ETHNOMEDICINAL, PHYTOCHEMICAL AND PRECLINICAL PROFILE OF GUAZUMA ULMIFOLIA LAM.


Shri B M Shah College of Pharmaceutical Education and Research, College Campus, Dhansura road, Modasa-383 315, District Sabarkantha, Gujarat (India).

ABSTRACT

*Guazuma ulmifolia* Lam. belonging to the family Sterculiaceae and commonly called Bastard cedar in Gujarati known as Bhadraksh. It is Native to Tropical America and widely distributed in tropical America from Mexico to northern part of Argentina & the middle part of Brazil. The bark and leaves have been traditionally used antibacterial, antidyserteric, antifungal, anti-inflammatory, antimicrobial, astringent, depurative, diaphoretic, emollient, febrifuge, hepatoprotective, pectoral, refrigerant, stomachic, styptic and sudorific. Phytochemically plant contains fatty acids, steroids, flavonoids, tannins, glycosides, carbohydrates, mucilage. Preclinical study on plant performed till date Anti-diabetic action, Anti-Hypertensive, Anti-microbial action, Anti-Oxidant, Anti-ulcer Action, Hair growth promoter, Weight loss agent.

Keywords: *Guazuma ulmifolia* Lam., folk uses, pharmacological, phytochemical.

INTRODUCTION

*Guazuma ulmifolia* Lam. belonging to the family Sterculiaceae and commonly called Bastard cedar, is native to tropical American countries. It was introduced into India more than 100 years ago [1]. It has naturalized to the local climatic conditions. This species has high economic importance. Its wood is used as fuel wood and charcoal, and its leaves are used as fodder for livestock. A beverage prepared from crushed seeds soaked in water is used to treat ailments like diarrhoea, dysentery, cold, cough and venereal disease. It is also used as a diuretic and astringent [2]. Rope and twine are made from the tough, fibrous bark and young stems [3]. In dry areas it is an important source of fodder for livestock, especially at the end of the dry season when there are no grasses. In many places farmers feed the leaves and fruits to cattle. Taxonomy of plant as Kingdom: Plantae, Subkingdom: Tracheobionta, Order: Malvales, Superdivision: Spermatophyta, Division: Magnoliophyta, Class: Magnoliopsida, Subclass: Dilleniidae, Family: Sterculiaceae, Genus: guazuma, Species: Guazuma ulmifolia Lam [4]. It is commonly
known as Bastard cedar but in different languages it has different common or vernacular names in Bengali - Nipaltunth, English- Bastard cedar, Honey fruit tree, Musket tree, Kannada- Bhadrakshi mara, Bucha, Rudraakshi, Malayalam- Rudraksham, Uttharasham, Oriya- Debodaru, Tamil-Rudrasam, Tenbachai, Thenmaram, tubakki, Sanskrit (Ayurveda)-Pundraaksha, Rudraakshi (fake rudraaksha), Telegu- Rudraksha, Thene-chettu, Udrikpatta, Siddha system- Rudraksham, Trade name - guazima firewood [5, 6, 7].

MACROSCOPIC DESCRIPTION [5, 6, 7]

A small or medium-sized tree up to 25 m tall. Brown, rough bark and spreading branches. Leaves of the tree are often lopped for cattle fodder, alternate in 2 rows in flattened arrangement and ovate to oblong or lanceolate, simple, tomentosa, 3-21 cm long and 2-6 cm wide, base unequally cordate, apex acuminate, margins serrate, scabrid above, pubescent beneath, base 5-7-nerved; petioles 0.5-2 cm long, with 3 or sometimes 5 main veins from rounded or notched unequal-sided base, Leaf stalks slender, 6-12 mm long, covered with tiny star-shaped hairs. Flower clusters (panicles) branched, small, yellow or purple, born in axillary thyrsiform cymes 2-4 cm long; sepals 5, at first spathaceous; petals 5. Flowers are 0.5-0.7 cm across, in terminal and axillary cymes-8. Fruit: (capsule) globose or ellipsoid, woody, tubercled, 5-celled, indehiscent, purplish-black, 1.2-4 cm long and 1.2-2.5 cm wide, containing numerous, ovoid, grey seeds 2.5-4 mm long & 1.8-2 mm wide and black when ripe.

ETHNOPHARMACOLOGICAL USE

The bark and leaves have been traditionally used by herbal medicine practitioners for their following properties: antibacterial, antisyphilitic, antifungal, anti-inflammatory, antimicrobial, astringent, deparutive, diaphoretic, emollient, febrifuge, hepatoprotective, pectoral, refrigerant, stomachic, styptic, sudorific and vulnerary [8]. Bark: Alopecia, asthma, bronchitis, bruises, burns, childbirth, constipation, coughs, dermatosis, dermatitis, diarrhea, dysentery, elephantiasis, fevers, fractures, gastrointestinal pain, gonorrhea, grippe, hemorrhage, hemorrhoids, hypertension, infections, influenza, kidney problems, leprosy, liver problems, malaria, nephritis, pneumonia, prostate problems, pulmonosis, skin conditions, stomach inflammation, stomachache, syphilis, ulcers, uterine pain, wounds. Fruit: Diarrhea, hemorrhage, infection, uterine pain. Leaves: Alopecia, asthma,
bruises, dermatitis, dysentery, erysipelas, fevers, inflammation, kidney diseases, liver diseases, skin eruptions, skin diseases, sores, ulcers, wounds. Root: Childbirth, Stem bark: Diarrhea. Wood: furniture, panels of coaches, packing cases and slack cooperage. It is also used as fuel and for making charcoal [9]. Bark: Demulcent, sudorific, tonic, In West Indies, inner bark remedy for elephantiasis, decoction of inner bark used in clarifying sugar juice, disease of chest and cutaneous [10,11]. Leaf extract: An extract of the leaves used to reduce corpulence. Seed: Astringent, carminative, antidiarrhoeal, In Java, stomach troubles [12].

**PHYTOCHEMICAL PROFILE** [13, 14]

Leaves: contain octacosanol, taraxerol-oac, friedelin-3-α-oac, β-sitosterol, and friedelinol-3-acetate. Heartwood: Kaempferol. Fruit: Sweet edible mucilage. When eaten in excessive quantities it is reported to cause diarrhoea. Bark: contains friedelin, betulin, β-sitosterol.

**PRECLINICAL STUDY OF PLANT**

**Anti-diabetic activity**

Alonso-Castro et al [15] has studied used in treatment of type 2 diabetes in Mexico. Non-toxic concentrations of aqueous extracts (GAE) were assayed on adipogenesis & 2-NBD-glucose uptake in murine 3T3-F442A preadipose cell line. GAE added to adipogenic medium (AM) did not affect adipogenesis at any of the tested concentrations (1-70 µg/ml), whereas in AM lacking insulin GAE 70 µg/ml induced triglyceride accumulation by 23%. On, other hand, GAE 70 µg/ml stimulated 2-NBDG uptake by 40% in insulin-sensitive 3T3-F442A adipocytes & by 24% in insulin-resistant adipocytes, with respect to incorporation showed by insulin-sensitive adipocytes stimulated with hormone. GAE exerts antidiabetic effects by stimulating glucose uptake in both model adipocytes without inducing adipogenesis.

Alarcon-Aguilara et al [16] has reported anti-hyperglycemic effect on 28 medicinal plants. Each plant processed in traditional way & intragastrically administered to temporarily hyperglycemic rabbits. Conclude eight out of 28 studied plants significantly decrease hyperglycemic peak and/or area under glucose tolerance curve. Concluded validity of Guazuma ulmifolia Lam their clinical use in diabetes mellitus, after their toxicological investigation.
Anti-Hypertension activity

Magos et al \cite{17} has studied in vivo & in vitro cardiovascular activity of procyanidin fraction (PCF) obtained from acetone extract of *Guazuma ulmifolia* Lam bark which traditionally used as antihypertensive. 10 mg/kg PCF doses orally administered to sugar-fed hypertensive rats decreased both systolic arterial pressure and the heart rate, whereas same doses i.v administered induced arterial hypotension which attenuated by NG-nitro-L-arginine methylester (L-NAME 31 mg/kg) pretreatment. In these experiments employed carbachol as positive control test. PCF reduced the contraction induced by norepinephrine (1 x 10 to power-7 M) in isolated aortic rings of normotensive (IC$_{50}$ -35.3+12.4 ng/mL) & sugar-fed hypertensive (IC$_{50}$-101.3 + 57.2 ng/ml) rats. Relaxant activity inhibited by either vascular endothelium removal or L-NAME (30 µM) pretreatment, while indomethacin (10 µM) or atropine (10 µM) had no effect. Preliminary analysis of PCF by HPLC-DAD-MS & FAB-MS allowed detection of complex of procyanidin oligomers consisting tetramers & trimers. *Guazuma ulmifolia* Lam bark having long-lasting antihypertensive & vasorelaxing properties linked to endothelium factors, where nitric oxide involved.

Anti-microbial activity

Nozawa et al \cite{18} has studied Crude extract (CE), aqueous (AqF), ethyl acetate (EtOAcF) fractions of plant corresponding AqF, EtOAcF of *Stryphnodendron adstringens* (Leguminosae) tested against poliovirus1 (P-1) and bovine herpesvirus 1 (BHV-1) in HEp-2 cultured cells. Highest % of viral inhibition found for EtOAcF which inhibited BHV-1 & P-1 replication by 100% & 99% respectively. *S.adstringens* (AqF) most efficient inhibiting BHV-1 & P-1 by 97% & 93%. In virucidal protocol plant CE inhibited replication of BHV-1 & P-1 by 60% & 26% respectively. *S. adstringens* inhibition of 62% demonstrated only with EtOAcF for P-1. IFA having greatest reduction in fluorescent cell number occurred with G. ulmifolia under therapeutic protocol for both virus strains. AqF & EtOAcF of *S. adstringens* showed most efficient with virucidal activity for P-1. Conclusion G. ulmifolia Lam & *S. adstringens* inhibited BHV-1&P-1 replication and blocked synthesis of viral antigens in infected cell cultures.

Kaneria et al \cite{19} has studied plants used in Saurashtra folk medicine reported to exhibit high antibacterial activity. *Guazuma ulmifolia* Lam. evaluated for their
antibacterial activity, total phenol content, flavonoid content, DPPH free radical scavenging activity & phytochemical analysis using successive extraction by cold percolation method with petroleum ether, ethyl acetate, methanol & water. In vitro antibacterial action evaluated against five bacterial strains viz. B.subtilis, S.aureus, P.aeruginosa, S. typhimurium & Enterobacter aerogenes by agar well diffusion method. Guazuma ulmifolia Lam. did not showed significant antibacterial action.

Navarro MC et al \(^{[20]}\) has studied MeOH & aqueous extracts from 5 plant species used in traditional medicine in Guatemala for treatment of microbial infections tested in vitro for their ability to scavenge DPPH, OH & O\(_2\) radicals & inhibit lipoperoxidation (LPO) relationship between their antioxidant activities and their effects against infectious agents. Guazuma ulmifolia Lam. showed effects against DPPH and OH.

**Anti-Oxidant Activity**

Yoshitani et al \(^{[21]}\) has studied inhibitor contains 0.001-10 %w/w of extract plant native to Mexico and belonging to family sterculiaceae, extract obtained from seed, stem, flower, fruit, bark, rhizome, root, or mixture so solvent water, EtOH, MeOH, butanol, propanol, 1, 3-butylene glycol, PEG, Ethyle acetate, benzene, hexane, pentane, acetone, MeOH, Et ketone, diethylether, THF, Pet.ether, acetonitrile at normal temperature or under heating. Obtained extracts has inhibiting effect of lipid peroxide & high safety.

**Anti-ulcer Activity**

Berenguer et al \(^{[22]}\) has studied Guazuma ulmifolia Lam., member of Sterculiaceae family issued in folk medicine because of its antioxidant, antimicrobial and anti-hypertensive properties. Most of the research work carried out on this plant, has focused on the bark because of its high conc. of antioxidant proanthocyanidins. Study was to assess gastroprotective effects of aqueous suspension of ethanolic extract from leaves and flowers in model of acute gastric ulcer induced by diclofenac as ulcerogenic agent using proton pump inhibitor omeprazole as protection reference. Extract administered 2 times orally to 3 groups of wistar rats at doses of 500, 250 &125 mg/kg, with a 24-h interval between doses. Diclofenac (100 mg/kg) has given1 h after last administration of extract. Pretreatment with Guazuma ulmifolia Lam. or omeprazole decreased ulcerated area in a dose-dependent way. Myeloperoxidase activity as a marker of neutrophile in filtration slightly reduced in vivo. In vitro anti-inflammatory action
clearly inhibited in dose dependent way. Lowest doses of extract significantly decreased levels of lipoperoxides & superoxide dismutase action increased similar extent as with omeprazole. Aerial parts Guazuma ulmifolia Lam. protect gastric mucosa against injurious effect of NSAIDs by anti-inflammation & radical scavenging mechanisms.

Hair growth promoter

Tsutsumi et al [23] has studied depilatory inhibitor which inhibits epilation & exerts hair growing and restoring effects has no injury to scalp and does not generate foul smell to scalp. Depilatory inhibitor, hair growing & restoring promoter composed of Pilocarpus jaborandi (Jaborandi) as a major component method for preventing epilation & promoting hair growth or restoring hair are implemented by pilocarpine extract of leaf, trunk, branch of Pilocarpus jaborandi. Additional, plant materials used in combination with other plants and its formulations.


Weight loss agent

Galustyan et al [25] has studied potential of plant dry extract plant leaves, murraya leaves, Curcuma aeruginoea Rhizoma, rhubarb rootstock, Curcuma xanthorrhizae rootstock, Orthosiphonis folium rootstock, maltodextrin and natural instant lyophilized coffee in specific component ratio effect, effective complex weight loss agent.

CHEMICAL REVIEW

Seigler et al [26] has studied cyanogenic glycoside Guazuma ulmifolia (2R)-taxiphyllin (>90 %), high occurs with (2S'')-dhurrinin. The cyanogenic glycosides of
Ostrya Virginii are (2S)-dhurrinin and (2R)-taxiphyllin in an approximate 2:1 ratio. First report of identification of cyanogenic compounds from the Betulaceae based on NMR spectroscopic and TLC data cyanogenic glucoside of Tiquilia plicata is dhurrin, whereas major cyanide-releasing compound of Tiquilia canescens is nitrile glucoside, menisdaurin. NMR and TLC data indicate that both compounds are present in each of these species. The spectrum was examined by CI-MS, 1H and 13C NMR, COSY, 1D selective TOCSY, NOESY, and 1J/2,3 J HETCOR experiments; all carbons and protons are assigned. The probable absolute configuration of (2R)-dhurrin is established by an X-ray crystal structure.

Jastrezebski et al [27] has studied bioactive compounds & antioxidant action of Prolipid, an herbal mixture, containing extracts of Guazuma ulmifolia Lam. Muraya paniculata (Rutaceae) and sonchus arvensis (Asteraceae). The contents of polyphenols and flavonoids were 19.87 ± 2.09 and 3.09 ± 0.31 mg gallic acid equivalent GAE/g DW and 2.09 ± 0.24 and 0.57 ± 0.05 mg catechin equivalent CE/g DW in water and methanolfractions, respectively. Anthocyanins & flavonols were found only in water fraction. Antioxidant action of Prolipid as determined by 4 different antioxidant assays higher in water than in methanol fraction. Correlation coefficients between polyphenols, flavonoid and antiioxidant activities of Prolipid water extracts with TEAC 0.97 & 0.90 respectively. Concluded that high content of polyphenol compounds are prolipidis contributor to antioxidant activity.

Shekhawat et al [28] has studied primary metabolites such as protein, lipid, starch, phenol, and carbohydrate in parts which are present in different proportion in plant species Guazuma ulmifolia Lam. The highest amt. of sol. sugar observed. 129.0 mg/gdw, protein 67.0 mg/gw in leaf, lipid 42.0 in root mg/gdw.

Arriaga et al [29] has suggested oil from leaves of G. ulmifolia Lam was analyzed by GC and GC/MS. The major constituents were precocene I (56.0%), caryophyllene (13.7%) and (2Z,6E)-farnesol (6.6%).

Arriaga et al [30] has evaluated the constituents of Guazuma ulmifolia Lam., Sterculiaceae, a tropical american tree, were studied. Twenty-four constituents (fattyacids, hydrocarbons and a diterpene, ent-kaur-16-en-19-oic acid) were identified
from hexane ext. of its leaves by inspection of their MS spectra and Kovats indexes. The fatty oil compound has not been previously reported.

George et al. [31] has studied the activity guided- bioassay fractionation of 70% acetone extract of bark of Guazuma ulmifolia Lam. inhibition of angiotensin II binding to AT 1 receptor led to isolation & identification of bioactive oligomeric & polymeric proanthocyanidins consisting mainly of (-)-epicatechin units. Displacement of [3H]-angiotensin II binding was dose-dependent and correlated with the degree of polymerization of different fractions containing proanthocyanidins. Strong displacement is seen for residual fraction suggesting that most active substances corresponding to highly polymerized proanthocyanidins. Angiotensin II AT 1 receptor binding might be considered as a potentially interesting biological activity of proanthocyanidins contributing to very broad spectrum of biological activities of the condensed tannins.

Hoer M et al. [32] studied antisecretory activity of Guazuma ulmifolia.Lam examined in rabbit distal colon mounted in using chamber. Chloride secretion stimulated by cholera toxin and prostaglandin E2 (PGE2). Guazuma ulmifolia Lam. extract (GUE) completely inhibited cholera toxin-induced secretion if the extract added to the mucosal bath prior to the toxin. Adding extract after administration of toxin had no effect on secretion. GUE did not inhibit PGE2-induced chloride secretion. These results indicate an indirect antisecretory mechanism. SDS-PAGE analysis of cholera toxin treated with GUE confirmed this presumption. GUE specifically interacted with subunit of the toxin. Preliminary phytochemical examinations showed that most active fraction contains procyanidins with a degree of polymerisation higher than 8.

David et al. [33] has isolated cyanogenic glycoside of Guazuma ulmifolia.Lam (2R)-taxiphyllin (>90%), with (2S)-dhurrin. To date, cyanogenic compounds have not been characterized from the Sterculiaceae. The cyanogenic glycosides of Ostrya virginiana (Betulaceae) and (2S)-dhurrin and (2R)-taxiphyllin in an approximate 2:1 ratio. This marks the first report of the identification of cyanogenic compounds from the Betulaceae. Based on NMR spectroscopic and TLC data, the major cyanogenic glucoside of Tiquilia plicata is dhurrin, whereas the major cyanide-releasing compound of Tiquilia canescens is the nitrile glucoside, menisdaurin. NMR and TLC data indicate that both compounds are present in each of these species. The spectrum was examined by CI-MS,


$^1$H and $^{13}$C NMR, COSY, 1D selective TOCSY, NOESY, and $^1J_{2,3}$ HETCOR experiments; all carbons and protons are assigned. The probable absolute configuration of (2R)-dhurrin is established by an X-ray crystal structure. The $^1$H NMR spectrum of menisdaurin is more complex than might be anticipated, containing a planar conjugated system in which most elements are coupled to several other atoms in the molecule. The coupling of one vinyl proton to the protons on the opposite side of the ring involves a $^6J$- and a $^5J$-coupling pathway. A biogenetic pathway for the origin of nitrile glucosides is proposed.

**PHARMACEUTICAL REVIEW**

Rocha JC et al [34] has studied photoacoustic spectroscopy applied to determine ex vivo percutaneous penetration of proanthocyanidins present in extracts of *Guazuma ulmifolia* Lam. in rats. Lotion formulation is containing 0.0663 mg of procyanidin B2. On day (1) animals topically applied during 7, 10 & 13 days each group of animals. After end of treatment animals killed, skin dissected to remove basal content and measurements carried out as a function of the period of time of treatment. Results showed despite very low concentration of active principle (procyanidin B2) in lotion, photoacoustic method able to show the presence of optical absorption bands from this substance in the dermis region, evidencing once again that this method may be useful for studies of topically applied formulations of interest in pharmacokinetic area.

**CONCLUSION**

*Guazuma ulmifolia* Lam. widely distributed throughout India. The plant appears to have a broad spectrum of activity on several ailments. Various parts of plant have been explored for Anti-diabetic, Anti-Hypertensive, Anti-microbial action, Anti-Oxidant, Anti-ulcer Action, Hair growth promoter, Weight loss agent. Phytochemically plant contains fatty acids, steroids, flavanoids, tannins, glycosides, carbohydrates, mucilage, and essential oil. The pharmacological studies reported in this review confirm therapeutic value of *G. ulmifolia* Lam. However, less information is available regarding clinical, toxicity and phytoanalytical properties of this plant. Several phytochemical studies have been reported but still it needs to progress. With availability of primary information further studies can be carried out like clinical evaluation, phytoanalytical studies and toxicity evaluation. The plant is preclinically evaluated to some extent; if these claims are
scientifically evaluated clinically, then it can provide good remedies and help mankind in various ailments.

ACKNOWLEDGEMENT

Authors are thankful to institute, Shri B M Shah College of Pharmaceutical Education and Research, and M. L Ghandhi higher education trust for providing facilities and support to come to an end my work to this level.

REFERENCES

1. www.ias.ac.in/currsci/oct252009/1112.pdf


For Correspondence:
Patel Jalpa G
Email: jalpa_patel303@yahoo.co.in