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CYMBOPOGON: A DIVERSE MEDICINAL HERB IN PHARMACY

Swati S. Barve[1*], Kirti D. Mahale[1], Sunil K. Mahajan[2]

[1]Post Graduate Student, [1]Post Graduate Student, [2]Head of Department,
[1]Department of Pharmaceutical Quality Assurance, [1]Department of Pharmaceutical Quality Assurance, [2]Department of Pharmaceutical Chemistry
MGV'S Pharmacy College, Panchavati, Nashik.
*- swati.barve1997@gmail.com

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Abstract:

Lemon grass (Cymbopogon species), is an individual from Poaceae family, which is known worldwide for its high essential oil content. They are broadly dispersed over all landmasses where they are utilized for different purposes. The business and restorative employments of different species are all around reported. Since days of year, the plant is used as helpful operator in Ayurveda, Unani, society, innate and locals. The plants involve different healthful (minerals and nutrients) and non-wholesome (strands, dynamic phytochemicals, including the flavonoids, terpenoids, lignans, sulfides, polyphenolics, carotenoids, coumarins, saponins, plant sterols, curcumins, and phthalides) part which makes personality of the plant as an intense helpful operator. The current paper features the properties of Lemon grass (Cymbopogon giganteus, Cymbopogon caesius, Cymbopogon jwarancusa, Cymbopogon commutatus, Cymbopogon densiflorus) remembering different synthetic constituents for lemon grass oil bestowing it upper, pain relieving, antipyretic, bactericidal, hostile to septic, carminative and astringent properties. These plants may likewise hold guarantee as intense enemy of tumor and chemopreventive medications. It has likewise been expended in different structures in Thai, Vietnamese and South East Asian cooking styles. The plant is additionally connected with wellbeing cases, for example, treatment in hacks, clogging, elephantiasis influenza, gum disease, migraine sickness, jungle fever, ophthalmia, pneumonia, vascular clutters, the runs and stomach hurt. It has additionally been asserted as mitigating, vasorelaxing, diuretic, and cure in treating ringworm invasion, apprehensive, gastrointestinal unsettling influences, fevers and hypertension. Lemon grass has high cancer prevention agent levels. The article likewise clarifies different extraction strategies for lemongrass fundamental oil. Henceforth this writing audit plans to examine these species and investigate their potential financial significance.

Keywords- *Lemon grass, Cymbopogon species, Poaceae, Citral, Essential oil.*

Corresponding author:
Swati S. Barve,
Post Graduate Student,
MGV'S Pharmacy College, Panchavati, Nashik.
**E-Mail:* *swati.barve1997@gmail.com*

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INTRODUCTION:

Lemon grass is a tall, fragrant, lasting plant having huge striped leaves with a lopsided edge. It is broadly known for its smoky, sweet, herbaceous and lemony aroma. It has a place with variety Cymbopogon, family Poaceae [1]. It contains fundamental oils with a fine lemon enhance. It is utilized as narcotics in India [2]. The basic oils acquired is portrayed by a few monoterpene constituents, ex. Limonene, citral, elemol, citronellal, 1, 8-cineole, citronellol, linalool, geraniol, methylheptenone, b-carophyllene, geranylformate and geranyl acetic acid derivative. GC-MS is commonly utilized for the compound portrayal of the basic oils [3-5]. In a few species of *Cymbopogon*, citral (geranial and neural isomers) is one of the significant chemical constituents of the oil having its uses in confectionery, perfumery and crude material for vitamin A (source for production of beta carotene) [6]. It is generally utilized in Asian (curries, teas, soups, poultry, fish and fish) and Thai cooking in blend with chile peppers, garlic and cilantro. In tropical nations this lemongrass herb (*Cymbopogon*) is generally utilized as a wellspring of medication [7]. In Brazil, the plant leaves are utilized as analgesic, antipyretic, spasmolytic, tranquilizer, anti-inflammatory and diuretic. Due to its genetic diversity, habitat and the agronomic treatment of this plant the chemical constituents of the oil vary widely [8]. It is also used over various pathogenic fungi due to its antimicrobial actions [9]. The plant is local to tropical Asia and now-a-days has become around the world. The Latin and African nations expend the herb generally. Additionally, the herb is utilized in the society meds for treatment of stomach related clutters, diabetes, anxious confusion, irritation and fever [10]. The mono-and polymeric flavonoids, such as apigenin glycosides, luteolin and proanthocyanidins strongly contribute to the antioxidant and anti-inflammatory characteristics [11]. These plants may likewise hold guarantee as powerful enemy of tumor and chemoprotective medications. The chemotypes from this variety have been utilized as biomarkers for their identification and classification [12]. *Cymbopogon* variety involves around 120 species. It develops in the sub-tropical and tropical locales of the world because of its wide uses in beauty care products, nourishment, pharmaceutical, and agribusiness and flavour enterprises. The high aldehyde substance of the *Cymbopogon* is answerable for its lemony scent [13]. Other than citral (more than about 75%), geranyl acetic acid derivative, geraniol and monoterpene olefins are likewise present in limited quantity [14]. It is likewise utilized as an enhancing operator in different nourishment items.

History

Lemon grass, a lasting plant usually developed in the sub-tropics and tropics, assigns two distinct species, West Indian, *Cymbopogon citrates* and East Indian, *Cymbopogon flexuosus*. It is called as the tropical Asia East Indian lemon grass on the grounds that different types of the lemon grass are local toward the South East Asia, South Asia and Australia (Sri Lanka, India, Thailand and Burma) (*Cymbopogon flexuosus*) otherwise called the Cochin or Malabar grass and for the related West Indian lemon grass (*Cymbopogon citratus*) [15]. In 17th century, lemon grass was being distilled for export. At world's fair at London crystal place in 1951, the first samples of closely related citronella oil were displayed. It is favourite oil in India for many years and is known locally as "choomana polu" which refers to the plant red grass stem [16]. The lemongrass is monetarily developed in the India, Guatemala, Paraguay, and the People's Republic of China, Sri Lanka, England and different pieces of Africa, Indochina, South America and Central America. Lemon grass a medicinal plant has been considered as an insect repellent and carminative. West Indian lemongrass is accounted for to have solid antimicrobial activity additionally goes about as a focal sensory system depressant. Fundamental oils of East Indian lemongrass have solid antifungal activity. The unpredictable oils additionally have some mutagenic and pesticidal activity. *Cymbopogon nardus* is a wellspring of citronella oil. Lemongrass has been generally accepted as safe plant extract/essential oil for the human consumption. It is one of the most versatile plants. It produces delicious herbal tea, which is often used in cooking as an efficient antibiotic and a near impermeable barrier to weeds. Incredibly fast to become established and drought tolerant [17].

Table 1: Botanical Classification of lemon grass.

Kingdom	Plantae
Unranked	Angiosperms
Unranked	Monocots
Unranked	Commelinids
Order	Poales
Family	Poaceae
Subfamily	Panicoideae
Tribe	Andropogoneae
Subtribe	Andropogoneae
Genus	*Cymbopogon*

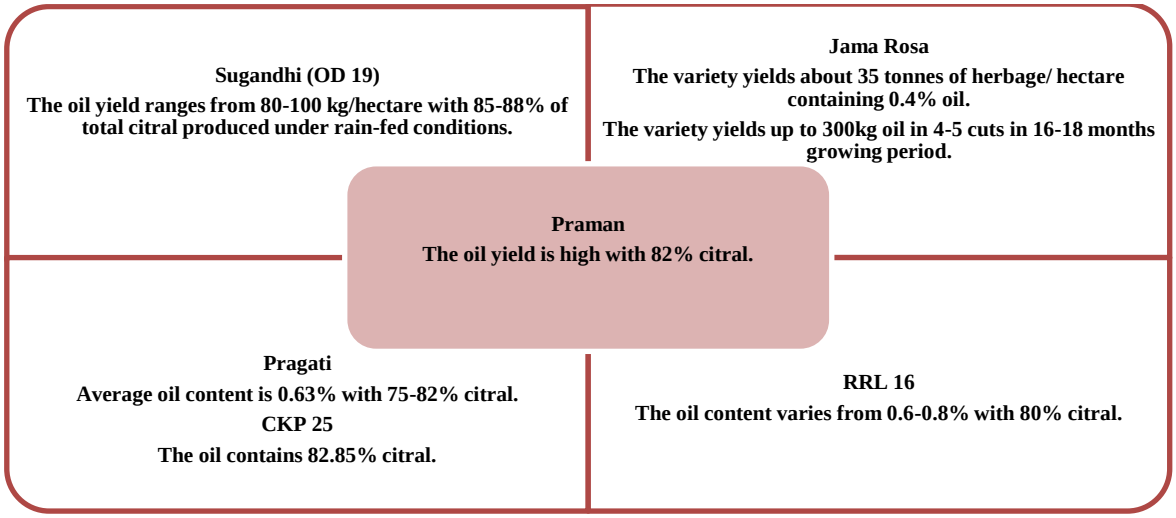


Fig 1: Currently grown varieties and their description.

Chemical composition

1. ***Cymbopogon giganteus*:** Hydrodistillation of the air-dried leaves of *Cymbopogon giganteus* gave oil yield of 0.91% (w/w) respectively. A total of 27 compounds representing 95.3% of the oils were identified in the essential oils of *Cymbopogon giganteus*. The major constituents in the oil were cis-p-mentha-1(7),8-dien-2-ol (19.4%), trans-p-mentha-2,8-dien-1-ol (16.4%) and limonene (13.7%). This composition is similar to those obtained in previous works [18-21].

2. ***Cymbopogon caesius***: Analysis of the *Cymbopogon caesius* oil by GC/MS revealed the presence of 35 compounds, of which 24 were identified (98.46% of the oil). The major constituents of the oil were, perillyl alcohol (25.6%), citronellal (6.8%), limonene (7.2%), geraniol (19.8%), citronellol (6.7%). Other additional 21 compounds were also identified in minor quantity namely, camphene (4.14%), myrcene (0.14%), methyl heptanone (0.46%), terpinolene (1.74%), linalool (0.97%), isopulegol (4.64%), borneol (0.85%), bornyl acetate (0.60%), eugenol (0.04%), citronellyl acetate (2.61%), perillaldehyde (4.01%), elemol (3.86%), guaiol (1.12%), caryophyllene oxide (0.84%), α-thujene (0.57%), α-pinene (0.99%), α-terpineol (0.54%), β-caryophyllene (0.85%) [22].

3. ***Cymbopogon jwarancusa:*** The major compositions of the essential oil of *C. jwarancusa* leaves were analysed by GC-MS, total compounds identified are 92.58%. The major components of *C. jwarancusa* were piperitone (54.36%), α-phellandrene (30.86%), limonene (3.4%), p-cymene (1.57%). Some additional components are, geranial, neral, myrcene, β-pinene, p-cymene (1.57%), caryophyllene oxide, δ-cymene (1.57%), β-guaiane, geraniol, nerol, linalool, β-guaiane, β-caryophyllene (0.82%), geranyl acetate, methyl heptanone, trans-piperitol, terpinolene, (-)elema-1,3,11-(13)-trien-12-ol[23].

4. ***Cymbopogon commutatus***: The essential oil of *Cymbopogon commutatus* was subjected to qualitative and quantitative analysis by FC and FC-MS, revealed the presence of 14 compounds. The major constituents of the oil were geraniol (64.26%) and geranyl acetate (15.79%). Other components which were present in minor quantity are, 2-caren-4-ol (0.08%), geranyl formate (0.07%), caryophyllene (0.81%), cadinen delta (0.08%), candinen butyrate (0.37%), elemol (0.91%), elemicin (0.03%), carpronsaure geranyl ester (0.50%), caren (2) (0.41%), geraniol-6,7-epoxid (0.07%), β-elemen (0.13%), α-eudesmol (0.06%) [24].

5. ***Cymbopogon densiflorus:*** The chemical characterization of essential oil was achieved by GC-MS, showed the monoterpenes as a major class of components, with trans-p-mentha-2,8-dien-1-ol (10.07%), cis-p-mentha-2,8-dien-1-ol (7.90%), trans-p-mentha-1-(7),8-dien-2-ol (20.68%), cis-piperitol (12.18%) and cis-p-mentha-1-(7),8-dien-2-ol (18.09%). Some additional components are, limonene (0.17%), isopulegol (0.16%), nerol oxide (0.33%), trans-dihydro carvone (0.18%), cis-4-caranone (6.78%), verbenone (1.49%), trans-carveol (2.37%), carvone (4.35%), isoamyl hexanoate (0.62%), perilla aldehyde (0.88%), ethyl 2-octynoate (0.21%), isoamyl octanoate (1.04%), (E)-nerolidol (0.10%), spathulenol (0.17%), caryophyllene oxide (0.24%), phenyl ethyl-2-hexanoate (0.53%), phenyl ethyl-2-octanoate (0.15%), abienol (0.81%),

oxygenated monoterpene (88.66%), hydrocarbon monoterpene (1.25%) [25].

Major Chemical Constituents

1. Antioxidants

   Antioxidants are substances which have the capability to neutralize or decrease the adverse effects of reactive oxygen species, reactive nitrogen species or both on normal physiologic function in humans [26]. The antioxidants from plant origin (natural antioxidants) have huge applications in food industry for increasing the stability and shelf life of food products. These also find use as nutraceuticals and phytoceuticals as they have significant impact on the status of human health and disease prevention [27]. Natural antioxidants, such as phenolics, flavonoids and tannins, possess more potent antioxidant activity than common dietary plants. Compounds responsible for such antioxidant activity can be isolated and used for prevention and treatment of free radical-related disorders [28].

2. Tocopherols

   Tocopherols are very important natural antioxidants. They can be divided into two groups: tocols and tocotrienols. Cereals and legumes are rich sources of tocopherols [29]. Oils and green vegetables are also sources of tocopherols [30]. The antioxidant mechanism of tocopherols involves reactions with free radicals (especially the peroxyl radical), resulting in the formation of a relatively stable phenoxy radical. Another mechanism of tocopherols includes singlet oxygen scavenging and quenching [30].

3. Carotenoids

   Carotenoids are yellow, orange or red pigments, which are found in high concentrations in certain edible fruits or roots (carrots, tomatoes, etc) [31]. Structurally they are long chain polyisoprenes with 40 carbon atoms. Some of them are precursors of vitamin A and may play antioxidant activity. Due to the delocalization mechanism of unpaired electrons over the conjugated polyene system (the radical trapping ability of carotenoids) it is less likely for the formed radical to take part in chain processes [32]. Carotenoids are effective O2 quenchers and quenching of singlet oxygen is due to an energy transfer from O2 to the carotene. Quenching also depends on the number of conjugated double bonds in carotene [33].

4. Flavonoids

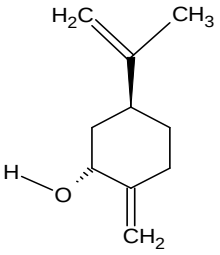
   Flavonoids represent a large and diverse group of phenolic compounds derived from higher plants. These aromatic compounds are formed in plants from the aromatic amino acids, phenylalanine, tyrosine and acetate units [34]. Flavonoids can display wide range of substitution patterns and oxidation states and are divided into flavonols, flavanonols, flavones, flavanones, catechins (flavan-3-ols) and anthocyanins. They have long been recognized as possessing anti-inflammatory, antiallergic, antimicrobial, hepatoprotective, antiviral, antimutagenic/anticarcinogenic and many more properties [35]. The antioxidant function and enzyme modifying actions of flavonoids could account for many of their pharmacological activities [36]. The compounds appear to possess variable mechanisms of action, which include radical Scavenging and metal ion complexation. Flavonoids having more hydroxyl groups, or hydroxyl groups ortho to one another, are more effective antioxidants. The B ring of flavonoids is more electron rich than the A and C rings and hence the B ring is primarily attacked by radicals [17].

5. Ascorbic acid

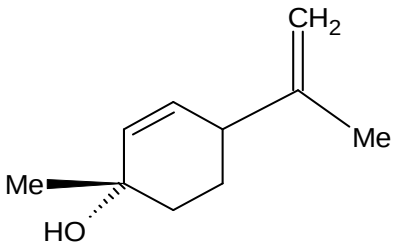
   This vitamin occurs in rather high concentrations naturally in many fruits and vegetables. Ascorbic acid acts as a multifunctional antioxidant and as a synergist for primary antioxidants. In the presence of higher concentrations of metal ions, ascorbic acid can show pro-oxidant properties by reducing back oxidized metal ions after which they can initiate new free radical reactions [31, 38].

Table 2: Plant Variety, its Common names, Family, Regions, Parts Used, and Major Chemical Constituents.

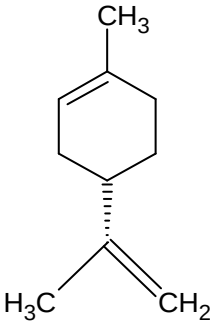
Species	Common name	Family	Region	Parts used	Uses	Major chemical constituent	References
Cymbopogon giganteus	Tsauri grass	Poaceae	Cameroon, West Africa	Decoctions of leaves and flowers	Used against bronchopulmonary affections, pain from scorpion's bite, Febrifuge, Antimalarial, Anticteric	Cis-p-mentha-1(7), 8-dien-2-ol (19.4%), trans-p-mentha-2, 8-dien-1-ol (16.4%), limonene (13.7%)	[19, 39, 40, 41, 42]
Cymbopogon caesius	Broad-leaved turpentine, Kachi grass, Buchu grass	Poaceae	Southern and Eastern Africa	Leaves	Antifungal, Antibacterial	Perillyl alcohol (25.6%), citronellal (6.8%), limonene (7.2%), geraniol (19.8%), citronellol (6.7%)	[22, 43, 44]
Cymbopogon jwarancusa	The Limon, oilgrass	Poaceae	Egypt, Africa (52 species), Asia (45 species) (found at roadside)	Root, flower and leaves	Root- to treat feverish condition, Flower- styptic, Leaves- antibacterial and antifungal	Piperitone (54.36%)	[23, 45, 46, 47]
Cymbopogon commutatus	Incense grass, Aromatic rush, Camel's hay	Poaceae	North-eastern Arabia	Leaves	Insect repellent, kidney problems, jaundice, bladder inflammation	Geraniol (64.26%)	[24, 48, 49]
Cymbopogon densiflorus	Abafado, Bai Mak Nao, Fever Grass, Bhustrina	Poaceae, Gramineae	Central and Western Africa (in Malawi, the Congo and Gabon) Southern Asia (In warm climates)	Leaves	Antioxidant, to treat Asthma, abdominal pain, epilepsy	Monoterpenes with trans-p-mentha-1(7).8-dien-2-ol (20.68%)	[25, 50-54]



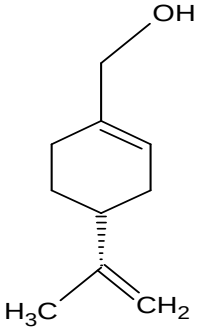
Cis-p-mentha-1(7), 8-dien-2-ol



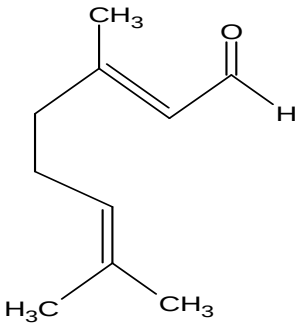
trans-p-mentha-2, 8-dien-1-ol



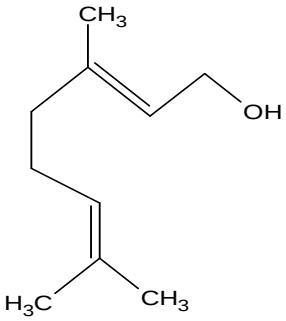
Limonene



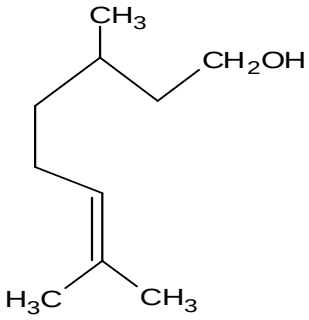
Perillyl alcohol



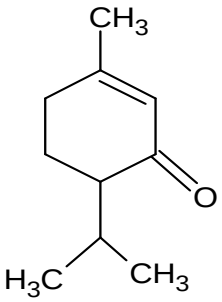
Citronellal



Geraniol



Citronellol



Piperitone

Fig 2: Structures of the chemical constituents in the *Cymbopogon* species.

Fig 3: Pictures of above mentioned *Cymbopogon* species.
a. *Cymbopogon giganteus*, b. *Cymbopogon caesius*, c. *Cymbopogon jwarancusa*, d. *Cymbopogon commutatus*, e. *Cymbopogon densiflorus*.

Extraction process of lemongrass essential oil

1. Solvent Extraction Method-

Accurately weighed sample of dry lemongrass leaves (about 150 gm) is should be taken in a clean beaker of suitable size. To it, n-hexane is added (about 500 ml). The mixture of leaves and n-hexane is to be shaken well and covered appropriately to avoid any evaporation of solvent. This mixture should be allowed to stand for 36 hours undisturbed in a clean and dry place away from sunlight to avoid evaporation of solvent. This process allows complete extraction of oil from the leaves. After the period of 36 hours is completed the extract is decanted into another clean beaker and, to this decanted extract ethanol is added (about 200 ml), because the oil is soluble in ethanol. This mixture of extract and ethanol is then transferred to a separating funnel. The mixture is shaken well and

then allowed to obtain equilibrium on the basis of their densities. This process is known as liquid-liquid extraction. The lower layer (ethanolic) and upper layer (hexane) are collected in 2 separate containers and should be placed in a water bath at 70-80°C to remove the ethanol leaving behind pure essential oil. This method is suitable for the plant materials which are heat sensitive and can degrade due to high temperatures [55].

2. Steam Distillation Method-

Steam distillation is a special type of distillation process mainly used for the separation of aromatic oils from heat sensitive materials. There are two types of steam distillation process: water/steam distillation and steam distillation. Accurately weighed sample of fresh lemongrass leaves (about 150 gm) should be placed in a suitable size of two-way RBF. To this distilled water should be added (about 250 ml approx.). The RBF is stoppered with a rubber cork connected to a condenser. Steam is allowed to pass directly into the mixture from the steam generator. The contents in the RBF are heated at a low temperature to just make water boiling. As the water starts boiling the steam generated into the flask release these volatile aromatic molecules from the plant materials. These escaped molecules then evaporate with the steam which travels to the condenser, where the temperature is controlled by passing water at RT counter currently through it. Further, these vapours condense and are collected in a receiver which is maintained at a low temperature with the help of an ice bath to prevent the evaporation of the volatile molecules. Further, this water-oil mixture is transferred in to a separating funnel and on the basis of the difference in the densities of oil and water oil is separated from water and stored in a tightly closed container. This process can also be carried by using only steam. This method is used widely and is also economical as it does not require any expensive solvents [55].

3. Soxhlet Extraction Method-

In this method, the sample (fresh or dry leaves of lemongrass) is placed in a thimble-holder, and during the operation is gradually filled with the condensate fresh solvent from the distillation flask. When the liquid reaches the overflow level, a siphon aspirates the solute of the thimble-holder and unloads it back into the distillation flask, carrying the extracted bulk liquid. The process is repeated continuously till the extraction is completed. The most significant drawback of this extraction process is the long time period required for the extraction. Also, a large amount of solvent is wasted during the process and also may cause environmental problems. As the extraction is carried out at the boiling temperatures of the solvents used, this may result in thermal decomposition of the extracted materials. Also, the Soxhlet assembly is unable to provide agitation, which would help accelerate the process. As the amount of solvent used is large its evaporation/concentration is mandatory. This process is restricted to solvent selectivity [56].

4. Supercritical Fluid Extraction Method (SFE)-

This method utilizes the temperature and pressure combination for the gases at which they behave as non-polar solvents to extract the materials. Desirable compounds can be extracted leaving behind undesirable compounds by this method by manipulating the solvating power of the gases with a change in its temperature or pressure. Generally, carbon dioxide (CO_2) is used as a solvent in SFE as it is non-flammable, noncorrosive, inexpensive, and has generally recognized as safe (GRAS) status. It also minimizes the potential of isomerization and hydrolysis during the extraction, due to low extraction temperatures (generally less than 100°C) and since water is not used during the extraction process. Other advantages of this method are, increased diffusion coefficient and low viscosity, lack of surface tension allowing for rapid diffusion, and lack of chemical residue. This method is a powerful technique in the field of separation technology. It produces the products with a high value added as the process operates at low temperatures and prevents contamination of the extracts from solvents. This prevents the thermal decomposition of the extracts as the process is carried out at low temperatures and also has a high product recovery. It is a non-toxic, non-explosive and cheaper as CO_2 is used as a solvent for extraction [56].

5. Hydro-Distillation Method-

This is one of the most frequently used methods for the extraction of essential oils from plant materials. This method is non-expensive as water is used as a solvent for extraction and also separation of oil from water is much easier than any other solvent. However, some compounds of the essential oil are water-soluble, especially at elevated temperatures can produce losses and smaller oil yields [56].

Table 3: Comparison of Percentage Yield produced by Solvent Extraction Method and Steam Distillation Method.

Method of Extraction	Yield (gm/150 gm sample)	Yield (%)
• Solvent Extraction Method • Steam Distillation Method	• 1.90 gm • 1.01 gm	• 1.30% • 0.70%

Solvent extraction method produces high essential oil content than steam distillation method because most volatile content is lost during the heating process in steam distillation method [56].

Table 4: Plant Variety Showing Inhibitory Actions Against below mentioned Microbial Species.

Sr. No.	Plant Variety	Microbial Species Inhibited
1.	*Cymbopogon giganteus*	Escherichia coli, Staphylococcus aureus, C. schoenanthus, Amblyomma variegatum.
2.	*Cymbopogon caesius*	Citrobacter, Klebsiella pneumoniae, Proteus mirabilis, Salmonella entericaser. Typhi and Shigella flexneri and Candida albicans, Trichophyton rubrum, Aspergillus niger, Aspergillus fumigatus.
3.	*Cymbopogon jwarancusa*	Streptococcus pyogenes, Salmonella typhi and Aspergillus fumigatus, Streptococcus equinus (ethanolic extract), Streptococcus pneumoniae (diethyl ether extract), Aspergillus fumigatus (acetone extract).
4.	*Cymbopogon commutatus*	--
5.	*Cymbopogon densiflorus*	Staphylococcus aureus, Streptococcus agalactiae, S. pyogenes, Enterococcus faecalis, Bacillus subtilis, Escherichia coli, Proteus mirabilis, P. fluorescens, Streptococcus pneumoniae, Salmonella typhi, S. typhi, S. paratyphi, Klebsiella pneumoniae.

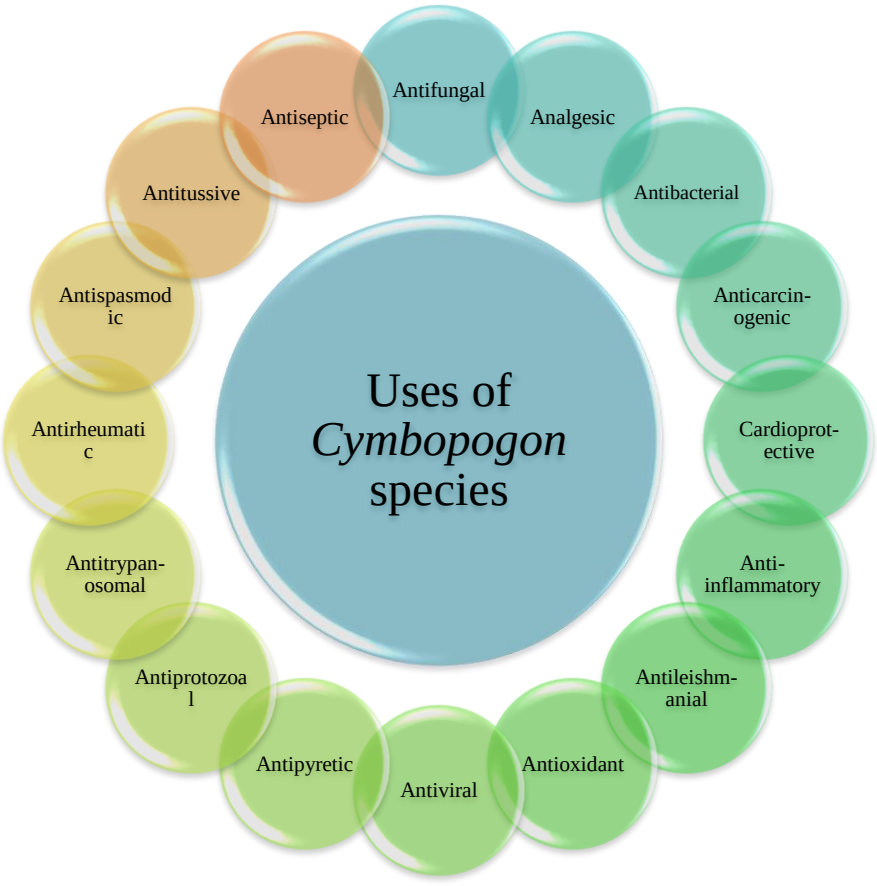


Fig 4: Pharmacological actions of *Cymbopogon* species.

Other Applications of Lemongrass-

1. Herbal Cookies
   Lemongrass powder is a superior method to include wholesome advantages in the treats. These treats were discovered competent in disease, diabetes, aggravation. As far as possible for human (Based on tests in rodents) is 0.7/mg/kg of body weight/day. These treats were found to increment in proximate piece with increment in level of lemongrass powder. The natural treats contain alkaloid (0.27%), saponin (0.20%), tannin (0.16%), steroids (0.10%), phenols (0.08%) and flavonoids (0.28%) in sensorially chose test. The example with 3% lemongrass powder was seen as exceptionally worthy over another example [57].

2. Lemongrass Oil Mouthwash
   Lemongrass oil is by all accounts an appealing specialist with antibacterial, mitigating and cancer prevention agent properties at 0.25% in mouthwashes. It tends to be utilized as an aid to mechanical nonsurgical periodontal treatment for plaque control and gum disease [58].

3. Production of paper mash
   A few types of grasses have just been inspected for pulping and papermaking. Lemongrass that is wealthy in cellulose has demonstrated its capability to turn into a crude material for paper enterprises [59-63].

4. Production of bio energy
   There are a few investigations into the production of bioenergy from lemongrass. However, further research is required on this bio oil to compete with the industrial grade oils, as the current industrial oils have more than double heating value compared to the produced bio oil. For instance, the bio gas from lemongrass had left the smaller amounts of total solids (TS), volatile solids (VS), volatile fatty acid (VFA), total ammonium Nitrogen (TAN), chemical oxygen demand (COD), orthophosphates, E. coli and Enterobacteriaceae counts in its solid and liquid residues [64, 65].

5. Production of silica
   Two unique techniques for getting silica from lemongrass have been accounted. One includes a corrosive filtering treatment while the different outlines silica creation straight forwardly by calcination. Among the diverse corrosive filtering temperatures, however the crystallinity of lemongrass debris (which was 55% before corrosive draining) diminished to 31% at 37℃, it significantly expanded to around 73% at 110℃. The crystallinity of lemongrass debris expanded from 36% (without calcination) to, best case scenario 63% (calcination at 700 ℃) in that examination. In the two procedures, siloxane (Si–O–Si) and silanol (Si–OH) bunches were apparent in lemongrass debris in all scopes of utilization temperatures that depend on lemongrass for silica creation. All things considered, of the two strategies, the corrosive filtering could be exceptionally viable as far as silica creation, at that point the ignition technique because of its high rates of silica content at last item [66].

6. Application in nourishment protection
   The antimicrobial exercises of EO of lemongrass against organisms are all around announced. Prominently, the movement of lemongrass EO was discovered more beneficial than different EOs against 12 significant bacterial species. In addition, the genuine favourable position of lemongrass EO is its activity against both gram positive and gram-negative microscopic organisms [67, 68].

7. Application in beautifying agents
   The organic exercises of lemongrass constituents are not just the key for applications in medications and nourishment science yet additionally significant for beauty care products applications. Citral, the fundamental segment of lemongrass oil is considered for delivering b-ionone which gives rose smell low focuses and along these lines huge for application perfumery ventures. The EO of *Cymbopogon* family has business utilizations in palmarosa oil, scent material and cleanser fragrance. There are various lemongrass items accessible in the restorative field with licensed equations in blend with lemon emollient oil and glycerol [69, 70].

8. Agriculture and cultivating
   Despite the fact that the use of lemongrass in horticulture and cultivating is related with its organic exercises, this is a moderately new territory of research and just a couple of studies have been accounted for. The underlying foundations of lemongrass have been utilized for support of an avalanche influenced soil in India. In an alternate report, lemongrass EO was discovered planned not just in administering isariopsis spot in grape leaves and build-up yet in addition expanding efficiency grape development. Lemongrass extricate has demonstrated improvement in germination of rice seed and seedlings, just as their energy file, and it was compelling for controlling seed-borne rice growths [71, 72].

9. Antifungal Activity of Lemon Grass Oil and Lemon Grass Oil Cream
   The safest strain was M. gypseum followed by T. rubrum, T. mentugrophytes and E. fioccosum, individually. The method of activity of lemon grass oil and citral were demonstrated to be fungicidal. The similar investigation of the viability of cream containing four unique fixations (IS%, 2%, 2.5% and 3%) of lemon grass oil was acted in vitro by opening dispersion examine. The 2.5% lemon grass oil was shown to be the base fixation for readiness of an antifungal cream for resulting clinical investigation. It was seen that all lemon grass oil cream displayed antifungal action which was portion subordinate. It was discovered that 2.5% and 3% lemon grass oil cream displayed preferable adequacy over those business creams (unpublished information). In this manner, 2.5% lemon grass oil would be the small mum fixation for arrangement of an antifungal cream for resulting clinical investigation [73].

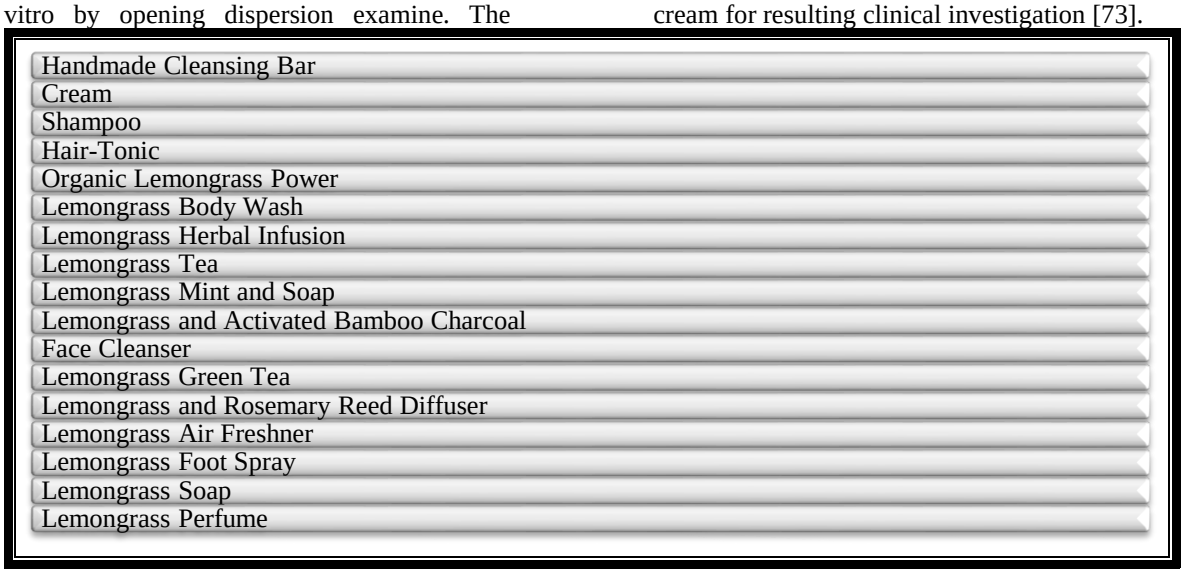


Fig 5: Marketed Products of Lemongrass.

CONCLUSION:

Lemon grass (*Cymbopogon* species), is an individual from Poaceae family. It is a therapeutic plant with mixes fit for controlling pathogens and expanding home grown protection from pathogenic sicknesses. Lemon grass fundamental oil is included a high substance of citral, which is utilized as a hotspot for the creation of β-carotene and vitamin A and so on. The oil can be utilized in numerous pharmacological conditions because of quality of different compound constituents. All the techniques for extraction are uncommon kind of partition process utilized for heat touchy fundamental oil which is insoluble in water and may decay at breaking point. The temperature of the steam must be sufficiently high to disintegrate the basic oil present, yet not annihilate or consume the fundamental oils.

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