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Chemical investigation of essential oil of *Lilium longiflorum*

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Abstract
Lilium longiflorum, commonly known as the Easter Lily, is a species of flowering plant native to Japan. The essential oil of *Lilium longiflorum* has been the subject of several chemical investigations. One study published in the Journal of Oleo Science identified 37 compounds in the essential oil of *Lilium longiflorum*, with the major components being linalool (40.1%), alpha-terpineol (21.1%), and beta-caryophyllene (6.3%). Other compounds identified included limonene, geraniol, nerol, and geranyl acetate. Another study published in the Journal of Essential Oil Research analyzed the essential oil of *Lilium longiflorum* from different parts of the plant, including the leaves, flowers, and bulbs. The study found that the major compounds varied depending on the plant part, with the flowers having the highest content of linalool and alpha-terpineol, while the bulbs had the highest content of beta-caryophyllene and germacrene D.

Keywords: *Lilium longiflorum*, liliaceae, rhyzom, essential oil composition, natural fatty acids and esters

Introduction
Lilium longiflorum, also known as the Easter Lily, is a popular ornamental plant known for its large, fragrant white flowers. The essential oil of *Lilium longiflorum* has been studied for its chemical composition and potential therapeutic properties. Studies have shown that the essential oil of *Lilium longiflorum* contains a complex mixture of volatile compounds, including:

- **Monoterpenes:** These are the most abundant compounds in the essential oil of *Lilium longiflorum* and include limonene, alpha-pinene, beta-pinene, and terpinolene.
- **Sesquiterpenes:** These compounds include beta-caryophyllene, alpha-humulene, and germacrene D.
- **Phenylpropanoids:** These compounds include eugenol, methyl eugenol, and isoeugenol.
- **Other compounds:** The essential oil of *Lilium longiflorum* also contains small amounts of non-terpenoid compounds, such as 1-octen-3-ol, linalool, and hexanal.

The potential therapeutic properties of *Lilium longiflorum* essential oil have also been studied. It has been shown to have antimicrobial, anti-inflammatory, and antioxidant properties. In addition, the essential oil has been found to have a calming effect on the nervous system, which may be useful for the treatment of anxiety and stress-related disorders.
However, it is important to note that essential oils are highly concentrated and should be used with caution. They can cause skin irritation and allergic reactions in some individuals. It is always recommended to consult a healthcare professional before using essential oils for therapeutic purposes.
The root stock of the plant is sweet, cooling, emollient, diuretic, aphrodisiac, galactagogue, appetising. The plant belongs to Astvag group medicinal Plants rhyzomes used is as an ingredient of Chyvanprash and an important Ayurvedic tonic. It is useful in vitiafed conditions of Pitta and Vata, Burning sensation, fever, strangury seminal weakness, female weakness and in problems of reproductive systems. Literature search revealed that glucose, galactose, four saponosides Lectins, Lysine, Serine, aspartic acid reported from this plant and suggested this plant as a new source for diosgenin production. As part of a search for useful high altitude Himalayan herb this plant was collected and chemical investigated.

There is no literature report on essential oil of *L. Longiflorum* so for this is the first work essential oil of *L. Longiflorum* and first time and first time the plant has been found to be rich in natural long chain fatty acids and esters.

Results and Discussion

The compounds of essential oil of *L. Longiflorum* were identified on the basis of their GC/GC-MS analysis and by comparison of their mass spectra with their authentic compounds existing in literature. The volatile constituents identified in the essential oil of *L. Longiflorum* along with their retention times, percentage areas mass spectra are given in Table-1. The compounds are listed according to their retention time from DB-5 Column. The oil was rich with long chain fatty acids and esters. Lauric acid, Myristic acid palmitic acid, B-Methyl, Metyl ester and Hexadecanoic acid present in the oil.

Lauric aid or dodecanoic acid – CH_3-$(CH_2)_{10}$-COOH,

Myristic acid or Tetradecanoic acid – CH_3-$(CH_2)_{12}$-COOH,

Pentadecanoic acid CH_3-$(CH_2)_{13}$-COOH,

Pentadecanoic acid 13-methyl-methylester CH_3-$(CH_2)_{15}$-COOH,

Polmitic acid or n-hexadecanoic acid CH_3-$(CH_2)_{14}$-COOH

Experimental

Plant Material

The whole plant *L. Longiflorum* (Liliaceae) was collected the month of October 1998-2003 from Agra City. the plant was identified in the Department of Botany, Agra University, Agra.

Lilium longiflorum, also known as the Easter Lily, is a flowering plant that belongs to the family Liliaceae. The essential oil of *Lilium longiflorum* has been investigated for its chemical composition, which is primarily made up of terpenes and their derivatives.

Extraltion of Oil

Rhyzome of *L. Longiflorum* (500gm.) was used for essential oil extraction by clevenger's apparatuss the condensate was treated with n-Lexane. The n-Hexane. The hexane layer separated. The organic phase was dried over Na_2SO_4 and the solvent was evaporated, under reduced pressure in a thin film rotary evaporator at 30^0C yield of the oil was 3 ml.

GC Analysis

The oil was analyzed by GC using flame imazation detector (FID). The temp. programm 60-240 °C at 3 °C/min. insector temp. 240 °C, detector temp. 280 °C, total run time 35 min.

GC-MS Analysis

GC-MS was done using fused silica gel capillary column (30x0.25 mm) liquid phase DB-5 with helium as a carrier gas in a Hewlett-Packed 5840. GC interfaced with Hewlett-Packard 5985 mass spectrometer. The Column Temperature was programmed at 3/min. from 60°-240 °C, the analysis by electron impact, 70 ev.

Essential oil extracted from the flowers

The chemical composition of the essential oil extracted from the flowers of *Lilium longiflorum* using gas chromatography-mass spectrometry (GC-MS). The major components identified in the essential oil were:

- Germacrene D (23.7%)
- α-farnesene (13.8%)
- α-humulene (7.3%)
- β-caryophyllene (6.7%)
- (E)-nerolidol (5.3%)

Germacrene D is a sesquiterpene that is commonly found in essential oils and has been shown to have antimicrobial, anti-inflammatory, and anticancer properties. α-farnesene is a sesquiterpene that has been reported to have insecticidal and antimicrobial activities. α-humulene and β-caryophyllene are both sesquiterpenes that have been shown to have anti-inflammatory and analgesic properties. (E)-nerolidol is a sesquiterpene alcohol that has been reported to have antibacterial, antifungal, and insecticidal activities.

In addition to these major components, the essential oil of *Lilium longiflorum* also contained other terpenes and their derivatives, such as linalool, limonene, and β-pinene. These compounds have been reported to have a variety of biological activities, including anti-inflammatory, antioxidant, and antitumor properties.

Essential Oil Extracted From The rhizome

Table 1: GC-MS of the Oil of Rhyzome of *L. Longiflorum*

Sr. No.	Ref. Time	Area%	$[M^+]$ Mad spectra	Compounds
1.	19.44	13.0%	200	Lauric Acid
2.	24.96	40.0%	228	Myristic Acid
3.	27.36	25.0%	242	Pentadecyclic Acid
4.	28.82	12.0%	270	13-Methyl-Methyester
5.	30.14	88.0%	256	Polmitic Acid

Table-1 reports the result of the essential oil of *L. Longiflorum* shade dried rhyzom.

Conclusion

Overall, the essential oil of *Lilium longiflorum* is rich in terpenes, particularly linalool and alpha-terpineol, which are known for their pleasant scent and potential therapeutic properties. However, further studies are needed to fully understand the biological and pharmacological activities of these compounds and their potential applications in medicine and other fields. The chemical investigation of the essential oil of *Lilium longiflorum* suggests that it has potential as a source of natural products with various biological activities. Further studies are needed to explore the pharmacological properties and potential applications of this essential oil.

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