

# Biochemical components and biological functions of *Mesosphaerum suaveolens* (L.): a comprehensive review

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## Abstract

Plants are a primary source of diverse secondary metabolites, many of which hold promising potential as future therapeutic agents. The biosynthesis of these metabolites is influenced by both biotic and abiotic factors, resulting in the accumulation of various phytochemicals and their derivatives that contribute to drug discovery and development. *Mesosphaerum suaveolens* (L.), an underexplored medicinal weed, has traditionally been used in Asia as a herbal tea, in India as food and a source of essential oil, and in folk medicine for treating fever, inflammation, and improving blood circulation. Its extracts are also valued for their distinct aromatic and organoleptic properties. This study highlights the biochemical profile, pharmacological activities, and therapeutic potential of *M. suaveolens*, emphasizing its role as a reservoir of bioactive compounds with relevance to future drug development.

**Keywords:** *Mesosphaerum suaveolens*, Antioxidant, Phytochemicals

## Introduction

*Mesosphaerum suaveolens* (L.), a plant native to tropical America, has now spread widely across tropical and subtropical regions of the world, where it is often recognized as a pantropical weed. Throughout history, nature has served as a repository of remedies for human ailments <sup>[1]</sup>. Modern pharmacological research provides scientific validation for many traditionally used medicinal plants, revealing their bioactive compounds and therapeutic potential.

The pharmacological value of plants is largely attributed to their diverse secondary metabolites, which are synthesized in different plant parts and at various stages of development. Species of this genus have traditionally been employed to treat multiple ailments and have been reported to possess tumorigenic, antifertility, antimicrobial, mycotoxic, and phytotoxic properties <sup>[2]</sup>. Phytochemical studies of *M. suaveolens* have identified diterpenoids, triterpenoids, flavonoids, lignans, and other metabolites. Notably, the chemical composition—particularly terpenoid content varies across species and geographical locations, influencing the properties of their essential oils <sup>[3]</sup>.

Hyptis species, including *M. suaveolens*, are known for their strong aromatic compounds, which are often associated with medicinal activity, making their essential oils a subject of extensive study <sup>[4]</sup>. In traditional medicine, various parts of the plant are used to manage different health conditions. For instance, decoctions are used for treating boils, eczema, and diabetes in northern Nigeria <sup>[4,5]</sup>. Crushed leaves are applied for migraines, while leaf and inflorescence infusions are used as stimulants, carminatives, diuretics, and antipyretics <sup>[6]</sup>. Whole-

plant decoctions have also been employed to treat diarrhea and kidney disorders.

Nutritionally, *M. suaveolens* is reported to contain proteins, carbohydrates, fats, fibers, alkaloids, tannins, saponins, flavonoids, and terpenoids, along with minerals such as potassium, calcium, and magnesium <sup>[7]</sup>. Pharmacological studies highlight its antioxidant, antimicrobial, antidiarrhoeal, anticancer, antidiabetic, anti-inflammatory, and insecticidal activities. Despite its widespread use, a comprehensive evaluation of the plant's efficacy across these dimensions has been limited. Given its dual value as both a food source and medicinal agent, this review provides an overview of the phytochemistry and biological activities of *M. suaveolens*, a plant that is often dismissed as a weed <sup>[8]</sup>.

## Phytochemistry

Plants produce a wide range of phytochemicals with valuable applications in medicine, cosmetics, and industry. Extracts of *M. suaveolens* have been obtained through various methods including Soxhlet extraction, maceration, and steam distillation, using solvents such as petroleum ether, chloroform, methanol, ethanol, n-hexane, and water <sup>[9]</sup>.

Phytochemical screenings confirm the presence of alkaloids, flavonoids, terpenoids, and tannins across most extracts, with saponins detected in some cases. Reported compounds include suaveolique acid, suaveolol, methyl suaveolate, rosmarinic acid, methyl rosmarinate, oleanolic acid, ursolic acid, and several lupane derivatives <sup>[19, 21-23]</sup>. Essential oils form a major component of its phytochemistry and contribute significantly to its pharmacological activity <sup>[10]</sup>.

**Biological activities****Antidiarrhoeal activity**

Diarrhea remains a major cause of malnutrition and dehydration, particularly in children and populations with poor sanitation. Ethanol leaf extracts of *M. suaveolens* have shown significant antidiarrhoeal activity in castor oil-induced diarrhea models in mice. Further studies are needed to isolate and characterize the bioactive compounds responsible for these effects [12].

**Anti-inflammatory activity**

Suaveolol and methyl suaveolate, isolated from *M. suaveolens*, demonstrated dose-dependent anti-inflammatory effects comparable to indomethacin in a mouse ear model of croton oil-induced dermatitis [13]. These findings support the traditional use of the plant for inflammatory conditions and highlight its potential in developing anti-inflammatory therapeutics [14].

**Antidiabetic activity**

Aqueous, methanol, and ethanol extracts of *M. suaveolens* have been evaluated in alloxan-induced diabetic rats, with significant hypoglycemic effects reported. The activity is attributed to the presence of tannins, terpenoids, and flavonoids. Acute toxicity studies suggest that methanol extracts are relatively safe [15, 16].

**Anticancer activity**

Essential oils from *M. suaveolens*, rich in terpenoids such as sabinene,  $\beta$ -caryophyllene, spatulenol, elemene, and 1,8-cineole, have shown cytotoxic effects against MCF-7 breast cancer cell lines [18]. Ethanol extracts induce apoptosis through inhibition of the anti-apoptotic protein Bcl-2 [17]. Ursolic acid, one of the major constituents, modulates mitochondrial metabolism, enhances reactive oxygen species production, and activates p53-mediated apoptosis, further supporting its anticancer potential [19, 20].

**Antioxidant activity**

The methanol leaf extract of *M. suaveolens* exhibits strong antioxidant properties, as demonstrated by DPPH radical scavenging assays. The IC<sub>50</sub> values indicate significant free radical scavenging capacity, confirming its role as a natural antioxidant source [21, 22].

**Antifertility activity**

Petroleum ether, alcohol, and aqueous extracts of *M. suaveolens* were tested in pregnant rats, with alcoholic leaf extracts showing complete antifertility effects at specific doses (125–150 mg/kg). Further studies are required to determine the exact mechanism and safe application of these extracts [23].

**Conclusion**

Phytochemical studies on *Mesosphaerum suaveolens* reveal a rich profile of bioactive compounds, predominantly mono- and sesquiterpenes. These secondary metabolites exhibit diverse

pharmacological properties, including antioxidant, anticancer, antidiabetic, antifertility, anti-inflammatory, and antimicrobial activities. Despite being widely regarded as a weed, *M. suaveolens* holds significant nutritional and medicinal value. Further comprehensive studies are warranted to validate its therapeutic efficacy and explore its potential applications in modern medicine.

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