

Leea macrophylla: A Review on Ethanobotanical Uses, Phytochemistry and Pharmacological Action

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ABSTRACT

Leea macrophylla Roxb. ex hornis a perennial shrub that belongs to the Leeaceae family. The plant has widely been used as a traditional medicine for long time. It is rich in phytochemical constituents such as alkaloids, steroids, glycosides, saponins, carbohydrates, proteins and tannins. Moreover, it has significant therapeutic effects and various preclinical studies have been conducted on the plant to elucidate its pharmacological response which includes anti-diabetic, hepatoprotective, antioxidant, antimicrobial, anti-inflammatory, antirolithiatic and anti-nociceptive, cytotoxic, antithrombotic, neuroprotective, wound healing and cardiogenic activity. The scientific validation is essential for the acceptance of medicinal plants as therapeutic agents against several disorders. Hence, the traditional uses, phytochemical constituents, medicinal significance and pharmacological effects of the plant are discussed in this review.

Key words: *Leea macrophylla*, Phytochemical constituents, Elephant's ear, Alkaloids, Phenolics, Ethanobotanical uses, Pharmacological Activities.

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INTRODUCTION

India is well known for its rich heritage and known repository for medicinal plants since ancient times. The traditional systems of medicine such as ayurveda, siddha and unani practices have been used for treating various types of health disease over a vast period of time. Traditionally used plants and their products have been widely evaluated for pharmacological properties have been increased throughout the world now a day's. Plant derived phytoconstituents imparts a leading role in boosting the health and treating various ailments in preventive and cytotoxic effects.^[1] As per W.H.O. report, more than 80% peoples from developing countries relies on herbal medicines for better health and because of this medicinal plants are growing worldwide. Hence, it is essential to study the uses of plants and other associated knowledge should develop for researchers to introduce new phytoproducts as well as the mechanisms in understanding the traditional knowledge for scientific validation.

PLANT INTRODUCTION

Leea macrophylla (Family - Vitaceae) commonly known as Gajkarni or Hattikaan is an erect herbaceous shrub widely distributed to sub-Himalayan tract and Western Ghats of India. The leaves of Plant looks like Elephant's ear. Hence, it is traditionally named as hathikarna or Hastikarnapalasa by the local tribal people. This traditional name of this plant might

be come from the morphological structures of leaf which looks like an Elephant's ear.

LEEAC MACROPHYLLA

Taxonomical Classification

Kingdom	Plantae
Phylum	Tracheophyta
Class	Magnoliopsida
Order	Vitales
Family	Vitaceae
Genus	Leea
Species	<i>Leea macrophylla</i> Roxb. ex Hornem.

Habit

Leea macrophylla known as Hastikarnapalasa widely distributed to Western Ghats and Sub-Himalayan region identified under Indian habitat growing up at altitude of 2000-2500 m relatively hotter parts of India. It is an erect herbaceous shrub attains the height about 1ft. – 3 ft. with tuberous roots and elephant ear shaped leaves.^[2]

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Common Names

Sanskrit	Dhola, Samudrika, Dholasamudrika, Hastikanda, Hastikarnapalasha, Hastiparni, Kekidanda, Morata, Samudraka, Jino
Hindi	Dholsamudra, Dholshumoodra, Samoodraka, Samudraka, Hathikana
Kannada	Mandala gadde
Marathi	Dimdo, Dinda, Gajakarni
Telugu	Peddapayagillaaku, Peddapayagillaku
Bengali	Dholsamudra
Malayalam	Niallu
Assamese	Kath tenga

Description

It is an erect herbaceous shrub widely found at an altitude of 2000-2500m throughout India. The plant grows up to the height of 1-3ft, perennial, numerous branches with tuberous roots found in warm region.



Leaves are simple, broad, oval shaped with cordate base, apex is acute or acuminate with serrate margin attains up to size of 20-60 cm long. The upper surface is dark green glabrous while the lower surface is light green fibrous surface. The leaves are oppositely arranged with 6-8 pairs. The Flowers greenish white with large corymbs with white petioles, branched, corymbose, terminal inflorescence. The berries are spherical, 5-6 diameter; green in color, branched on ripening becomes purple.^[3]

Medicinal Significance

Chowdhary *et al.* 2008 showed therapeutic uses of *Leea* genus in the treatment of cancer, dysentery, body-ache and sexual disability.^[4] The leaves are traditionally used in snake bites, arthritis, tonsillitis, tetanus, rheumatism, nephrolithiasis, pain, sore and blood effusion.^[5]

The leaves, seeds and roots are used in ayurvedic preparations since ancient times in the preparation of seasonal tonic modaka preparation.^[6] The leaves are also used in gastric tumor, goiter, lipoma, tetanus^[7] and in urinary disturbances.^[8,9] The leaves are used for vegetable purposes by local tribes^[10] and is also applied externally to relief pain and to stop the

Table 1: Preliminary phytochemical screening of *Leea macrophylla* leaves in alcoholic and aqueous extracts.^[12]

S.No.	Tests Compounds	Alcoholic extract	Aqueous extract
	Carbohydrates	++	--
	Proteins and amino acids	--	--
	Alkaloids	++	--
	Anthraquinones	--	--
	Phenolic compounds	++	++
	Steroids	++	--
	Flavonoids	--	--

{++}, presence; {--}, absence

Table 2: Preliminary phytochemical screening of *Leea macrophylla* seeds in different extracts.^[13]

Tests Compounds	Extracts			
	Methanol	Ethyl acetate	Chloroform	n-Hexane
Carbohydrates	+	+	-	-
Proteins	+	+	-	-
Glycosides	+	+	-	-
Alkaloids	-	-	-	-
Phenolics	+	+	-	-
Saponins	-	-	+	+

(-)Absent (+)Present

effusion of blood.^[11] Powdered roots along with coconut oil are used in burn wounds and sores. The healing property of the leaves is due to the presence of alkaloids, saponins and phenolic compounds.^[12]

Preliminary Phytoconstituents Investigation

Leaves showed presence of alkaloids, phenolic compounds and steroids in alcoholic extract. The phytochemical screening of seeds extracts revealed the presence of different phytoconstituents like phenolic compounds, saponins and glycosides.^[13]

PHARMACOLOGICAL ACTIVITIES

Anti-inflammatory activity

Anti-inflammatory was reported in the methanolic extract of leaves of plant both *in-vivo* and *in-vitro*. The phytochemical study showed the presence of sterols, triterpenoids and ascorbic acid in extract. The *in-vitro* studies revealed the inhibitory action in the production of inflammatory mediators' viz. prostaglandin E₂, tumor necrotic factor- α , interleukin-6 and interleukin-1 β . The *in-vivo* study was evaluated by using carrageenan induced paw edema and cotton pellet granuloma technique at a dose of 100 and 200 mg/kg showed significant reduction in the granuloma tissue formation and exhibited analgesic activity.^[14]

Hepatoprotective activity

Different fractions of *Leea macrophylla* crude extract were evaluated for antioxidant and CCl₄-induced acute liver injury in rats. The antioxidant potential was screened by 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging effect, FeCl₃ reducing effect, superoxide scavenging effect and iron chelating effect. The hepatoprotective action was determined by resorption of lipid profiles, total protein and CK-MB.^[15]

Antidiabetic activity

The antidiabetic activity was investigated the protective effects of polyphenols present in plant using fructose-fed STZ-induced type 2 diabetes method. The research shows the preventive action of phenols and flavanoids by modulating the pancreatic β -cell functions for controlling diabetes type 2. The serum markers for estimation of insulin, liver and cardiac enzymes, uric acid, lipid profiles and creatinine using ELISA method were analyzed. *In vitro* study was performed by inhibition of α -amylase and histopathological studies were also done on pancreatic tissues. Results suggested significant decrease in blood glucose level, aspartate transaminase (AST), liver glycogen, creatinine kinase (CK-MB), lactate dehydrogenase (LDH) and cholesterol level.^[16]

Antimicrobial

The ethanolic extract of *Leea macrophylla* (Roxb.) was screened for antibacterial and antifungal activities against pathogenic bacteria and fungi respectively using ciprofloxacin and fluconazole standards. The assay was performed by disc diffusion method showed mild to moderate zone of inhibition against different microbes as *Aspergillus niger*, *Blastomyces dermatidis*, *Candida albicans*, *Pityrosporum ovale*, *Trichophyton* sp. *Microsporum* sp. and *Cryptococcus neoformans* were strongly inhibited.^[17]

Antirolithiatic effect

The ethanolic extract of whole plant was investigated ethylene glycol-induced urolithiasis model of rats. The results were significantly decreased the levels of phosphorous, calcium and oxalate and increased the levels of magnesium and creatinine.^[18]

Antinociceptive activity

The antinociceptive activity was reported in the roots of *L. macrophylla* at the dose of 200 mg/kg significantly inhibited the number of writhes as compared to the control group, almost similar to diclofenac sodium as standard. Furthermore, the partitioning fractions of extract in pet ether, carbon tetrachloride and ethyl acetate at the same dose exhibited anti-nociceptive activities with inhibition of writhing, respectively.^[19]

Wound healing

The wound healing potential of *Leea macrophylla* justifies its traditional use against incision wound model. A bioadhesive gel of plant extract was tropically applied over infected area showed complete wound contraction in 20 days. The results also showed a significant increase in superoxide dismutase, antioxidants glutathione and catalase, whereas decrease in the level of enzymes lipid peroxidation and nitric oxide.^[20]

Cytotoxic activity

The roots of *Leea macrophylla* was investigated for preliminary cytotoxic activity using brine shrimp lethality bioassay. The ethanolic extract and its different partitioning fractions in carbon tetrachloride, chloroform and ethyl acetate showed the LC_{50} values 2.39, 0.049, 4.53 and 0.09 μ g/ml, respectively which were comparable to the standard vincristine sulphate, (LC_{50} : 0.34 μ g/ml).^[21]

Anti thrombotic activity

The ethanolic extract of *Leea macrophylla* was evaluated for anti thrombotic activity using streptokinase as a standard. The extract exhibited 20.61% clot lysis at a dose of 5 μ g/ μ l compared to the standard streptokinase (81.53%) at a dose 100 μ l.^[17]

Neuroprotective

The Methanolic extract of roots of *Leea macrophylla* was investigated for neuroprotective activity using morris water maze test. The results significantly reduced the locomotion and increased the duration of sleep at a the dose of 100 and 200 mg/kg. The test extract also reduced the number malondialdehyde content, nitric oxide and advanced oxidation protein product.^[22]

Cardiotonic

The aqueous and alcoholic extract of *Leea macrophylla* was evaluated for cardiotonic activity using isolated frog heart perfusion technique. The Increased dose of extracts from 0.1 to 0.4 ml had showed increase in heart rate and force of contraction. A significant effect was also observed on the height of force of contraction (positive inotropic effect).^[23]

Gastroprotective

The gastroprotective effect of *Lee macrophylla* was investigated by ethanol and pylorus ligation inducing gastric ulcer. The extract at a dose of 100, 200 and 400 mg/kg significantly showed protective action towards gastric ulcer as compared to the standard drug omeprazole. The protective mechanism of plant is due to presence of phytoconstituents like Alkaloids, Flavonoids, Glycosides and Phenols.^[24]

CONCLUSION

The review of plant *Leea macrophylla* provides its ethnobotanical uses and scientific information for many diseases and disorders. The preliminary phytochemical screening showed the presence of phenolic compounds, alkaloids, steroids, saponins etc on various parts plays a medicinal importance of plant. However, till there is no scientific data on its chemical constituents and study required for further investigation for its chemical compounds is necessary to justify their presence for treatment in various diseases and disorders. The various parts of plant in different extract exhibit anti-inflammatory, hepatoprotective, antidiabetic, antimicrobial, antirolithiatic effect, antinociceptive, wound healing, cytotoxic, anti thrombotic, neuroprotective, cardiotonic and gastroprotective action. Hence, more scientific data is required for exploring its chemical constituents in the treatment of diseases and disorders for making new therapeutic drugs.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

ABBREVIATIONS

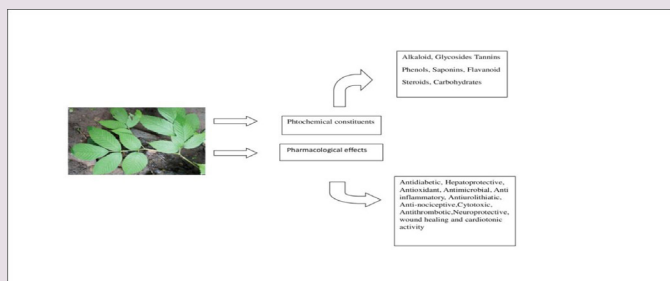
DPPH: 2,2-diphenyl-1-picrylhydrazyl; **CCl₄:** Carbon Tetrachloride; **FeCl₃:** Ferric Chloride; **CK-MB:** Creatine kinase-MB; **STZ:** Streptozotocin; **ELISA:** Enzyme-Linked Immunosorbent Assay.

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GRAPHICAL ABSTRACT



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SUMMARY

Leea macrophylla (Family- Vitaceae) commonly known as Gajkarni or Hattikaan is an erect herbaceous shrub widely distributed to sub-Himalayan tract and Western Ghats of India. The leaves of Plant looks like Elephant's ear. Hence, it is traditionally named as hathikarna or Hastikarnapalasa by the local tribal people. The leaves, seeds and roots are used in ayurvedic preparations since ancient times in the preparation of seasonal tonic modaka preparation. The leaves are also used in gastric tumor, goiter, lipoma, tetanus and in urinary disturbances. Powdered roots along with coconut oil are used in burn wounds and sores. The healing property of the leaves is due to the presence of alkaloids, saponins and phenolic compounds. It has significant therapeutic effects and various preclinical studies have been conducted on the plant to elucidate its pharmacological response which includes antidiabetic, hepatoprotective, antioxidant, antimicrobial, anti-inflammatory, antiurolithiatic and anti-nociceptive, cytotoxic, antithrombotic, neuroprotective, wound healing and cardiotoxic activity.

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