

Review Article

A Comprehensive Review on: The Efficacy of Biocompounds of *Leucas Aspera*

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Abstract

The plant *L. aspera* derived biomolecules have potential efficacy against various gram positive and gram negative organisms. *In-vitro* activity depends on the ability of the antimicrobial agent to reach its microbial target site and to overcome various mechanisms of resistance in the infected bacilli. The effective biocompounds penetrate to the target site of organism must retain and exhibit significant activity at different concentration of the biocompounds. These biomolecules were nontoxic at dose levels and should not be metabolised to toxic intermediates. Are used on these clinical importance focused on review on *L. aspera*.

Keywords: *L. aspera*; Active biomoieties; Flavonoids; Glycosides; Antimicrobial activity

Introduction

The *L. aspera* is a holy plant and have divine value in India. This plant is widely distributed in India and which have there about 80 species of *Leucas* genus embrace available in Karnataka region. *L. aspera* plant is mostly looks like shrub, herbs with woody roots. The axillary or terminal inflorescence is usually with indeterminate augmentation. bracteoles are roughly erect and as per the vernacular name in kannada called as thumba, in hindi called goma madhupati and telugu called as thummichittu which belongs kingdom plantae and belongs to family labiatae and genus *Leucas* and species *aspera* which contain secondary metabolites like Leucasperones A and B, alkaloids, alpha sitosterol and beta sitosterol, linifolia, apigenin, Amyl propionate, stearic acid, oleic acid, linoleic acid, phenolic compound, falconoid and this plant exhibits various pharmacological properties because of huge active biocompounds and it exhibits antimicrobial activity [1-15].

Taxonomical Classification: Kingdom: Plantae; Plant Sub-kingdom: Tracheobionta; Vascular Plant Super Division: Spermatophyta; Seed Plant Division: Angiosperma; Class: Dicotyledonae; Sub-Class: Gamopetalae; Series: Bicarpellatae; Order: Tubiflorae; Family: Labiatae; Genus: *Leucas*; Species: *Aspera*.

Vernacular Names: Sanskrit: Dronapushpi, Chitrapathrika, Chitrakshup; Punjabi: Guldor; Bengali: Darunaphula; Hulkasha; Gujarati: Kulnphul; Hindi: Goma madhupati; Sindhi: Kubo; Maharashtra: Bahuphul; Bombay: Tumba; Telugu: Thummichittu.

Geographical Distribution

L. aspera commonly known as 'Thumbai' is found along roadsides and fallow fields from plains to 400m. It is found in

Africa, Asia, Pacific Islands, South America and China. It is distributed throughout India from the Himalayas down to Ceylon [8]. In India and the Philippines *L. aspera* is a very common weed. It also found in a Bangladesh, Indo-China, and Malesia is a common aromatic herb found in Africa, temperate and tropical countries of Asia.

Morphological Description

L. aspera is an annual herb that erects to a height of 15 to 60 cm and has branches and a sturdy, hispid, abruptly quadrangular stem.

Stem

The stems have four conspicuous furrows, a quadrangular shape, are up to 4 mm thick, taste slightly bitter, and have a pale greenish-yellow surface texture [19].

Leaves

Yellowish-green, ovate or lanceolate, sub-acute, somewhat pubescent, up to 8.0 cm long and 1.25 cm broad, with an entire or crenate margin, serrate, and tasting pungent (Rai *et al.*, 2005), with a sub-sessile or short petiole measuring 2.5 to 6 mm in length and being acute. The leaves are oriented opposite to one another, acute to acuminate, sessile, globose in shape, 2 to 3.5 cm in diameter, and encircled by a profusion of foliaceous bracts.

Flowers

Bracts are 6 mm long, linear, sharp, bristle-tipped, and ciliate with long, slender hairs. Flowers are white, sessile, small, dense

terminal or axillary whorls. dense axillary, less frequently terminal, and typically distant whorls inflorescence.

Corolla

Corolla Upper lip: 3 mm long, thickly white-woolly, erect, concave, villous externally; tube: 5 mm long and pubescent above, annulate in the middle; lower lip: about twice as long, 3 fid, spreading, mid-lobe, bigger and the middle lobe absent, rounded; lateral lobes short, sub-acute. Four didynamous stamens, climbing under the upper lip, connivent anthers, divaricated cells, and lastly confluent stamens. A disc that is completely lobed, uniformly lobed, or occasionally expanded up front. (Khanam and Hassan, 2005) Nutlets are ovoid, triquetrous, obtuse to truncate, and rounded at the apex.

Root

The roots are long, smooth, cylindrical, and zigzag, and they have numerous wiry, tiny rootlets. The size varies, there are few cracks, and the fibrous material has a distinctive taste [19].

Fruits

Nutlets, also known as Schizocarpicarcerules, are 2.5 mm long, brown, smooth, with an angular inner face and a rounded outer face (Hooker *et al.*, 1984).

Seeds

The seeds are oblong, triangular, smooth, and dark brown in color, measuring 0.3 cm length by 0.1 cm wide.

Calyx

Calyx variable, tubular, 8 to 13 mm long; tube curved, contracted above the nutlets; mouth small, very oblique, not villous, the upper part produced forward; teeth small, triangular, bristle-tipped, ciliate, with the upper tooth being the largest. Ten nerved, frequently striate, mouth equal or oblique teeth 6–10 abnormally uneven, pubescent to hirsute teeth (Khanam and Hassan, 2005).

Pharmacological Activity

Hepatoprotective²⁰:

The cold methanolic extract of the whole plant of *L. aspera* was reported to have significant hepato-protection in CCl₄ induced liver damage (Mangathayara, *et al.*, 2005). *L. aspera* leaves fresh juice was tested against carbon tetrachloride (CCl₄) induced liver damage. The evaluation markers used were GOT, GPT, Alkaline phosphate, glucose, bilirubin, cholesterol and total protein. Silymarin was used as a standard for comparison. The fresh juice showed good result against liver disorders (Shirish and Pingale, 2010) hydroalcoholic leaf extract of *L. aspera* on

Table 1: Phytochemical constituents [16-19].

S. No	Phytochemical Compound	Secondary metabolites
1.	Terpenes and Terpenoid compounds	Oleanolic acid, Ursolic acid, Squalene, β -caryophyllene, α -humulene, α -pinene, epi- α -bisabolol, Limonene, x-thujene, Menthol, Leucasperone A, Leucasperone B.
2.	Sterols and Fatty compounds	3-Sitosterol, 9,12,15-Octadecatrienoic acid methyl ester, nHexadecanoic acid, Linoleic acid, Oleic acid, Stearic acid, Ceryl alcohol.
3.	Glycoside compounds	Glucoside, Linifolioside, Leucasperosides-A Leucasperosides-B, Leucasperosides-C.
4.	Long chain compounds	(4-(24-Hydroxyl-1-oxo-5-n-propyltetracosanyl)-phenol), 28-Hydroxypentatriacontan-7-one, 7-Hydroxydotriacontan-2-one, 1-Hydroxytetracontan-4-one, 32-Methyltetracontan-8-ol, Nonatriacontane, 5-Acetoxytriacontane.
5.	Flavonoid compounds	Catechin, Acacetin, Apigenin.
6.	Lignane compound	Nectandrin B, meso-Dihydroguaiaretic acid, Macelignan, (-)-Chicanine, Licarin A, erythro-2-(4-allyl-2,6-dihydroguaiaretic-1-(4-hydroxy-3-methoxyphenyl)propan-1-ol
7.	Miscellaneous compound	Nicotine alkaloids, Galactose sugar, 1,2 Benzenedicarboxylic acid bis(2-methylpropyl) ester, 1-Octen-3-ol, Amyl propionate, Isoamyl propionate, A.

male albino wistar rats was investigated, and shown significant hepatoprotective property.

Antioxidant Activity²¹:

Antioxidant property of *L. aspera* was reported by many researchers. The ethanol extract of *L. aspera* showed very potent antioxidant activity. Better antioxidant activity was observed in the petroleum ether extract of *L. aspera* leaf, and the order of the activity is petroleum ether > ethanol > isopropyl alcohol > ethyl acetate > chloroform. They also suggested ethanol or isopropanol (polar solvent selection) and petroleum ether (non-polar solvent selection) for better extraction of phytochemicals and phytoconstituents. Moreover, better antioxidant activity was observed in wild leaf extracts when compared to *in-vitro* callus extract.

Antibacterial Activity²²:

It was observed that the chloroform and petroleum ether extracts of *L. aspera* Its root, flower, leaf, and stem exhibits good antibacterial activity against Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, Salmonella typhimurium, Salmonella choleraesuis, and Shigella flexneri [16]. The earlier study reported that the ethanolic and methanolic decoctions contain more active phytoconstituents than the water and these organic solvents showed better antimicrobial properties against various bacterial strains.

Central Nervous Activity²³:

The root ethanolic extract of *L. aspera* was assessed employing pentobarbitone induced sleeping time test, the hole cross test and the open field test on Swiss albino mice for its impact on Central Nervous System (CNS). The results supported that *L. aspera* root may possess biologically active constituent (s) having CNS activity [30]. Furthermore, ethanolic extract of roots exhibited noteworthy peripheral antinociceptive activity at the concentration of 400 mg/kg.

Antihyperlipidemic –Activity²⁴:

L. aspera leaves exhibit antihyperlipidemic action in an *in-vivo* animal model. Dexamethasone can be used to produce hyperlipidemia in rats, which results in a notable rise in TG and serum cholesterol levels as well as an increase in the atherogenic index. As a result of keeping serum levels of cholesterol and TGs close to normal levels, the ethanolic extract of leaves from *L. aspera* Linn. (200 and 400 mg/kg) therapy significantly inhibited dexamethasone-induced hyperlipidemia in rats.

Dynamic Trajectory Analysis Against COVID-19 Spike Protein²⁵:

In comparison to HCQ and Remdesivir, major phytocon-

Table 2: Pharmacological value of *L. aspera*.

Tissue	Extract	Activity
Whole plant extract	Ethanol extract	Anti-helmentic activity
Leaves	Ethanol extract	Anti-hyperlipidemic activity
Whole plant	Ethanol extract	Anti-pyretic activity
Whole plant	Petroleum –ether extract, ethanol extract	Anti-psoriatic activity
Whole plant	Methanol extract	Antivenom activity
Leaf	Hydroalcoholic extract	Hepatoprotective activity
Root	Ethanol extract	CNS depressant activity
Flowers	Ethanol extract	Antibacterial
Root	Methanol	Antioxidant

stituents of *M. Citrifolia* and *L. aspera*, as well as the molecule 4- (24-hydroxy-1-oxo-5—n-propyltetracosanyl)-phenol from *L. aspera*, demonstrated significantly greater dynamic trajectory activity of forming the stable complex with S- protein and total denaturation of spike protein.

Anti-Pyretic-Activity²⁶:

L. aspera and *Glycosmis pentaphylla* ethanol extracts were investigated for anti-pyretic effects in rats using a Brewer's yeast induced pyrexia model. The antipyretic action was demonstrated by the extract of *L. aspera* (200mg/kg) and the conventional paracetamol group over the course of the six-hour test period, most likely due to the inhibition of prostaglandin synthesis in the hypothalamus.

Anti-Psoriatic-Activity²⁷:

Psoriasis-reducing action

The effects of *C. juncea*'s petroleum ether extract and *L. aspera*'s ethanol extract on nitric oxide production and lipid peroxidation on skin keratinocyte proliferation suggested antioxidant-mediated anti-psoriatic activity. Since the dawn of human civilization, herbal remedies for skin conditions have been documented.

Antivenomous –Activity²⁸:

The *L. aspera* Linn. methanol extract was chosen for a thorough investigation into the isolation, purification, and characterization of the active chemical responsible for neutralizing the cobra venom. This compound was found to have strong antivenom activity.



Figure 1: *L. aspera* plant.



Figure 2: *L. aspera* stem.



Figure 3: *L. aspera* leaves.

Cytotoxicity²⁹⁻³⁰:

The cytotoxic and anti-tumor activities of natural and manufactured substances can be correlated using the brine shrimp lethality assay, which is a quick and affordable approach. The hydroalcoholic extract of the whole plant, particularly the root extract, showed cytotoxicity in several experiments of *L. aspera* using this model ($LC_{50}=1,900$ g/ml). In a test using brine shrimp, Morshed et al. discovered that the ethanol, ethyl acetate, and n-hexane extracts of *L. aspera* had LC_{50} of 114.70 g/ml, 43.97 g/ml, and 30.32 g/ml, respectively. In an in-vivo cytotoxicity against *Artemiasalina* (brine shrimp nauplii) was also investigated by Alam et al. They discovered that the dichloromethane fraction contains two active ingredients, amyirin and tocopherol, had cytotoxic effect, with LC values of 241 and 195 ppm, respectively.

Anti-ulcer Activity³¹:

Aspirin-induced ulcer and shay rat ulcer as experimental models to study the antiulcer efficacy of *L. aspera* alcohol extract. They concluded that this was due to an anti-secretory and protective effect on the stomach mucosa after observing a considerable decrease in acid secretion and a decrease in ulcer score in rats Reddy et al.

Anti-Parkinson's Effect³²:

Parkinson's disorder is a progressive neurodegenerative condition brought on by the loss of dopaminergic neurons in the midbrain's Substantia Nigra Pars Compacta (SNpc). Rotenone is an alkaloidal insecticide that is used to make animals develop Parkinson's disease. Through improved motor coordination, protective changes in oxidative marker levels, and no dopamine content loss, *L. aspera* ethanol extract was reported to protect rats from rotenone-induced Parkinson's disease.

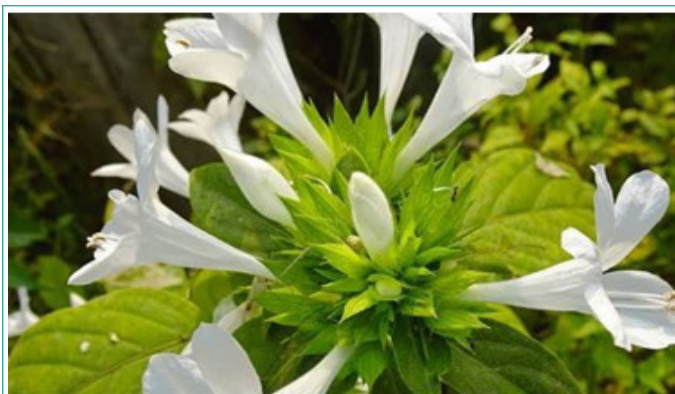


Figure 4: *L. aspera* flower.



Figure 5: *L. aspera* root.

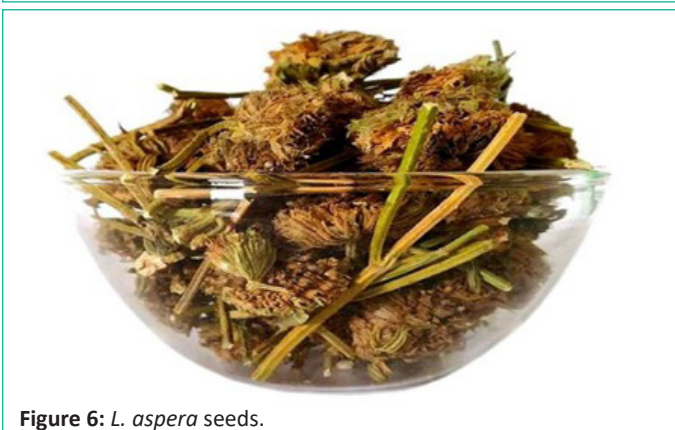


Figure 6: *L. aspera* seeds.

Anti-Microbial Activity³³:

When the methanol extract of *L. aspera* flowers, its fractions, the alkaloidal residue, and the expressed floral juice were examined for antimicrobial activity, the extract and methanol fraction showed good antibacterial activity, with the alkaloidal residue having the highest activity.

Anti-Inflammatory Activity³⁴:

L. aspera leaf ethanolic extract shown considerable ($p < 0.001$) anti-inflammatory efficacy in both acute and chronic inflammation at various dosages. Additional research could clarify its function in the management of inflammatory illnesses.

Antidiabetic Activity³⁵:

In both streptozotocin- and alloxan-induced hyperglycemic rats, *L. aspera* extracts in ethanol and petroleum ether shown strong anti-hyperglycemic activity. Additionally, they might enhance the state of diabetes as shown by measurements such as body weight, blood cholesterol, and triglyceride levels. The *L. aspera* plant extracts were evaluated for their oral hypoglycemic and anti-diabetic properties. Diabetic rats generated by alloxan and streptozotocin were tested for glucose oral tolerance.

The plant extract and isolated metabolites had strong anti-diabetic effects by increasing glucose absorption and modulating critical enzymes in glucose metabolism.

Antinociceptive Activity³⁶:

The ethanolic extract of *L. aspera* root was tested for antinociceptive, antioxidant, and cytotoxic properties using acetic acid induced writhing inhibition, 1,1-Diphenyl-2-Picryl Hydrazyl (DPPH) free radical scavenging assay, and brine shrimp lethality bioassay, respectively. At dosages of 250 and 500 mg/kg, the extract significantly inhibited acetic acid-induced writhing in mice. With an IC_{50} of 8 g/ml, the extract demonstrated considerable free radical scavenging activity. The extract was deadly to brine shrimp, with an LC_{50} value of 0.

Conclusion

From the literature, *L. aspera* showed good antibacterial, antioxidant, anticancer, anti-inflammatory, anti-diabetic, and other effects.

L. aspera has a long history of use because of their great medicinal potential to treat and even cure a wide range of illnesses. *L. aspera* contains phenolics, glycosides, and terpenes that have high biological action. The investigations demonstrated a considerable reduction in both acute and chronic inflammation.

Therefore, there is still a ton of need for more scientific research on *L. aspera* to determine its medicinal effectiveness and economic viability.

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