



Pharmacognostical Investigation of *Cymbopogon citratus* (DC) Stapf

Kumar Ravinder¹, Krishan Pawan², Swami Gaurav¹, Kaur Paramjot², Shah Gagan³ and Kaur Appramdeep¹

¹CT institute of Pharmaceutical Sciences, Jalandhar, INDIA

²Punjabi University, Patiala, INDIA

BIS College of Pharmacy, Moga, INDIA

Abstract

Cymbopogon (lemon grass, lemongrass, citronella grass or fever grass) is a genus of about 55 species are indigenous in tropical and semi-tropical areas of Asia and are cultivated in South and Central America, Africa and other tropical countries. The essential oil of *Cymbopogon citratus* contains Citral α (40%), citral β (32%), nerol (4.18%), geraniol (3.04%), citronellal (2.10%), terpinolene (1.23%), geranyl acetate (0.83%) etc and all are important raw material used in the pharmaceutical, perfumery and cosmetics industries, especially for the synthesis of Vitamin A and ionones. Citral possesses various biological activities i.e neurobehavioral effect, larvicidal activity, hypoglycemic and hypolipidemic effects, hypocholesterolaemic effect, free radical scavengers and antioxidants effect, ascaricidal activity, antiprotozoan activity, antinociceptive effect, antimycobacterial activity, antimalarial activity, anti-inflammatory activity, antifungal activity, antifilarial activity, antidiarrhoeal activity, anti bacterial activity and anti amoebic effect

Keywords: *Cymbopogon citratus*, Citral, Hypoglycemic, Anti-inflammatory activity.

INTRODUCTION

Taxonomy

Current Name: *Cymbopogon citratus* (DC.) Stapf
Family/Genus: Poaceae (Graminae)

Synonym(s)

Lemon grass stalk
Andropogon citratus

Common names

Brazil - Capim-cidrao, Capim-santo

Egypt	-	Lemon grass
English	-	Lemon grass, Citronella, Squinant
Ethiopia	-	Tej-sar
Hindi	-	Sera, Verveine
Indonesian	-	Sereh
Italian	-	Cimbopogone
Malaysia	-	Sakumau
Mexico	-	Zacate limon
Swedish	-	Citrongräs
Thailand	-	Ta-khrai
Turkish	-	Limon otu
USA	-	Citronella

Classification [1]

Kingdom	-	<i>Plantae</i> – Plants
Subkingdom	-	<i>Tracheobionta</i> – Vascular plants
Super division	-	<i>Spermatophyta</i> – Seed plants
Division	-	<i>Magnoliophyta</i> – Flowering plants
Class	-	<i>Liliopsida</i> – Monocotyledons
Subclass	-	<i>Commelinidae</i>
Order	-	<i>Cyperales</i>
Family	-	<i>Poaceae</i> – Grass family
Genus	-	<i>Cymbopogon</i> Spreng. – Lemon grass
Species	-	<i>Cymbopogon citratus</i> (DC.) Stapf – lemon grass

Ethnopharmacology

Argentina: Decoction of leaf is taken orally with “mate” tea for sore throat, empacho, and as an emetic.[2]

Brazil: The tea made from its leaves is popularly used as antispasmodic, analgesic, anti-inflammatory, antipyretic, diuretic and sedative. [3,4]

Cuba: Hot water extract of dried leaves is taken orally as a hypotensive, for catarrh and rheumatism. [5]

Egypt: Hot water extract of dried leaves and stem is taken orally as a renal antispasmodic and diuretic. [6]

India: Fresh entire plant is said to repel snakes [7]. Two to three drops of essential oil, in hot water is taken orally for gastric troubles. For cholera, a few drops of oil with lemon juice are taken orally [8] . Hot water extract of dried leaves is used for bathing in cases severe headache and fever. [7] . A tea prepared from lemon grass is used as a sedative for the central nervous system. [9].

Indonesia: Hot water extract of the entire plant is taken orally as an emmenagogue [10]

Malaysia: Hot water extract of the entire plant is taken orally as an emmenagogue [11].

Thailand: Fresh entire plant is inhaled as a fragrance and eaten as a condiment [12]. Hot water extract of dried entire plant is taken orally as a stomachic [13]. Hot water extract of dried root is taken orally for diabetes [14]

USA: Hot water extract of entire plant is used externally by Laotian Hmong in Minnesota for healing wounds and bone fractures [15] .

Description***Geographical source***

C. citratus is native is native to Sri Lanka and South India and is now widely cultivated in the tropical areas of America and Asia. [16, 17] .

Botanical description

Lemongrass is equally versatile in the garden. This tropical grass grows in dense clumps that can grow to 6 ft (1.8 m) in height and about 4 ft (1.2 m) in width, with short rhizome. [18].

Leaves

The straps like leaves are 0.5-1 in (1.3-2.5 cm) wide, about 3 ft (0.9 m) long, and have gracefully drooping tips. The evergreen leaves are bright bluish-green and release a citrus aroma when crushed.

Leaf arrangement: most emerge from the soil, usually without a stem.

Leaf type: simple

Leaf margin: entire

Leaf shape: linear

Leaf venation: parallel

Leaf type and persistence: fragrant

Leaf blade length: 18 to 36 inches

Leaf color: green

Fall characteristic: showy

Flowers

The lemongrasses plants that you are likely to encounter are cultivars and do not typically produce flowers or flowering panicles are rarely formed.

Inflorescence

Inflorescences are 30 to 60 cm long and nodding, the partial inflorescences are paired racemes of spikelets subtended by spathes [19]

Microscopy of leaf

In cross sections of lemongrass leaf blades and leaf sheaths, only discrete single cells stain with Schiff's reagent. These oil cells possess a dense content that stains red, indicative of the presence of aldehydes, most likely geranial and neral, the major components of lemongrass essential oil. The oil cells are parenchymatous cells embedded in the adaxial side of the leaf mesophyll , commonly appearing adjacent to non-photosynthetic tissues, between the vascular bundles of this C₄ grass. Leaf sheaths also contain similarly stained oil cells. The oil cells, both in sheaths and blades, are morphologically indistinguishable from their neighboring parenchymal cells, except that they contain secreted material. In addition, the cell walls of the oil cells are highly fluorescent, indicating a high degree of lignification, confirmed by phloroglucinol-HCl staining. [20]

Chemical constituents***Essential oils***

The chemical composition of the essential oil of *C. citratus* varies according to the geographical origin, the compounds as hydrocarbon terpenes, alcohols, ketones, esters and mainly aldehydes

have constantly been registered [21,22]. The essential oil (0.2 to 0.5%, West Indian lemon grass oil) consists of mainly citral [23]. Citral is a mixture of two stereoisomeric monoterpene aldehydes, the trans isomer geranial (40 to 62%) dominates over the cis isomer neral (25 to 38%) [24, 25].

Table: composition of essential oil in *C.citratu*s. [26-29]

Essential oil composition	Percentage of components
Citral α	40.8%
Citral β	32%
Nerol	4.18%
Geraniol	3.04%
Citronellal	2.10%
Terpinolene	1.23%
Geranyl acetate	0.83%
Myrcene	0.72%
Terpinol	0.45%
Methylheptenone	0.2%
Borneol	0.1-0.4%
Linalyl acetate	0.1%
α Pinene	0.07%
β Pinene	0.04%

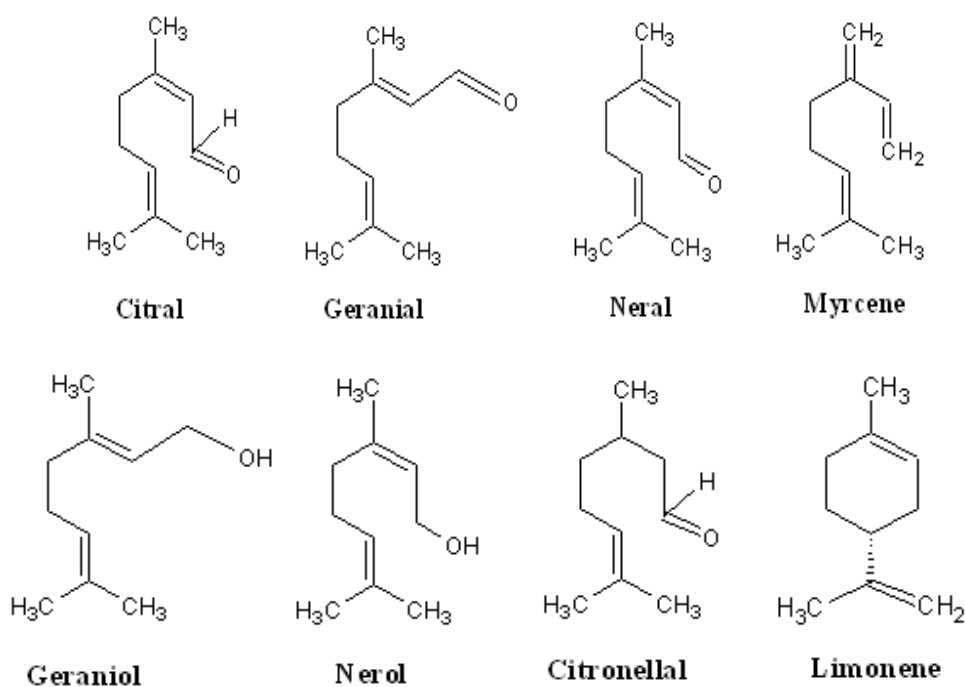
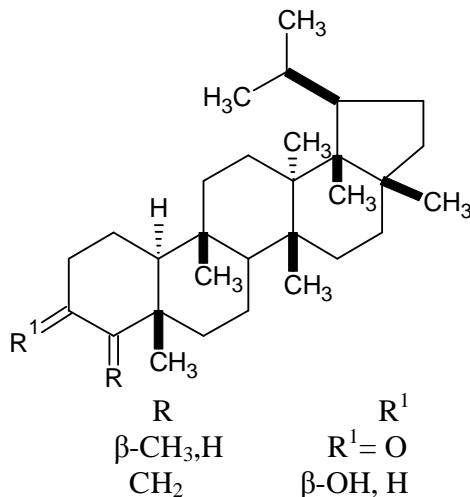


Fig 1 . Chemical structure of the major constituents of lemongrass essential oil.[30]

Triterpenoids

Isolated and identified new tripernoids from leaf wax namely is cymbopogone and cymbopogonol [31].



- (1) Cymbopogone
- (2) Cymbopogonol

Fig 2. Basic chemical skeleton of tripernoids

Flavonoids & Phenolic compounds

It consists of luteolin and its 6-C and 7-O –glycosides, [32] (Guanasingh and Nagarajan, 1981), isoorientin 2'-O-rhamnoside [33] and isolation of the flavonoids quercetin, kaempferol and apiginin [34] from aerial parts. The phenolic compounds elimicin, catecol, chlorogenic acid, caffeic acid and hydroquinone isolated from plant [35] .

Biological activities**Anti amoebic effect**

Essential oil in broth culture was active on *Entamoeba histolytica*. [36]

Anti bacterial activity

Chromatographic fraction of essential oil in agar plate was active on *Bacillus subtilis*, *Escherichia coli*, *Staphylococcus aureus* [37,38] and *Salmonella paratyphi*, *Shigella flexneri*. [39]. These activities are shown in two of the three main components of the oil identified through Chromatographic and mass spectrometric methods. While the α-citral (geranial) and β-citral (neral) components individually elicit antibacterial action on gram-negative and gram-positive organisms, the third component, myrcene, did not show observable antibacterial activity on its own. [37] The extract was also active when the volatile oil extract was oxidized via the active oxygen method. [40,41,42,43]

Antidiarrhoeal activity

C. citratus stalk decoction reduced the faecal output in a dose-dependent manner. [17]

Antifilarial activity

Fresh leaves were active on *Setaria digitata*. [44]

Antifungal activity

Lemon grass oil active against such dermatophytes as *Trichophyton mentagrophytes*, *T. rubrum*, *Epidermophyton floccosum*, *Microsporum gypseum* [45] and among the most active against human dermatophyte. Other studies reported that lemon grass oil actions against keratinophilic fungi, 32 ringworm fungi [46, 47] and food storage fungi [48]. Lemongrass oil also effective as an herbicide and an insecticide, because of these naturally occurring antimicrobial effects.

Anti-inflammatory activity

Hot water extract of dried leaves administered intragastrically to rats was active vs. carrageenin-induced pedal edema. [5]

Antimalarial Activity

The essential oils of *C. citratus* were found to produced 86.6% suppression in growth of *Plasmodium berghei* when compare to chloroquine (taking inhibition by chloroquine as 100%) [49]

Antimutagenicity

The ethanolic extract of Lemon grass extract exhibits anti-mutagenic activity in various models [50,51,52] and retards the growth of fibrosarcoma cells transplanted in mice in association with prevention of lung metastasis [53]. Plant extract shown to inhibition on the formation of azoxymethane induced DNA adducts and aberrant crypt foci in the rat colon [54]. Plant extract inhibitory effects on the early phase of hepatocarcinogenesis after initiation with diethylnitrosamine in male Fischer 344 rats.

Antimycobacterial activity

Essential oil in agar plate was active on *Mycobacterium smegaris*.

Antinociceptive effect

Essential oil of *C. citratus* possesses a significant antinociceptive activity. Comparing the results obtained with three different experimental models of nociception (hot-plate, acetic acid-induced writhings, and formalin test) we can speculate that essential oil acts both at the peripheral and central levels. [55]

Antiprotozoan activity

A dose-dependent antiprotozoan effect of the essential oil of *C. citratus* could be observed on two strains of *Crithida deanei*. [56]

Ascaricidal activity

Fresh leaf essential oil has ascaricidal activity. [57]

Free Radical Scavengers and Antioxidants effect

Methanol, MeOH/water extracts, infusion, and decoction of *C. citratus* were shown free radical scavenging effects by measuring the bleaching of the 1, 1-diphenyl-2-picryl-hydrazyl (DPPH) radical, scavenging of the superoxide anion, and inhibition of the enzyme xanthine oxidase and lipid peroxidation in human erythrocytes. [58]

Hypocholesterolaemic effect

The elevated cholesterol concentration was significantly lowered in the animals given the plant extract. This reduction was found to be dose dependent. This result shows that the extract possesses hypocholesterolaemic potential. [59]

Hypoglycemic and hypolipidemic effects

Fresh leaf aqueous extract of *C. citratus* was administered in normal rats lowered fasting plasma glucose and total cholesterol, triglycerides, low-density lipoproteins, very low-density lipoprotein dose dependently while raising the plasma high-density lipoprotein level in same dose-related fashion but with no effect on plasma triglycerides level. [60]

Larvicidal activity

Fresh leaf essential oil has larvicidal activity. [57]

Neurobehavioral effect

Essential oil was evaluated for sedative/hypnotic activity through pentobarbital sleeping time, anxiolytic activity by elevated plus maze and light/dark box procedures and anticonvulsant activity through seizures induced by pentylenetetrazole and maximal electroshock. Essential oil was effective in increasing the sleeping time, the percentage of entries and time spent in the open arms of the elevated plus maze as well as the time spent in the light compartment of light/dark box. In addition, essential oil delayed clonic seizures induced by pentylenetetrazole and blocked tonic extensions induced by maximal electroshock, indicating the elevation of the seizure threshold and/or blockage of seizures spread. [61]

CONCLUSION

The present study show the essential oil of cymbopogon citrates have the various important constituents such as Citral α (40%), citral β , nerol, geranicol, citronellal, terpinolene, geranyl acetate etc and these all chemical components of cymbopogon citrates useful in various biological and pharmacological effects i.e. neurobehavioral effect, larvicidal activity, hypolipidemic effects, hypocholesterolaemic effect, free radical scavengers and antioxidants effect, ascaricidal activity, antiprotozoan activity, antinociceptive effect, antimycobacterial activity, antimalarial activity and hypoglycemic effect etc.

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