Medicinally important *Leucas zeylanica* (L.) R. Br.: A review

P. W. H. K. P. Daulagala

Department of Botany, Faculty of Natural Sciences, Kandy Regional Centre, The Open University of Sri Lanka, Polgolla, Sri Lanka

Corresponding Author: pdaulagala@yahoo.com, pwdau@ou.ac.lk

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**Abstract:** Medicinal plants have been used for treatment of many diseases among human beings. Drugs obtained from plants are easily available, less expensive, safe and rarely cause undesirable side effects. *Leucas zeylanica* (Family: Lamiaceae) commonly known as ‘Ceylon Slitwort’ is one such plants that is being used traditionally as herbal medicine, since it contains a diverse range of phytochemicals with promising biological activities. This plant has been investigated for its phytochemicals such as alkaloids, steroids, flavonoids, other phenolic compounds and terpenoids which are responsible for antifungal, antioxidant, antibacterial, antidiabetic, larvicidal and antihelminthic activities. Further, in future, extensive scientific research and commercial exploitation of these phytochemicals have to be performed in the direction of preparation of drugs for treatment of a variety of diseases in humans. This review describes the taxonomic classification, botanical description, distribution, phytochemistry, pharmacological properties and biological activities of phytochemicals extracted from *L. zeylanica*, which will hold its prestigious position in the field of indigenous medicine in future.

**Keywords:** Antimicrobial - *Leucas zeylanica* - Medicinal plants - Pharmacology - Phytochemistry.


**INTRODUCTION**

Medicinal plants are gifts of nature and are of great importance to human health. They have been used to cure a vast number of diseases among human beings all over the world (Kumar & Devanna 2016, Geethika & Kumar 2017). For the past few decades, there has been a global awareness about the cultivation, conservation as well as research of traditionally important medicinal plants (Larsen & Olsen 2007). The basis of this interest lies in their economic feasibility, less toxicity and various pharmacological activities (Samani et al. 2016). Herbs and different drugs derived from plants have been extensively used as traditional medicine all over the world and are popular as alternatives to produce new prospective natural drugs for many aggressive diseases (Rai et al. 2005). According to the data provided by the World Health Organization (WHO), approximately 80% of the world population is using herbal medicine for some aspects of their primary health care by manipulating nearly 70,000 different plant species (Foster et al. 2005).

Research findings indicate that many disease-causing microorganisms have developed resistance to some commercial antibiotics due to the unselcetive use of antimicrobial drugs. This situation has created immense clinical problems in treatments of many infectious diseases. The development of antibiotic resistant microorganisms and their distribution in microbial world encouraged scientists to search for new antimicrobial agents from plants (Davis 1994). Several medicinal plants have been investigated against mitigation and cure of a variety of devastating human diseases such as cancer (Desai et al. 2008). The medicinal importance of these plants is increasing rapidly nowadays and depends upon their chemical constituents that produce marked healing action on the human body. The most important of these agents are alkaloids, flavonoids, phenolic compounds and tannins (Hill 1952, Edeoga et al. 2005). These chemical constituents that produce definite physiological actions in the human body are important sources of antimicrobial agents and of many pharmaceutical drugs.

*Leucas zeylanica* (L.) R. Br., (syn. *Phlomis zeylanica* L., *Leucas sericea* Elm.) commonly known as Ceylon Slitwort, is a species within the genus *Leucas* and belongs to one of the largest and most distinguished families of flowering plants, the Family Lamiaeae (Li & Hedge 1994) which is commonly known as the mint family.
Throughout the world, hundreds of Lamiaceae species are used as medicinal and aromatic plants (Zielinska & Matkowski 2014). In Sri Lanka, there are 63 plant species of family Lamiaceae belonging to 12 genera and out of these 63 species, 51 of them are indigenous and the remaining 12 are endemic (Dassanayake & Fosberg 1981).

**TAXONOMY AND DESCRIPTION**

**Kingdom:** Plantae  
**Subkingdom:** Tracheophyta  
**Super division:** Spermatophyta  
**Division:** Angiospermae  
**Class:** Dicotyledonae  
**Order:** Lamiales  
**Family:** Lamiaceae  
**Subfamily:** Lamioideae  
**Genus:** Leucas  
**Species:** Leucas zeylanica

**Botanical description**

*Leucas zeylanica* is a terrestrial, erect and annual herbaceous plant of about 30–60 cm in height (Fig. 1). The stems are quadrangular, succulent and sub-glabrous. Leaves are simple, packed at the apex of the stems, 3.0–7.5 cm × 0.5–1.5 cm, without stipules and decussate. The petiole is indistinct. The blade is lanceolate, sub-glabrous and shows ably 4–6 pairs of secondary veins which are sunken above and raised below. The margin is laxly lobed and recovered. The inflorescences are dense few-flowered terminal heads. The flowers are pure white and hairy at the base. The corolla is bi-lobed with the lower lobe much larger and indistinctly bifid. The calyx is tubular, sub-glabrous and shows eight tiny lobes. The androecium consists of two pairs of stamens. The fruit consists of four tiny nutlets packed in an accrescent calyx (Wiart 2006).

**Distribution**

*Leucas zeylanica* is native to Southeast Asian countries (Hossain *et al.* 2004) and found in China, India, Sri Lanka, Nepal, Bangladesh, Myanmar, Thailand, Malaysia, Indonesia, New Guinea and Philippines. It grows in various habitats including weedy and sunny localities, often on sandy soils, paddy dams, wastelands, open grasslands and road-sides (Li & Hedge 1994).

**PHYTOCHEMISTRY**

Phytochemicals are biologically active, naturally occurring chemical compounds found in plants, which provide more health benefits for humans than those attributed to macronutrients and micronutrients (Hasler & Blumberg 1999). These compounds are known as secondary plant metabolites and some of them are tannins, alkaloids, terpenoids, steroids, phenolic compounds, polyphenolic compounds and flavonoids, which provide definite physiological actions on the human body (Hill 1952). Each of these secondary metabolites have one or
more of the biological properties such as antioxidant activity, antimicrobial activity, modulation of detoxification of enzymes, stimulation of the immune system, decrease of platelet aggregation, modulation of hormone metabolism and anticarcinogenic property (Rao 2003) and an individual compound may have one or more of these biological properties. These phytochemicals can accumulate in different parts of the plants, such as in the roots, stems, leaves, flowers, fruits or seeds (Costa et al. 1999).

*Leucas zeylanica* is used traditionally to treat various diseases but not scientifically well justified. The leaf extracts of six *Leucas* species including *L. zeylanica* were screened by Geethika & Kumar (2017) for the qualitative analysis of various phytoconstituents such as alkaloids, flavonoids, phenols, tannins, terpenoids, saponins, carbohydrates, proteins and amino acids and glycosides in aqueous, methanol, ethanol and chloroform extracts. The methanolic leaf extract of *L. zeylanica* was found to possess a high amount of phenolics and a minimum quantity of tannins. The results showed that the leaf extracts were poor in alkaloid composition and could be detected only in methanol extracts similar to the tannins. Of the four types of extracts tested, methanol extracts showed the presence of most of the phytochemicals analysed i.e., alkaloids, phenolics, tannins, terpenoids, carbohydrates and glycosides, except flavonoids, saponins, proteins and amino acids. The leaf extract of *L. zeylanica* showed a high degree of composition of carbohydrates in all four extracts. The results depicted above revealed that the phytochemical composition of the extract varied with the solvent used for the extraction of the leaf samples.

Another study based on the phytochemical analysis was carried out by Manoranjan et al. (2018) using the seed, leaf and stem extracts of the plant and found that only the crude ethanol extracts of stem and leaves of *L. zeylanica* contained tannins, and the flavonoids were the common constituent detected in extracts obtained from all three plant parts. Similar to tannins, alkaloids were found only in leaves and stems of *L. zeylanica* and absent in seeds. Further, it was observed that phlobatannins were found only in leaves of *L. zeylanica* but not in other parts of the plant and saponins were not detected in any part of the plant tested.

The phytochemical studies carried out by Mian et al. (2017) using the whole plants of *L. zeylanica* also found the presence of steroids, alkaloids, tannins, phenolic compounds and flavonoids in ethanolic extract used for screening.

**PHARMACOLOGICAL PROPERTIES**

The world is blessed with amusing prosperity of medicinal plants. Human beings have used plants directly or with some modifications as medicine for various health issues for thousands of years. Herbal plants are an integral part of traditional medicine worldwide and most researchers are more focused on natural chemicals in plants than man-made synthetic chemicals due to their environmental, economic and health benefits. Herbal plants are a natural source of numerous important phytochemicals and they are extensively used in many pharmaceutical industries worldwide.

*Leucas zeylanica* is a medicinally important plant and used in countries such as India, Bangladesh, Sri Lanka as a treatment for coughs, cold and headache, toothaches, abdominal pain, scabies, scorpion and snake bites (Caius 1998) and in addition to treat convulsions caused by fever (Yusuf et al. 2007). The fresh juice of leaves is used as a remedy for headache and cold (Chopra et al. 1996). It is also applied to skin diseases. The flowers are used for cough and cold. Further, it is used effectively in the treatment of worm infections by Sri Lankan traditional and ayurvedic physicians. It is also documented that a decoction of *L. zeylanica* can be used as an anthelmintic drug for *Enteroebius vermicularis*, a common parasite that lives in the human digestive system (Ediriweera & Rajapaksha 2014). In Malaysia, the leaves are used in wound healing and also taken as a sedative.

**BIOLOGICAL PROPERTIES**

**Antioxidant activity**

Oxidative stress has been related increasingly to the onset and/or progression of various human diseases such as Parkinson’s disease, Alzheimer’s disease, amyotrophic lateral sclerosis, multiple sclerosis, depression, memory loss, lung and kidney disorders, liver and pancreatic diseases, cancer, ageing, diseases of the reproductive system including the male and female infertility etc. (Rahman et al. 2012). The phytochemical evaluation data of the extracts obtained from the whole plants and the leaves of *Leucas zeylanica* revealed the presence of many phytochemicals (Geethika & Kumar 2017, Mian et al. 2017, Manoranjan et al. 2018), and out of which, flavonoids and phenols are strong antioxidants and have an important role in the human health care system.
Antibacterial activity

According to a study carried out by Rajakaruna et al. (2002), a total of six bacteria, i.e. Gram-positive Staphylococcus aureus (methicillin-resistant), Bacillus subtilis, Enterobacter faecalis, Gram-negative Escherichia coli, Pseudomonas aeruginosa H187 (wild type) and a non-acid fast bacterium Mycobacterium phlei were screened against some medicinal plant extracts including L. zeylanica for antibacterial activity using disc diffusion assay. The results showed that the extract of L. zeylanica produced the largest zones of inhibition against the two bacteria Staphylococcus aureus and Bacillus subtilis and the activity of the extract was either light induced or light enhanced.

Abdullah et al. (2019) tested the potential of L. zeylanica leaf extract to eliminate Escherichia coli and Staphylococcus aureus in Corbicula fluminea (“Etak”), a freshwater mollusc species regularly consumed as a popular snack among the Kelantanese in Malaysia. The antibacterial properties of methanolic leaf extract of L. zeylanica was tested using disc diffusion assay and the results obtained exhibited that 70 μg ml⁻¹ of L. zeylanica extract was the optimum concentration to give the effect of 10.6 mm and 14.8 mm inhibition zones for Escherichia coli and Staphylococcus aureus respectively.

Antifungal activity

In an investigation carried out by Babu et al. (2016), the antifungal activities of methanol extract of L. zeylanica leaves was tested against a group of different dermatophytes named Candida tropicalis, Candida albicans, Trichophyton mentagrophytes, Microsporum gypseum, Microsporum nanum, Aspergillus flavus, Epidermophyton floccum and Penicillium sp. using agar well diffusion assay. Out of those fungi tested, some were susceptible to leaf extracts of L. zeylanica (except Microsporum gypseum, Microsporum nanum and Epidermophyton floccum) with the highest activity against Penicillium sp. with a zone of inhibition of 10 mm, which is nearer to control where the control clotrimazole showed an inhibition zone of 10.5 mm. L. zeylanica leaf extract showed the minimum activity against Candida tropicalis (inhibition zone of 0.45 mm), but a considerably reduced activity against the yeast Candida albicans was recorded with 4 mm diameter of an inhibition zone.

Antifungal activity of ethanolic extracts of leaves, stem and seeds of L. zeylanica was detected against Aspergillus sp., Penicillium sp., Trichoderma sp., Mucor sp. and Rhizopus sp. using the agar streaking assay (Manoranjan et al. 2018) and it was found that seed and stem extracts of L. zeylanica exhibited the antifungal activity against Mucor sp. of the fungi tested.

Larvicidal (mosquitocidal) activity

In work performed by Hung et al. (2019), the essential oil obtained from the aerial parts of L. zeylanica grown in Vietnam was examined for larvicidal activity against the Aedes mosquitos, one of the most important vectors of arboviruses such as dengue (Gubler 1998), yellow fever (Barrett & Higgs 2007) Chakungunya (Dhimal et al. 2015) and many other diseases of humans and animals.

The essential oils obtained by hydrodistillation and analyzed by gas chromatography-mass spectrometry were screened against Aedes aegypti and Aedes albopictus. Mortality of mosquito larvae was recorded after 24 hours and 48 hours of exposure to the L. zeylanica essential oil during which no nutritional supplement was added. L. zeylanica essential oil showed good larvicidal activity against both Aedes albopictus and Aedes aegypti with median lethal concentration LC₅₀ (24 hours) values of 67 and 44 μg ml⁻¹ respectively.

Antidiabetic activity

The antidiabetic potentiality of L. zeylanica plants was analyzed using a decoction prepared form the leaves and introducing it orally to 30 male Albino Wistar rats (Rattus norvigicus) in five experimental groups by Dutta et al. (2016). The study was designed to evaluate the blood glucose lowering effect of the aqueous extract of L. zeylanica leaves using the alloxan-induced diabetic rats and compared the activity with diabetic control and antidiabetic drug (Glibenclamide). The results showed that the extracts of L. zeylanica produced significant changes in serum glucose and cholesterol level in alloxan-induced diabetic rats. The prolonged treatment of the leaf extracts produced a consistent reduction in blood glucose levels. The continuous treatment with the leaf extract of L. zeylanica for 10 days produced a significant decrease in the blood glucose levels of the diabetic rats, but not in the normal rats.

Anti-helminthic activity

Radhika & Bindu (2018) tested the leaf extracts of L. zeylanica for the anti-helminthic activity using an Indian adult earthworm (Pheretima posthuma) which has anatomical and physiological similarity with the intestinal roundworm parasites of human beings. Earth worms were placed in Petri dishes containing two species regularly consumed as a popular snack among the Kelantanese in Malaysia. The antibacterial properties of methanolic leaf extract of L. zeylanica was tested using disc diffusion assay and the results obtained exhibited that 70 μg ml⁻¹ of L. zeylanica extract was the optimum concentration to give the effect of 10.6 mm and 14.8 mm inhibition zones for Escherichia coli and Staphylococcus aureus respectively.
different concentrations (10 and 20 mg ml\(^{-1}\)) of ethanolic and acetone extract of leaves of *L. zeylanica*. Time taken for paralysis or death was noted. The observations showed that the anti-helminthic activity of ethanol extract was more effective compared to the acetone extract. The earthworms were more sensitive to the ethanol extracts at 20 mg ml\(^{-1}\) concentration as compared to the reference drug albendazole.

A decoction prepared from the *L. zeylanica* plants was tested for worm infection with special reference to *Enterobius vermicularis*, a parasite that lives in the human digestive system and is universally common, especially among school-age children (Ediriweera & Rajapaksha 2014). A hundred patients suffering from *E. vermicularis* infections were selected and fifty of them were given 120 ml of decoction of *Leucas zeylanica* twice a day for 7 days. The remaining fifty patients were given 120 ml of placebo twice a day for 7 days as the control treatment. From the results obtained, it was concluded that decoction of *L. zeylanica* can be used as an effective, low-cost, and indigenous treatment for *Enterobius vermicularis* infections among humans.

CONCLUSION

Presently there is an increasing interest in worldwide on herbal medicines and researches are carrying out to investigate the pharmacological properties of their phytochemical constituents and their use in treating many human diseases. The results of the studies carried out by many researchers revealed that the type and the number of phytochemical constituents obtained from *Leucas zeylanica* plants varied with the method and solvent used during the extraction. Among them, ethanol and methanol were considered as more suitable solvents. Phytochemical and pharmacological investigations revealed the presence of various chemical constituents such as alkaloids, phenolic compounds, steroids, flavonoids and terpenoids which are responsible for antifungal, antioxidant, antibacterial, antidiabetic, larvicidal and antihelminthic activities. Further extensive scientific exploration and commercial utilization of these phytochemicals have to be done in the direction of quality preparation of drugs from *L. zeylanica* in future for the treatment of a variety of disease conditions among humans.

REFERENCES


