Ethnobotanical survey of genus *Leucas*

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**ABSTRACT**

Plants of genus *Leucas* (Lamiaceae) are widely distributed throughout Asia, Africa, and India. The plant is used in traditional medicine to cure many diseases such as cough, cold, diarrhea, and inflammatory skin disorder. A variety of phytoconstituents have been isolated from the *Leucas* species, which include lignans, flavonoids, coumarins, steroids, terpenes, fatty acids, and aliphatic long-chain compounds. Anti-inflammatory, analgesic, anti-diarrheal, antimicrobial, antioxidant, and insecticidal activities have been reported in the extracts of these plants and their phytoconstituents. An overview of the ethnobotanical, phytochemical, and pharmacological investigations on the *Leucas* species is presented in this review.

**Key words:** Bioactive constituents, ethno medical information, *Leucas*

**INTRODUCTION**

Plants are indispensible sources of medicine since time immemorial. Studies on natural products are aimed to determine medicinal values of plants by exploration of existing scientific knowledge, traditional uses, and discovery of potential chemotherapeutic agents. Phytochemicals are used as templates for lead optimization programs, which are intended to make safe and effective drugs.[1] Plants of genus *Leucas* (Lamiaceae) have been widely employed by the traditional healers to cure many diseased conditions, which insinuated that this genus has immense potential for the discovery of new drugs or lead molecules. The genus *Leucas* comprises about 80 species.[2] The highest species diversity has been found in East Africa.[3] In India, 43 species are available.[4] Plants of genus *Leucas* are generally shrubs, subshrubs, annual herbs, or perennial herbs with woody root and/or stem base. Leaves are opposite, entire, or with spiky lobes, oval shaped with tapered end, petiolated, or sometimes without intervening stalk. The axillary or terminal inflorescence is usually with indeterminate augmentation. Bracteoles are roughly erect. The calyx shape varies within the genus (often tuberlar shape); sometimes calyx enlarges into fruits. Calyx comprises of five connate sepals (one upper, two lateral, and two lower) and 5–20 secondary lobes. Whitish hairs are generally present on the outer surface of the upper lip of the corolla, although yellowish cream color or red hair can also be present in some species.[5,3] The investigated parts of the *Leucas* species include roots, seeds, stem, leaves, and whole plants. The present review not only covers phytochemical progress made on the plants of genus *Leucas* over the past few decades but also incorporates their uses in different formulations and in the treatment of various diseases by the traditional healers across the globe.

**Traditional use of selected species**

The plants of genus *Leucas* have been used by the tribals in various parts of Asia, Africa, and India. Widely employed different species, their parts, and mode of application/administration in various diseases are presented as follows.

**Ethnomedical information**

*Leucas aspera* (Lamiaceae)

Hot water extract of *Leucas aspera* is used orally as stimulant, anthelmintic, laxative, and diaphoretic.[1] It is also used orally for the treatment of headache, asthma, and bronchitis.[8] Hot water extract of entire plant is also used to treat inflammation, dyspepsia, and jaundice.[2] Entire plant extract is used orally to treat scabies, psoriasis, and snake bite.[7] The plant *Leucas aspera* is externally used as an insect repellant.[6] *Leucas aspera* and *Ocimum canum* are externally used to fumigate dwellings.[7] A handful of flowers roasted in ghee are given orally (5–10 g once a day) for treatment of cough and colds.[7] The flowers are crushed and...
The leaves with those of pills, and taken orally once a day for 9 consecutive days to treat fever. The infusion of plant is used orally to treat headache.\[^3\] The infusion of plant is used externally as antivenin.\[^3\] The plant juice is used orally for treatment of headache.\[^3\] The plant extract is used externally as an antivenin.\[^2\]

**Leucas cephalotes** (lamiaceae)\[^3\]

The decoction of dried aerial parts of plant (India) is used orally for diarrhea.\[^7\] The decoction of entire plant (India) is used orally to reduce fever.\[^4\] The H\,O\, extract of entire plant (India) is used orally as an appetizer.\[^3\] The flowers and leaves are applied externally as poultice to treat headache.\[^1\] The decoction of flower heads in Nepal is used orally to treat jaundice.\[^7\] The decoction of flowers in India is used orally as an emmenagouge.\[^6\] Hot water extract of dried flowers in India is used orally for coughs.\[^8\] Hot water extract of dried flowers in India is used orally for colds.\[^9\] The juice of unripe fruits (India) is used externally to treat scabies.\[^2\] The juice of leaves is used nasally as an antivenin.\[^2\] The juice of leaves is used externally as an antivenin.\[^2\] The dried leaves are used orally as a blood purifier.\[^3\]

**Leucas indica** (lamiaceae)\[^3\]

The flowers are used orally to treat typhoid fever.\[^4\] The leaves are pounded with garlic, pepper, and leaves of *Piper longum* and made into pills and used orally to treat typhoid fever.\[^5\] Leaves along with tender shoots of *Monnarda charantia*, pepper, garlic, and common salt are pounded, in equal quantities, made into pills, and taken orally once a day for 9 consecutive days to treat pneumonia.\[^6\] The leaves with those of *Alternanthera sessilis* in equal quantity are pounded with “ghee” and the extract is applied to eyes, and paste made into pills, which are taken for 40 days orally to treat night blindness.\[^6\]

**Leucas lanata** (lamiaceae)\[^3\]

The plant juice is used orally for treatment of headache.\[^7\] The plant juice is used orally for treatment of stomach-ache.\[^8\] Leaves are made into a paste and applied externally for cuts and wounds.\[^9\] A poultice of leaves is placed on affected area to promote exudation of pus from boils.\[^3\] The juice is used orally as an antitoxic for reptile poison.\[^3\]

**Leucas lavandulaefolia** (lamiaceae)\[^3\]

The decoction is used orally for treatment of diarrhea.\[^1\] The juice of plant mixed with *Rabdia cordinia* and *Niodula tabbaun* is used externally as an antivenin.\[^1\] The infusion of plant is used orally to treat fever. The infusion of plant is used orally to treat headache.\[^1\] One handful of *Leucas infula* plants, 50 g *Brassica campestris* seeds, and one average *Coriuna longa* rhizome are ground into a paste, which is applied externally to the forehead daily at sunrise for 7 days to treat migraine.\[^3\] The infusion of plant is used orally for cough.\[^4\] The infusion of plant is used externally for skin diseases.

**Leucas martinicensis** (lamiaceae)\[^3\]

Hot water extract is used orally for gastroenteritis, cholera, malaria, syphilis, leprosy, diarrhea, and dysentery. The leaves are also used orally for pain during pregnancy. The infusion is used ophthalmically for proptosis, for conjunctivitis, and for corneal disease.

**Leucas mollissima** (lamiaceae)\[^3\]

The leaf juice is applied externally (rubbed on forehead) in headache. The decoction is used orally to treat diabetes mellitus. The decoction is used orally to treat hepatitis. The hot water extract is used orally to treat liver diseases.

**Leucas plukkenetii** (lamiaceae)\[^3\]

The leaves are used orally for curing throat troubles.\[^3\] The twig is orally used as food.\[^3\]

**Leucas stelligera** (lamiaceae)\[^3\]

The plant is used orally in females as an emmenagouge.\[^3\]

**Leucas urticaefolia** (lamiaceae)\[^3\]

The decoction is used orally to expel placenta after delivery in cows. The decoction is used orally to expel placenta after delivery in buffalos.

**Leucas zeylanica** (lamiaceae)\[^3\]

The plant is externally rubbed on abdomen after child birth in human pregnant.\[^3\]

**COMMON COMPOUNDS REPORTED IN GENUS LEUCAS**

**Phenolic compounds**

Plant phenolics are a structurally diverse set of compounds responsible for organoleptic properties of plants with a wide range of therapeutic activity. They occur in plants in the form of simple phenolic acids or as complex structures associated with the oxygenated heterocyclic ring, such as benzoic acid derivatives, stilbenes, tannins, anthocyanins, flavonoids, and coumarins.\[^4\] In plants of the genus *Leucas*, phenolics are found in abundance, Organic acids, namely, methoxybenzyl benzoate, 4-hydroxy benzoic acid, and urtic acid have been isolated from the chloroform fraction of methanolic extract of whole plant of *Leucas urticifolia*.\[^5\] Mishra *et al*. reported 4-(24¢-hydroxy-1¢oxo-5¢- propyltetracosanyl) - phenol from the shoots of *Leucas aspera*.\[^6\] Sadhu *et al*. isolated eight lignans, namely, nectandrin B, (-)-chicanine, meso-dihydroguaiaeric acid, maceflignan, myristagenol B, erythro-2-(4-allyl-2, 6- dimethoxyphephonyx)-1-(4-hydroxy-3-methoxy phenyl) propan-1-ol, machilin C, (7R, 8R)-, and (7S, 8S)-lizarin from the methanol extract of the whole plant of...
**Glycoside**

Two new flavonoidal glucosides leufolin A and B were reported from the ethyl acetate fraction of methanolic extract of whole plant _Leucas urticifolia_.

A novel phenylethanoid glycoside, 3-O-methyl-polimioside and angoroside C, 2-(3-hydroxy-4-methoxyphenyl)- 3-ethyl-O-a-L-rhamnopyranoxylosyl-(1®3)-O-a-L-rhamnopyracetoxylosyl-(1®6)-4-O-E-feruloyl-b-Dglucopyranoside, incanidoside D, martynoside, and acteoside were reported in the methanolic extract of the whole plant of _Leucas i ndica_.

A flavonoidal glycoside, baicalin, reported from the fresh flower of _Leucas aspera_.

Further, the isopimarane-type diterpenoidal glycosides ‘leucasperosides A, B, C and linifolioside reported in _Leucas aspera_ and _Leucas linifolia_.

Flavonoidal glycoside apigenin 7-O-(6¢¢-O-(p-coumaroyl)) - b-Dglucoside has been isolated from the _Leucas aspera_ while cosmosin, anisofolin A, and luteolin 4¢-O-b-D-glucuronopyranoside were reported from _Leucas ephalobate_.

Chandrasekhar et al. reported the isolation of chrysoeriol-6¢¢-(O¢Ac)-4¢-b-glucoside from ethanolic extract of the aerial parts of _Leucas larundulatfolia Rees_.

**Fatty acids**

_Leucas ephalobates_ and _Leucas urticifolia_ seeds were found to have a high content (28% w/w) of laballanic acid. Varying concentrations of oleic acid (87) and linoleic acid (88) were found in _Leucas aspera_, which was contingent upon crop variation.

**Miscellaneous**

_Leucas aspera_ is widely used in countryside as foods and also for nutritional requirement. It is reported to have high content (21.3%) of protein. Structures of some glycosides isolated from _Leucas species_. Significant amounts of total carotenoid and b-carotene. Asperphenamate and alkaloid nicotine have also been reported in _Leucas aspera_.

Long-chain compounds nonatriacontane, 1-dotriacontanol, 1-hydroxytetratriacontan-4-one, 32-methyltetratriacontane were reported in _Leucas aspera_.

Aliphatic ketols, namely, 28-hydroxypentatriacontan-7-one, 7-hydroxy-dotriacontan-2-one, 5-acetoxy-triacontane were isolated from the shoots of _Leucas aspera_. 1-hentriacontan-11-one, 1-dotriacontanol, phytol, and a new diterpene fatty acid ester known as trans-phytaly pmalrate were reported from _Leucas nutans_.

Amyl propionate and isoamylpropionate were present in high concentration in the essential oil fraction of the leaf and flower parts of _Leucas aspera_. Accumulation of heavy metals reported in plants adversely affect the quality, safety, and their medicinal value. Higher concentration of zinc (201 μg/g), iron (809 μg/g), and strontium (133 μg/g), have been reported from _Leucas linifolia_ grown in the North Eastern region of India.

**PHARMACOCOLOGICAL ACTIVITY**

**Anti-inflammatory activity**

The whole plant extract of _Leucas aspera_ was reported to have anti-inflammatory activity and caused degranulation of mast cells. Significant anti-inflammatory activity of the yellow-
colored chromatographic fraction of *Leucas aspera* extract was observed in the chronic and acute models of inflammation. It was observed that the activity was due to the inhibition of histamine and serotonin.\(^{[80]}\) Srinivas *et al.* showed that a dose of 50 mg/kg of *Leucas aspera* dried leaf powder in 2% gum acacia showed significant anti-inflammatory activity, which was found to be better than acetylsalicylic acid in the carrageenin-induced paw edema model and less active than phenylbutazone, when tested in cotton pellet-induced granuloma in rat model.\(^{[80]}\) Goudgaon *et al.* reported that the anti-inflammatory activity of *Leucas aspera* is mainly due to its alkaloidal component, and the tannins present have no role.\(^{[81]}\) Sadhu *et al.* reported that methanol extract of the whole plant at 3 \(\times\) 10\(^{-5}\) g/mL concentration possesses inhibitory anti-inflammatory activity against both PGE1- and PGE2-induced contractions in guinea pig ileum, and the isolated compound (3-O-b-D-glucosyl (1\(\beta\))2)-b-D-glucoside) was found to be mainly responsible for this activity.\(^{[82]}\) Manivannana and Sukumar reported that the bioactive constituents (baicalein and baicalin) of *Leucas aspera* flowers exhibited significant RBC membrane stabilizing activity.\(^{[83]}\) The acetone extract of the roots of this plant was found to possess anti-inflammatory activity in the preliminary studies.\(^{[84]}\) Extract of *Leucas mollissima* Wall also exhibited potent anti-inflammatory activity, which was mainly due to its bioactive constituent, apigenin-7-O-b-D- (6\(\epsilon\epsilon\)-p-coumaroyl) glucoside.\(^{[85]}\)

### CENTRAL NERVOUS SYSTEM ACTIVITY

Methanol and acetone extracts of whole plant of *Leucas lavandulaefolia* possess dose-dependent antinociceptive activity, which may be mediated by their central and peripheral actions.\(^{[86]}\) In a similar study, Ethanolic extract of *Leucas aspera* root showed significant peripheral antinociceptive activity at a dose of 400 mg/kg.\(^{[87]}\) Mukherjee *et al.* reported a yellow-colored fraction from the methanol extract of *Leucas lavandulaefolia*, which exhibited dose-related effects on general and exploratory behavior and muscle relaxant activity in rats and mice.\(^{[88]}\)

### COUGH, COLD, AND ANTI-DIARRHEAL ACTIVITIES

Saha *et al.* reported that the semisolid mass from the yellow-colored band obtained from methanol extract of *Leucas lavandulaefolia* showed significant dose-dependent anti-tussive activity. This effect was comparable to codeine phosphate and suggested that this activity was mediated by the CNS.\(^{[89]}\) Mukherjee *et al.* reported that the ethanol extract of aerial part of *Leucas lavandulaefolia* significantly reduced the incidence and severity of diarrhea in the castor oil-induced diarrhea in rats.\(^{[90]}\)

### ANTI-DIABETIC ACTIVITY

The methanol extracts of whole plant of *Leucas lavandulaefolia* possess a dose-related strong hypoglycemic activity and have similar potency to that of glibenclamide at an oral dose of 400 mg/kg.\(^{[91]}\)

### ANTIMICROBIAL ACTIVITY

Menthone, pulegone, and pipertitone-rich essential oil of *Leucas glabrata* possessed significant antimicrobial activity against selected gram positive and negative bacteria and fungi strains at a concentration of 0.45 to 1.14 mg/mL (MIC).\(^{[92]}\) Significant antimicrobial activity was reported for the alkaloidal fraction and the total methanol extracts the *Leucas aspera* flowers.\(^{[93]}\) The methanol extract of *Leucas zeylanica* and 80% ethanolic extract of *Leucas aspera* leaves were found to exhibit potent inhibitory activity against *Staphylococcus aureus* and *Bacillus subtilis*.\(^{[94]}\) Interestingly, the volatile oil obtained from the leaves of this plant exhibited high sensitivity for *Pseudomonas aeruginosa*, *Haemophilus influenza*, *S. aureus*, and *Candida albicans* but practically no sensitivity against *Bacillus subtilis*, *Proteus vulgaris*, *Neisseria gonorrhoea*, *Trichoderma viride*, and *A. niger*.\(^{[95]}\)

### ANTIOXIDANT ACTIVITY

Methanol extract of the whole plant of *Leucas mollissima* showed insignificant free radical and superoxide anion scavenging activity.\(^{[96]}\) However, significant activity was found in the ethanolic extract of *Leucas aspera* root (IC50 = 7.5 μg/mL).\(^{[97]}\)

### HEPATO-PROTECTIVE ACTIVITY

The chloroform extract of *Leucas lavandulaefolia* whole plant, obtained after defatting with petroleum ether, was found to have hepatoprotective activity in D (+) galactosamine-intoxicated rat model.\(^{[98]}\) The cold methanolic extract of the whole plant of *Leucas aspera* was found to exhibit significant hepatoprotection in CCl4 induced liver damage.\(^{[99]}\)

### CYTOTOXICITY

Various studies using Brine shrimp lethality assay model showed that the hydroalcoholic extract of *Leucas aspera* whole plant exhibited cytotoxicity (LC50 = 1900 μg/mL)\(^{[100]}\) and this activity was more in the root extract (LC50 = 52.8 μg/mL).\(^{[101]}\)

### INSECTICIDAL AND REPELLENT ACTIVITY

*Leucas aspera* leaves are used as mosquito repellent and as insecticide.\(^{[102]}\) These claims were vindicated by extensive studies, which indicated that *Leucas aspera* leaf extract exhibited significant larvicidal activity against first, second, third, and fourth instar larvae of *Culex quinquefasciatus*.\(^{[103]}\) *Leucas aspera* leaf extract (4% solution) showed 90% death of the fourth instar larvae\(^{[104]}\) and 100% death after 24 h were recorded for the third instar larvae of *Anopheles stephensi*.\(^{[105]}\) The petroleum ether extract of the leaves of *Leucas aspera* exhibited LC50 between 100 to 200 ppm against the fourth instar larvae of *C. quinquefasciatus*, *A. stephensi*, and *Aedes aegypti*.\(^{[106]}\) *A. stephensi* larval treatment with *Leucas aspera*
leaf extract resulted in significant fall of its carbohydrate and DNA profile.\cite{54} Further, the highest mortality was seen during the moulting, melanization, and tanning processes, which are controlled by hormones.\cite{106} Hence, the above findings suggest that the larvicide activity of the plant may be due to disturbance in hormonal and metabolic process of larvae. The seed oil obtained from *Leucas cephalotes* and *Leucas urticifolia* failed to show repellent/anti-feedant activity against adult *Tribolium castaneum*. Herbst insect.\cite{54}

### MISCELLANEOUS ACTIVITY

Mukherjee *et al.* reported that yellow-colored chromatographic fraction of the methanol extract of *Leucas lavandulaefolia* showed effects on general behavior pattern of experimental mice and also exhibited tranquilizing effect.\cite{54} Saha *et al.* reported wound healing activity of methanol extract of *Leucas lavandulaefolia* in the excision and the incision wound models in rats.\cite{54} They also observed significant contracting ability, wound closure time, tensile strength, and regeneration of tissues at the wound sites.\cite{54} In another study, the protective role of *Leucas aspera* against the snake (cobra) venom poisoning was studied in mice. This study revealed that *Leucas aspera* alcoholic extract treatment significantly improved the survival time, which may be due to the stabilization of mast cells and inhibition of the secretion of platelet activating factor and histamine.\cite{54}

### CONCLUSION

The following manifestations can be made on the basis of this comprehensive perusal of literature of the plants belonging to genus *Leucas* being used traditionally due to their immense therapeutic potential to treat/cure various diseases. Phenolics and triterpenes are present in plants and exhibit significant biological activity. Many studies demonstrated significant anti-inflammatory activity of the extracts and some isolated constituents obtained from the plants of this genus. This vindicated the use of certain species in the chronic and acute inflammatory diseases including psoriasis, dermatitis, and other skin disorders. A variety of phytoconstituents have been isolated from the different species of the genus *Leucas*. However, only a few species have been explored exhaustively for their chemical constituents and pharmacological activities. Thus, there remains a tremendous scope for further scientific exploration of this genus to establish their therapeutic efficacy and commercial exploitation.

### REFERENCES


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