhead light combined with side protection. Best thickening best on

well-drained fertile sites with average to heavy soils at prefer in the pH range 6.5 to 7.5 while tolerating pH 6 to 8.5^[12].

The tree is reported to be extremely firm in the wind but opposed to cyclones. The species has some weed potential and may invade native forest communities. It should not be planted in close to areas of high nature significance protection^[13]. Flowering and fruiting are seasonally distinct in nature. The fruit are formed once a year and trees start to produce fruit frequently when about 15 years old. Seeds have a thin, tail-like wing that makes them rotate when they fall; they are thus dispersed by wind as far as 500 meters from the parent tree^[14].

In natural stands, it is beneficial to open the canopy over dense, young regeneration in which young tree is about 1.8 meters high. In plantation forestry, the tree has always been planted at 30 meters (333 stems/hac), because it requires large spot of light. Plantations established at such wide spacing rarely need thinning unless selectively to remove diseased stems^[15].

The tree is self-pruning and additional pruning is not essential, when grown for wood, the tree has an alternation age of 30 to 35 years, with a final stocking rate of plant 150 to 250 stems/hac. Hybridization has been confirmed by cytological studies i.e.,flowering are evergreen, deciduous, smooth-

textured shiny/glossy-textured. Bloom Colors are looks like pale yellow, pale green, inconspicuous and required spacing 30 to 40 ft^[16].

Botanical Description

Synonyms:*Swietenia belizensis* Lundell, *Swietenia candollei* Pittier, *Swietenia krukovi* Gleason, *Swietenia macrophylla* King var. *Swietenia tessmannii* Harms.

Botanical name:*Swietenia macrophylla* King, Family-Meliaceae & Subfamily-Swietenioideae.

The chemical constituents of this plant have been reported in variety of medical conditions. The bark is used to cure diarrhea and fever; crushed fruit shells are used as a potting medium. The bark produces gums and used for dyeing and tanning leather. Seed kernels yield the oil which is very bitter and purgative^[17-19]. The wood is valued for high-quality woodwork and furniture, musical instruments, veneer, etc.

Swietenia macrophylla is an evergreen tree where the flowers are pollinated by insects and have self-fertile, properties, prefers well-drained soil and can grow in heavy clay in acid or neutral soils but generally it prefers moist soil. The plant can tolerate physically powerful winds but not maritime exposure given in fig. 1.



Figure 1:*Swietenia macrophylla* plant,fruit, seeds and peeled seed

Morphological Investigation^[20-22]

Foliage: Leaves are asymmetric, simple pinnate compound, with 4 to 6 leaflets. Young leaves are pink or red and gradually change to dark green when mature. Mature leaves are up to 20cm long.

Flowers: The tree produces small, fragrant, white flowers, which are held in inflorescences called panicles.

Fruits: When ripe, the fruits of the tree are dry hard woody capsules measuring up to 40 cm in length. These split open from apex to base to release numerous winged brown seeds that are dispersed by the wind.

Propagation: Propagated from seeds and can be harvested from mature fruits which are collected directly from the tree, then beaten to open up the capsule. Seeds do not require any pre-treatment. Fresh seeds have a high germination rate measured above 90%.

Phytochemical Investigation

The plant possess following phytochemical prosperity in both aqueous and alcohol extract such as; alkaloid, cardiac glycosides, flavonoids, reducing sugar, saponin, tannins and terpenoids shows in table 1^[23-25].

Table1: Different types of the chemical compound present in seeds, leaves, and stems-bark

S.N.	Seed	Leaf	Steam-bark
1	Swietenine	Swietenolide monohydrate	Swietemacrophyllanin
2	Swietenolide	swietephragmin H	Catechin
3	8,30-epoxyswietenine acetate	Swietephragmin I	Epicatechin
4	Swietenine acetate	Swietephragmin J	-
5	Swietenolide diacetate	Swietemacrophine	-
6	Swietenolide diacetate	γ -himachalene	-
7	Augustineolide	Germacrene D	-

Chemical Constituents: The chemical composition of a pure substance corresponds to the relative amounts of the elements that constitute the substance itself^[26]. It can be expressed with a chemical formula such as an empirical or molecular formula of *Swietenia macrophylla* (King) plant shows in table 2^[27,28]. Table 2: The different chemical constituent present in *Swietenia macrophylla* plant

S.N.	Compound name	Chemical formula
1	Hexadecanoic Acid	$\text{CH}_3 (\text{CH}_2)_{14} \text{COOH}$
2	Ethyl Hexadecanoate	$\text{C}_{18}\text{H}_{36}\text{O}_2$
3	Cadena-1,4-diene	$\text{C}_{15}\text{H}_{24}$
4	Germacrene D	$\text{C}_{15}\text{H}_{24}$
5	Germacrene A	$\text{C}_{15}\text{H}_{24}$
6	γ -himachalene	$\text{C}_{15}\text{H}_{24}$

Structure of major chemical constituent: The main chemical components of the primary plant cell wall include cellulose in the form of organized micro fibrils; a complex carbohydrate made up of several thousand glucose molecules linked end to end^[29]. The structure is given in fig. 2.

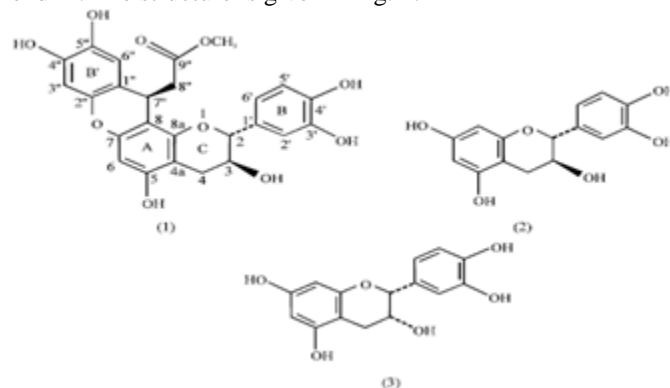


Fig. 2: Chemical constituents isolated from *Swietenia macrophylla*; (1) Phenylpropanoid-substituted catechin, (2) Catechin, and (3) Epicatechin.

Ecological Investigation

Swietenia macrophylla is found in all forest types, from the edge of the pine savannah to the climax rainforest, but mostly in mixed hardwood forest belts, along riverbanks, on deep alluvial soils of considerable fertility^[30]. It occurs, scattered or in undersized groups, but densities of more than 4 to 8 trees/ha are rarely encountered. In tropical America, it is surrounded by the pioneer species reoccupying corrupted farming land. It has been shown that furniture is outcompeted by *Swietenia macrophylla* in a mixed stand^[31,32]. In the Philippines, the species has some weed potential and may invade native forest communities, especially the following disturbance. It should not be planted in close to areas of high nature protection^[33].

Under natural conditions, big-leaves mahogany thrives in both deciduous and evergreen rainforest and occurs scattered or in small groups, but more than 4 to 8 mature trees per ha are rarely encountered^[34]. It has been claimed that under natural circumstances it regenerates in essentially even-aged stands after catastrophic disturbances of the forest, e.g. hurricanes, fire, and flooding^[35]. Mature mahogany plant may survive such events because of their strong buttresses and resistance to fire and spread their seeds into the resulting gaps or clearings. However, it has also been demonstrated that big-leaved mahogany does not require gaps for seed germination, probably except in evergreen forest where little light penetrates through the canopy^[36,37].

Within its natural range, it has been found on alluvial soils, volcanic soils, heavy clays, and lateritic soils, soils derived from limestone, granite and other sedimentary, igneous or metamorphic rock formations and even on shallow rendzinas^[38]. In tropical America, mahogany is surrounded by the pioneer species reoccupying degraded agricultural ground. It has been exposed that furniture is outcompeted by mahogany in a mixed stand^[39].

Pharmacological Investigation

The pharmacological investigation on *Swietenia macrophylla* King plant at conducted in different types of *in*

vitro and *in vivo* models for the treatment of different disease as shown in table 3.

Table 3: *In-vivo* and *in-vitro* pharmacological study on leaves, steam of bark extract

S.N.	Activity	Dose/ Route	Animal Model	Reference
1	The Analgesic Activity	Novalgin (20 mg/kg b.w.)/oral	Albino Rats	Charlieret al. 1961 ^[40]
5	The Acute Anti-Inflammatory Effect	Indomethacin (20 mg/Kg b.w.)/oral	Male animals were used	Winter et al. 1962 ^[41]
6	The Antipyretic Effect	Paracetamol (20 mg/kg b.w.)/oral	Albino Rats	Tomazettiet al. 2015 ^[42]
7	The Diuretic Activity	Moduretic 5 mg/kg/oral	Albino Rats	Mousa et al. 2005 ^[43]
8	Antiulcer Activity	Indomethacin (20 mg/kg b.w.)/oral	Male albino rats	Corellet al. 1979 ^[44]
10	Hepatoprotectie Potential	CCl4, 25 % in liquid i.p. paraffin (5 ml/kg b.w.)	Male Albino Rats (130-140 gm)	Beutleret al. 1963 ^[45]

Traditional Uses

The complete of the knowledge, skills, and practices based on the theories, believes, and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and mental illness by use of *Swietenia macrophylla* King plant^[47-49]. The several disease conditions which are rationally managed by use of different plant parts are reported as; manage diabetes mellitus, hypertension, leishmaniasis, malaria, diarrhea, body temperature, dysentery, cancer, coughs, chest pain, intestinal pain, ulcer, inflammatory, and act as hepatoprotective potential^[50,51].

Conclusion

The fruit and seeds of *Swietenia macrophylla* king are process good pharmacological properties for the human health and can be exposed by testing of fruit, seeds, and leave the different health effects of chemical substances reported from fruit, seeds, and leaves contain. There are three main active ingredients reported for beneficial effect is flavonoids, saponin, and alkaloids. Flavonoids are a phenolics compound that contains lots of pigments of the plant. Flavonoids are valuable for human especially because it is an antioxidant that exterminates free radicals and improves the immune system.

The anti-oxidizing properties of the flavonoids content of fruit, seeds and leave produce desirable effects in the aggressive various diseases caused by directly or indirectly through high blood pressure and heart problem due to oxidation. It is reported that the flavonoids could be improves cardiovascular system by smoothing blood circulation, clearing blood vessels from clogging cholesterol, and preventing arteriosclerosis plague.

Saponin is a glycoside that forms the soapy foam as presently mixed with water. It is a natural soap that is derived from seed of the *Swietenia macrophylla* king plants and recognized to have hypoglycemic properties when consumed orally. The saponin substance consists of fruit, roots and leaves thus make

a powerful natural medicine for the community suffered from diabetes mellitus. Even though saponin don't induce the poisonous effect on warm-blooded animals when they eat as food. The hypoglycemic effect of saponin is even stronger than that of generic anti-diabetic drugs especially metformin. Saponin extracted from mahogany seeds may possible to beneficial in the management of analgesic effect as one of the best natural ways to maintain the chronic pain in human beings.

Swietenia macrophylla king plant furthestmost health reimbursement of fruit, seeds, and leaves due to the alkaloid content. It has been generally conventional that the most illnesses arise in the human body when the pH level is very low and leads to the infection of the human body, including toxins and free radicals scavenging activity. The alkaloid helpful for detoxifying the human body and prevent the cell damage due to oxidation.

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Conflicting of Interest

The authors declared no potential conflicts of interest with respect to the authorship, or publication of this review article.

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