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Review Article

Leucas aspera – A Review of its Biological activity

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ABSTRACT
Herbal plants are integral parts of the traditional medicine worldwide and most of the rural and urban population uses these plants in many of their regular needs even today. The current researchers are more focused on natural chemicals than the synthetic chemicals due to their environmental, economical and health benefits. Plants produce many chemical compounds for its biological activities including defence mechanism against microbes, insects and herbivorous animals and these chemicals are called as phyto-chemicals. Herbal plants are a natural source of many important phyto-chemicals and widely used in Pharmaceutical, food and cosmetic industries. A wide variety of herbal plants are available in the Indian subcontinent and they are the backbone of Indian traditional medicines Ayurveda and Siddha. *Leucas aspera* Linn., commonly known as Thumbai or Dronpushpi is a small, erect, branched annual aromatic herb, distributed throughout India from the Himalayas down to Ceylon. Though it grows as a weed throughout the country, it has a number of medicinal values and it is used in traditional medicine to treat many diseases. The study of various biological properties of this plant will be useful for its potential use in respective industries. Medicinally, it has been proven to possess various pharmacological values like anti-fungal, anti-pyretic, antioxidant, antimicrobial, antinociceptive, analgesic, anti-diarrheal, insecticidal, anti-inflammatory and cytotoxic activity in a number of studies by different researchers in the past several years. The available reports on anti-microbial activity, anti-oxidant activity and pharmacological value of *L. aspera* are discussed in this review.

Key words: Antimicrobial activity, Antioxidant, Herbal plant, Medicinal value, Indian medicinal plant.

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INTRODUCTION

Human beings have used plants as medicine for diverse health issues for thousands of years.[1] Plants are widely used in traditional medicine of different countries and are a source of many potent and powerful drugs.[2] *Leucas aspera* Linn. (*L. aspera*) belonging to the family Lamiaceae is an annual, branched, herb erecting to a height of 15-60 cm widely distributed throughout India. The taxonomic classification and anatomy of this plant were well documented and discussed by many researchers.[1,3,4,5] It contains triterpenoids, oleanolic acid, ursolic acid and b-sitosterol, nicotine, sterols, glucoside, diterpenes and phenolic compounds.[5] This plant is used in Indian traditional medicines Ayurveda and Siddha. It has various pharmacological activities like Carminative, antihistaminic, antipyretic, and antiseptic. It is used for treating jaundice, anorexia,dyspepsia, fever, helminthic manifestation, respiratory and skin diseases.[6] Antimicrobial activity and antioxidant property of this plant is also proved. *L. aspera* is used as one of the content in IPM (Integrated Pest Management) for controlling *Pseudodendrothrips mori* [7] and reported as a good insecticide.[8] *L. aspera* is a potent plant to synthesis silver nanoparticles [9] and also reported to have phytotoxic substances.[10] Due to the importance of *L. aspera* in modern medicine as a potential candidate for curing many diseases, the antimicrobial property, antioxidant property and the pharmacological value of this plant is explained in this review.

ANTI MICROBIAL ACTIVITY

Identification of antimicrobial agents from different sources to combat microbial resistance is the great interest of current researchers. Antimicrobial susceptibility testing has wide applications in drug discovery, epidemiology and prediction of therapeutic outcome.[11] The antimicrobial property of *L. aspera* was reported and discussed by many researchers (Table 1). Saritha *et al.*, explained the mode of antimicrobial action and suggested that they act to cause pores in the bacterial membranes and leakage of cellular contents. They explained that the detergent properties of phenols and flavonoids from this plant could be the reason for the bacterial membrane damage and the action is time and concentration dependent.[12] Gangadharan *et al.*, reported that the phytochemical analysis indicated that ethanol can extract more active principles of the plant than the water for better antimicrobial activity.[13] Sarathambal *et al.*, suggested the petroleum ether extract of *L. aspera* was more effective.[14]

Bacterial communities that are surrounded in a self-produced matrix of extracellular polymeric substances (EPS) form Biofilm.[15] Formation of biofilm in the hostile environment is a survival strategy of bacteria and fungi to adapt to their living environment. Clinical treatment of biofilm infections is difficult as microbes in biofilm are tolerant and resistant to antibiotics and the immune responses.[16] Methanol and ethyl acetate extract of *L. aspera* prevents the *Streptococcus pyogenes* from forming biofilm.[17]

ANTI OXIDANT PROPERTY

Oxidative stress has an adverse effect on human health and lack of antioxidants can quench the reactive free radicals facilitating the development of degenerative diseases, including cardiovascular diseases, cancers, neurodegenerative diseases, Alzheimer's disease and inflammatory diseases.[18] A diet supplement with antioxidant compound may be a solution to avoid the adverse effects of oxidative stress and most of the herbal plants are reported to have antioxidant potential. Antioxidant property of *L. aspera* was reported by many researchers.[19,20,21,22,23,24,25,26,27] The ethanolic extract of *L. aspera* exhibited very potent antioxidant effect.[25] 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.[26] They also suggested ethyl alcohol or isopropyl alcohol (polar solvent selection) and petroleum ether (non-polar solvent selection) for the better extraction of phytochemicals. Better antioxidant activity was observed in wild leaf extracts when compared to *in vitro* callus extract.[27] While comparing to ethyl acetate and n-hexane extracts, ethanol extract showed more anti-oxidant activity.[19]

Table 1: Antimicrobial activity of *L. aspera*.

S.No	Compound/Extract	Activity
1	Ethanol extract[23]	*Bacillus subtilis, Bacillus megaterium, Staphylococcus aureus, Salmonella typhi, Salmonella paratyphi, Shigella dysenteriae, Vibrio cholera, Pseudomonas aeruginosa*
2	Ethanol extract[12]	*Escherichia coli*
3	Plant extracts (root, stem and flower)[30]	*Staphylococcus aureus*, *E. coli*, *P. aeruginosa*, *Salmonella typhimurium*, *Salmonella choleraesuis* and *Shigella flexneri*
4	Aqueous extract of the whole plant[31]	*S. aureus, E. coli* and *P. aeruginosa*
5	Ethanol extract[13]	Klebsilla &, *S.aureus*
6	Methanol leaf extract[32]	*Candida tropicalis, Candida albicans, Trichophyton mentagrophytes, Microsporum gypsum, Microsporum nanum, Aspergillus flavus, Epidermophyton floccosum, Penicillium sp.*
7	Chloroform extract[14]	*V. cholerae* and *S. typhi*
8	Methanol extract[20]	*Bacillus cereus, B. megaterium, B. subtilis, P. aeruginosa, S. paratyphi, S. typhi, Shigella dysenteriae, Shigella sonnei, S. aureus,*
9	Aqueous extracts[33]	*Salmonella mgulani, Salmonella bovis, Salmonella worthington*
10	Ethyl acetate and methanol extracts of *L. aspera*[34]	*Plasmodium falciparum*
11	Methanol extract[35]	*S. typhi, S. aureus, Klebsiella vulgaris, S. dysenteriae, Shigella boydii, E. coli*
12	Volatile oil[36]	*P. aeruginosa, Haemophilus influenza* and *Candida albicans*

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

S.No	Tissue	Compound/Extract	Activity
1	Aerial parts	Hydroalcoholic extract	Arthritis, anti-arthritic activity[37]
2	Leaf	Hydroalcoholic extract	Hepatoprotective activity[38]
3	Aerial parts	Methanol extract	Ulcer protective effect[39]
4	-	Ethyl acetate fraction	Anticancer activity[40]
5	-	A-amylase inhibitor	Diabetes[41]
6	Leaves	Aqueous suspension	Anabolic effect [42]
7	Roots	Methanol and petroleum ether extracts	Analgesic activity[43]
8	-	Hydro-ethanol and aqueous extract	Chemoprotective effect[44]
9	-	Nano-particles of *L. aspera*	Anticancer activity[45]
10	-	Ethanol extract	Antiepileptic activity[46]
11	Whole plant	Ethanol extract	Cytotoxic activity[47]
12	Whole plant	Aqueous and alcoholic extracts	Antiinflammatory action[48]
13	Shoot system including stem, leaves and flower	Ethanol extract	Antiinflammatory activity[49]
14	Whole plant	Aqueous extract	Hepatoprotective[24]
15	Leaf	Methanol Extract	Cytotoxic Activities[21]
16	-	Ethanol extract	Antidiabetic activity[50]
17	Leaf	Ethanol extract	Antidiabetic activity[51]
18	Whole plant	Methanol Extract	Antihyperglycemic activity[52]
19	Whole plants	Ethanol extract	Cytotoxic effect[23]
20	Root	Ethanol extract	Cytotoxic effect and antinociceptive activity[22]
21	Root	Ethanol extract	Central nervous system depressant activity[53]
22	Leaf	Triterpenoid from methanol extract	Antivenom activity[54]
23	Leaf	Methanol leaf extract	Antivenom activity[55]
24	Aerial parts	Ethanol extract	Antipsoriatic activity[56]
25	-	Diterpenes	Activity Inhibiting Prostaglandin-Induced Contractions[57]
26	Whole plants	Ethanol extract	Anti-inflammatory activity[58]
27	Whole plants	Methanolic extract	Anti-mutagenic activity[59]
28	Whole plants	Ethanol extract	Anthelminthic activity[60]

PHARMACOLOGICAL VALUE

The Ethno medicinal use to cure cold, cough, and skin disorders by a village population in India supports its medicinal value.[28] Several researchers reported the use of *L. aspera* for treating different health issues (Table 2). Phytochemicals and trace elements present in this plant are responsible for its use as medicine for many diseases. Major elements identified in the *L. aspera* include Carbon, Oxygen, Calcium, Silica, and Aluminum. Apart from this presence of Iron, Sodium, Potassium, Phosphorus and Chlorine were also identified.[29] Yashvanth *et al*., also reported that no harmful heavy metals were detected in their study.

CONCLUSION

L. aspera is a common plant found as weed throughout the Indian subcontinent. Its antimicrobial potential recorded by the researchers proves that it has broad spectrum antimicrobial activity. The antioxidant potential of this plant proves that it is one of the natural sources of antioxidant and it can be used as a preventive medicine. Alcoholic extracts showed better activity than aqueous extracts. The research on the pharmacological value of this plant proves that it has valuable compounds for curing many diseases and thus it is a promising plant for future advanced medicine.

CONFLICT OF INTEREST

None.

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