



REVIEW ARTICLE

Essential Oil Components of Lemon grass leaves (Cymbopogon citratus) and its Importance: A Narrative Review

Juveriya Israr ^a, Indrajeet Singh ^b, Hara Prasad Mishra ^{c, *}, Smruti Sikta Mishra ^d, Shabroz Alam ^e, Ram Krishna ^f, Khursheed Ahmad ^g, Harsh Mehra ^h, Goutam ^h

^a Department of Biosciences and Technology, Shri Ramswaroop Memorial University Lucknow- Deva Road, Barabanki, Lucknow, Uttar Pradesh, India-226003

^b Department of Biotechnology, Faculty of Engineering and Technology, Rama University, Mandhana, Kanpur, Uttar Pradesh, India-209217

^c Department of Pharmacology, University College of Medical Sciences, University of Delhi, Delhi, India-110095

^d University of Delhi, Delhi, India- 110002

^e Department of Biotechnology, Era Medical University, Lucknow, Uttar Pradesh, India- 226003

^f Department of Botany, D.A.V. (PG) College, Muzaffarnagar-251001

^g Department of Zoology, University of Lucknow-226007

^h University College of Medical Sciences, University of Delhi, Delhi, India-110095

ARTICLE INFO

ABSTRACT



Received 11 March 2023;
Revised 22 April 2023;
Accepted 13 May 2023.

Keywords:

Lemongrass, Essential oil, Poaceae, Citral, Aromatic.

Cymbopogon citratus, sometimes known as lemongrass, belongs to the Poaceae family. It is a medicinal plant that contains chemicals that can inhibit the growth of pathogens and boost the body's natural defenses against infectious disorders. Lemongrass is frequently used in baked goods, confections, herbal teas, and other non-alcoholic beverages. Lemongrass essential oil is frequently used as a scent in perfumes and beauty products like creams and soaps. The creation of beta carotene, and other nutrients is derived from citral, which is present in high concentrations in lemongrass essential oil. Lemon grass oil is therefore used in several pharmaceutical businesses for its anti-depressant, analgesic, antipyretic, bactericidal, and antiseptic properties due to the presence of diverse chemical elements.

An official publication of the Global Pharmacovigilance Society.

Introduction

Lemongrass is a tall shrub with broad, unevenly striped leaves. It has a distinctive aroma that is smokey, sweet, herbaceous, and lemony. The herb *Cymbopogon flexuosus* is frequently used to make soups, curries, and drinks. This plant has a relaxing quality. It belongs to the

Poaceae family. It grows in many tropical and subtropical regions of Southeast Asia, Africa, and other continents. The grass known as lemon grass (*Cymbopogon citratus*) is indigenous to Sri Lanka, Pakistan, and India (Manzoor et al., 2013). Other than the foothills of Sikkim and Arunachal Pradesh, the Western Ghats (Kerala,



* Corresponding Author

Hara Prasad Mishra

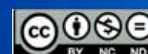
E-mail: drharaprasad20@gmail.com

Contact: +91 79827 71498

* Copyright: 2582-7235 // © 2023 The Author(s).

Published by Global Pharmacovigilance Society.

This is an open-access article under the CC BY-NC-ND license.



Available online 1 June 2023

Maharashtra), Karnataka, and Tamil Nadu states are in India (Tzortzakis et al., 2007). A tall perennial grass with the common name "lemongrass," *Cymbopogon citratus*. It is a member of the *Cymbopogon* genus of aromatic grasses and has essential oils with a delicate lemon flavour. Lemongrass is widely used as a vital health ingredient in Asia. It is used as a central nervous system sedative in India (Schaneberg et al., 2002). The monoterpene components of the *Cymbopogon* essential oils, such as limonene, citral, elemol, citronellal, 1,8-cineole, citronellol, linalool, geraniol, methylheptenone, b-carophyllene, geranylformate, and geranyl acetic acid derivatives, are what distinguish them. GC-MS is typically used to chemically characterize essential oils (Ahmad et al., 2007, Al-Maskri et al., 2011, Arshad et al., 2014). One of the key components of the oil found in a few species of *Cymbopogon*, citral, has major modern applications as a raw material for vitamin A, confections, and perfumes (Singh et al., 2011). By cramming several lemongrass plants into a pot or nursery bed, a small piece of the tropics can be grown. This herb adds one additional quality to the nursery along with the textural splendor and growth of a luxury grass: lemon-flavored leaves with a hint of ginger. In tropical nations, the herb *Cymbopogon citratus*, sometimes known as lemongrass, is a common source of medications (CARD, 2007). Plant leaves are used to make tea and are commonly used in

Brazil as a diuretic, analgesic, antipyretic, spasmolytic, and tranquilizer. On a dry basis, this plant contains 1% to 2% essential oil. Due to its genetic variability, environment, and agronomic treatment, lemon grass oil (LGO) has a significantly varied chemical makeup (Tzortzakis et al., 2007). Citral (geranial and neutral isomers) is a compound found in high concentrations in lemongrass essential oil and is utilized as a source for the manufacture of beta-carotene, vitamin A, and other compounds. For a variety of pathogenic fungi, LGO's antimicrobial activity is employed (Vardar-Ünlü et al., 2003). Originally from tropical Asia, lemon grass is now cultivated all over the world. Due to its mild citrus flavor, dried and fresh lemongrass leaves are frequently used in Asian curries, teas, and soups. They are also appropriate for chicken, shellfish, and fish. South American and African nations use this plant extensively as an aromatic herb. Furthermore, its aerial components are frequently used in folk medicine to treat gastrointestinal issues, diabetes, nervous system issues, inflammation, and fever. In recent years, functional lemongrass components have been identified. Mono- and polymeric flavonoids, such as apigenin glycosides, luteolin, and proanthocyanidins, have been acknowledged as making a significant contribution to the antioxidant and anti-inflammatory properties of an important oil-free lemongrass infusion (Amirdivani, 2011).



(a) Whole plant



(b) Dried leaves



(c) Essential oil

Figure 1: Lemongrass Plant (Plant and derived products)**Taxonomical Classification**

Kingdom: Plantae

Division: Magnoliophyta

Class: Liliopsida

Order: Poales

Family: Poaceae

Genus: *Cymbopogon* SprengSpecies: *citratus***Pharmacology**

There are still many pharmacological studies that can be done based on the substances, even if many more have already been done. The results of these studies are summarised in the paragraphs that follow. Additionally, the pharmacological profiling of *Cymbopogon citratus* has been tabulated in Table 1.

Table 1: Pharmacological profiling of *Cymbopogon citratus* (Opeyemi, 2015).

Property	Pharmacological effect
Cytotoxicity	Shows high toxicity against Chinese Hamster Ovary (CHO) cells (IC ₅₀ = 10.63 µg/mL) and moderately toxic against human fibroblast cell line 138 (W138) cells (IC ₅₀ = 39.77 µg/mL).
Insecticidal	LC ₅₀ of 48.6 µL/L against housefly larvae
Neurobehavioral effects	Capability to serve as a sedative, anxiolytic, and anticonvulsant.
Antitrypanosomal	Modest activity against <i>Trypanosoma brucei</i> ; IC ₅₀ = 1.837 ± 0.13 µg/mL
Anti-diabetic	Shows activity against poloxamer-407-induced type 2 diabetic (T2D) in Wistar rats
Chemopreventive activity	Inhibits the early phase of hepatocarcinogenesis in the rat

Antibacterial Activity

The essential oil's chromatographic fraction on an agar plate proved effective against *Salmonella paratyphi*, *Escherichia coli*, *Staphylococcus aureus*, *Bacillus subtilis*, and *Shigella flexneri* (Onawunmia et al., 1984). Two of the three major oil components discovered using chromatographic and mass spectrometric techniques exhibit these behaviors. Myrcene, the third component, did not exhibit any discernible antibacterial activity on its own, but the -citral (geranial) and -citral (neral) components independently elicit an antibacterial response on gram-negative and gram-positive organisms. When the volatile oil extract was oxidized using the active oxygen technique, the extract was still functional. (Wannissorn et al., 2005).

Anti-inflammatory Activity

As compared to carrageenan-induced pedal edema, the hot water extract of the dried leaves given to rats proved effective (Carbajal et al., 1989).

Antimalarial Activity

As opposed to chloroquine, the active compounds of *Cymbopogon citratus* were shown to limit *Plasmodium berghei* development by 86.6% (assuming chloroquine's 100% inhibition as the reference point (Tchoumboungang, 2005).

Hypoglycemic and Hypolipidemic Effects

In experimental rats, a fresh leaf aqueous decoction of *Cymbopogon citratus* reduced fasting plasma glucose, total cholesterol, triglycerides, low-density lipoproteins, and very low-density lipoprotein in a dose-dependent manner while increasing plasma high-density lipoprotein levels in a dose-dependent manner. However, the plasma triglyceride levels were unaffected (Adeneye, 2007).

Lemon grass is a very essential medicinal plant for the treatment and prevention of many diseases due to its unique qualities and chemical composition.

Conflict of Interest**Antimutagenicity**

In several models, the ethanolic extract of lemon grass demonstrates an antimutagenic effect. It also slows the development of fibrosarcoma cells implanted in mice, hence preventing lung metastasis (Vinitketkumnuen et al., 1994). In the rat colon, the plant extract is known to suppress the development of azoxymethane-induced DNA adducts and aberrant crypt foci (Puatanachokchai et al., 1994). After being initiated with diethylnitrosamine, the plant extract had inhibitory effects on the early stages of hepatocarcinogenesis in 344 male Fischer rats (Puatanachokchai et al., 2002).

Discussion

Cymbopogon citratus, sometimes known as lemongrass, belongs to the Poaceae family. It is a medicinal plant that contains chemicals that can inhibit the growth of infections and boost the body's natural defenses against infectious disorders. Lemongrass is frequently used in baked goods, confections, herbal teas, and other non-alcoholic drinks. Lemongrass essential oil is frequently used as a scent in perfumes and beauty products like creams and soaps. Citral, a substance found in large quantities in lemongrass essential oil and used as a source for the creation of beta carotene, vitamin A, and other compounds, is one such compound. Lemon grass oil is therefore used in several pharmaceutical businesses for its anti-depressant, analgesic, antipyretic, bactericidal, and antiseptic properties due to the presence of diverse chemical elements.

Conclusion

Many types of phytochemicals identified in the *C. citratus* components and the therapeutic potential connected to them have been highlighted in this review.

The authors declare that there is no conflict of interest.

References

- Adeneye, A.A. Agbaje, E.O. (2007). Hypoglycemic and hypolipidemic effects of fresh leaf aqueous extract of *Cymbopogon citratus* Stapf in rats. *J Ethnopharmacol*;112:440-4.
- Ahmad, M.A. Hanif, R. Nadeem, M.S. Jamil, M.S. Zafar. (2008). Nutritive evaluation of medicinal plants being used as condiments in the South Asian Region. *Journal of the Chemical Society of Pakistan*. 30(3): 400-405.
- Al-Maskri, A.Y. M.A. Hanif, M.Y. Al-Maskari, A.S. Abraham, J.N. Al-sabahi, O. Al-Mantheri. (2011). Essential oil from *Ocimum basilicum* (Omani Basil): a desert crop. *Natural product communications*. 6(10): 1934578X1100601020.
- Arshad, Z. M.A. Hanif, R.W.K. Qadri, M.M. Khan. (2014). Role of essential oils in plant diseases protection: a review. *International Journal of Chemical and Biochemical Sciences*. 6: 11-17.
- Amirdivani, S. A.S. Baba. (2011). Changes in yogurt fermentation characteristics, and antioxidant potential and in vitro inhibition of angiotensin-1 converting enzyme upon the inclusion of peppermint, dill and basil. *LWT-Food Science and Technology*. 44(6): 1458-1464.
- Carbajal, D. Casaco, A. Arruzazabala, L. Gonzalez, R. Tolon, Z. (1989). Pharmacological study of *Cymbopogon citratus* leaves. *J Ethnopharmacol* 1989;25:103-7.
- C.A.R.d.A. Costa. (2007). Estudo da ação ansiolítica e sedativa de preparações obtidas de *Cymbopogon citratus* (DC) Stapf.
- Francisco, V. G. Costa, A. Figueirinha, C. Marques, P. Pereira, B.M. Neves, M.C. Lopes, C. García-Rodríguez, M.T. Cruz, M.T. Batista. (2013). Anti-inflammatory activity of *Cymbopogon citratus* leaves infusion via proteasome and nuclear factor- κ B pathway inhibition: contribution of chlorogenic acid. *Journal of ethnopharmacology*. 148(1): 126-134.
- Lertprasertsuke, N. Matsushima, T.(1994). Antimutagenicity of lemon grass (*Cymbopogon citratus*, Stapf) to various known mutagens in *Salmonella* mutation assay. *Mutat Res* ;341:71-5.
- Manzoor, F. N. Naz, S.A. Malik, S. Arshad, B. Siddiqui. (2013). Chemical Composition of Essential Oils Derived from *Eucalyptus* and *Lemongrass* and Their Antitermitic Activities Against *Microtermes Mycophagus* (Desneux). *Asian Journal of Chemistry*. 25(5): 2405.
- Melo SF, Soares SF, Costa DR, Silva DC, Oliveira DM, Bezerra RJ, et al. (2001). Effect of the *Cymbopogon citratus*, *Maytenus ilicifolia* and *Baccharis genistelloides* extracts against the stannous chloride oxidative damage in *Escherichia coli*. *Mutat Res*;496:33-8.
- Opeyemi A, Opeoluwa O, Pamela R, Nkeh-Chungag B, Oyedeji A. (. 2015). *Cymbopogon* Species; Ethnopharmacology, Phytochemistry and the Pharmacological Importance. *Molecules*; 20:7438-7453.
- Onawunmia, G.O. Yisak, W.A. Ogunlana, E.O.(1984). Antibacterial constituents in the essential oil of *Cymbopogon citratus* (DC.) Stapf. *J Ethnopharmacol*;12:279-86.
- Puatanachokchai R. Antimutagenicity, cytotoxicity and antitumor activity from lemon grass (*Cymbopogon citratus*, Stapf) extract.(1994). Master's thesis, Faculty of Medicine. Thailand: Chiang Mai University.
- Puatanachokchai R, Kishida H, Denda A, Murata N, Konishi Y, Vinitketkumnun U, et al. (2002). Inhibitory effects of lemon grass (*Cymbopogon citratus*, Stapf) extract on the early phase of hepatocarcinogenesis after initiation with ethylnitrosamine in male Fischer 344 rats. *Cancer Lett*;183:9-15.
- Schaneberg, B.T. I.A. Khan. (2002). Comparison of extraction methods for marker compounds in the essential oil of lemon grass by GC. *Journal of agricultural and food chemistry*. 50(6): 1345-1349.
- Singh, B.R. V. Singh, R.K. Singh, N. Ebibeni. (2011). Antimicrobial activity of lemongrass (*Cymbopogon citratus*) oil against microbes of environmental, clinical and food origin. *International Research Journal of Pharmacy and Pharmacology*. 1: 228-236.
- Tchoumboungang F, Zollo PH, Dagne E, Mekonnen Y. (2005). In Vivo Antimalarial Activity of Essential Oils from *Cymbopogon citratus* and *Ocimum gratissimum* on Mice Infected with *Plasmodium berghei*. *Planta Medica*;71:20-3.
- Tzortzakis, N.G. C.D. Economakis. (2007). Antifungal activity of lemongrass (*Cymbopogon citratus* L.) essential oil against key postharvest pathogens. *Innovative Food Science & Emerging Technologies*. 8(2): 253-258.
- Vardar-Ünlü, G. F. Candan, A. Sökmen, D. Daferera, M. Polissiou, M. Sökmen, E. Dönmez, B. Tepe. (2003). Antimicrobial and antioxidant activity of the essential oil and methanol extracts of *Thymus pectinatus* Fisch. et Mey. Var. *pectinatus* (Lamiaceae). *Journal of Agricultural and Food Chemistry*. 51(1): 63-67.
- Wannissorn, B. Jarikasem, S. Siriawang, ai, T. (2005). Antibacterial properties of essential oils from Thai medicinal plants. *Fitoterapia*;76:233-6.