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Review Article

**REVIEW ON THE GC-MS ANALYSIS OF ESSENTIAL OIL OF
EUPATORIUM TRIPLINERVIS VAHL, ASTERACEAE**Dhanya A S^{*1}, Ajitha H S¹¹ College of Pharmaceutical Sciences, Govt. Medical College, Thiruvananthapuram,
Kerala, India.**Abstract:**

Eupatorium triplinervis, a tropical plant belonging to the family Asteraceae has been employed in traditional medicine for its diverse therapeutic properties. The review will provide an in-depth examination of Chemical composition and variability of *E. triplinervis* essential oil and leaf extracts like petroleum ether, n-hexane, acetone, ethanol and methanol. The retention time and peaks that corresponds to the bioactive compound identified and the biological activity and inhibitory properties (Pa and Pi) values of the compounds found in the various solvent leaf extracts varies in their different biological activities ranging from cytotoxicity, anti-bleeding, inflammation, itching, and intra-abdominal pressure evaluated by literature search. The analysis estimates anti-inflammatory, astringent, anti-hemorrhagic, antinephritic, antifibrinolytic, antispasmodic activity, and other biological activities to express structural predicted target site for drug design and serves as a beneficial tool to assess the compounds, their side effects, and toxicity. The yield of essential oil typically ranges from 0.5-2.5% (v/w) with a pale yellow – green colour. GC-MS analysis revealed the presence of 90 compounds including sesquiterpenes (α -caryophyllene, β -caryophyllene), monoterpenes (limonene, β -pinene), and phenolic compounds (eugenol, vanillin). Petroleum ether extract showed maximum number of compounds and least was for n-hexane leaf extract. Pharmacological activities, including antimicrobial, anti-inflammatory, antioxidant, and antipyretic effects, were correlated with the identified phytochemicals. PharmaExpert, was used to analyze pharmacological potential of major constituents. By consolidating the current knowledge on *E. triplinervis*, this review seeks to stimulate further research into its untapped pharmacological potential and promote its development as a natural remedy for various health conditions.

Keywords: *Eupatorium triplinervis*, GC-MS profiling, phytochemical constituents, pharmacological implications, essential oil, extracts.

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INTRODUCTION:

Eupatorium triplinervis Vahl, a thin perennial herb belonging to the Asteraceae family, has been employed in traditional medicine for centuries, particularly grows in temperate and tropical regions. The plant is reputed for its diverse therapeutic properties, including anti-inflammatory, antimicrobial, antioxidant, and antipyretic activities. Essential oils extracted from *E. triplinervis* have garnered significant attention due to their potential pharmacological applications. The review deals with in-depth examination of Chemical composition and variability of *E. triplinervis* essential oil, Pharmacological potential of major constituents, correlations between chemical composition and biological activities an future perspectives for therapeutic applications and research directions. Gas Chromatography-Mass Spectrometry (GC-MS) analysis has emerged as a pivotal technique for elucidating the chemical composition of essential oils. This review aims to comprehensively summarize the existing literature on the GC-MS analysis of *E. triplinervis* essential oil, highlighting its major constituents, chemical variability, and potential pharmacological implications. By consolidating the current knowledge on *E. triplinervis* essential oil, this review seeks to stimulate further research into its untapped pharmacological potential and promote its development as a natural remedy for various health conditions.

MATERIALS AND METHODS:

A comprehensive literature search was conducted using major databases, including PubMed, Scopus, Web of Science, and ScienceDirect. Studies were

included with reported GC-MS analysis of *E. triplinervis* essential oil, quantitative data on chemical composition investigated pharmacological activities of the essential oil or its constituents etc. Hydro distillation is a traditional and widely used method for essential oil extraction. The fresh raw plant material undergone Clevenger hydro distillation for essential oil extraction and the plant extracts after extraction of coarsely powdered leaves (20g) with various solvents like Petroleum ether, N-hexane, Acetone, Methanol, Ethanol and Water for 16- 24 hours were collected, dried with Anhydrous sodium sulphate before GC-MS analysis an kept at 4°C. Yield of extraction, Chemical composition (GC-MS analysis), Physical properties (density, refractive index, color) and Organoleptic characteristics (odor, appearance) are analyzed and tabulated. PharmaExpert, a software used to analyze the relationship between Pharmacological relation of the compounds on multiple targets.

RESULTS AND DISCUSSION:

Hydro-distillation yield for *Eupatorium triplinervis* essential oil typically ranges from 0.5-2.5% (v/w) with a pale yellow coloured oil with Transparent to slightly opaque appearance, moderately thick consistency, refractive index found to be 1.5 and 0.91 specific gravity. The essential oil and the plant extracts revealed a complex composition of more than 80 compounds, representing 92.1% of the total oil content. The chromatogram of the essential oil from fresh plant of *Eupatorium triplinervis* is indicated below in figure 1. which given total 22 peaks with of which major 4 peaks of β -Caryophyllene, β -Elemene, β -Selinene and Cis- isolongifolanone.

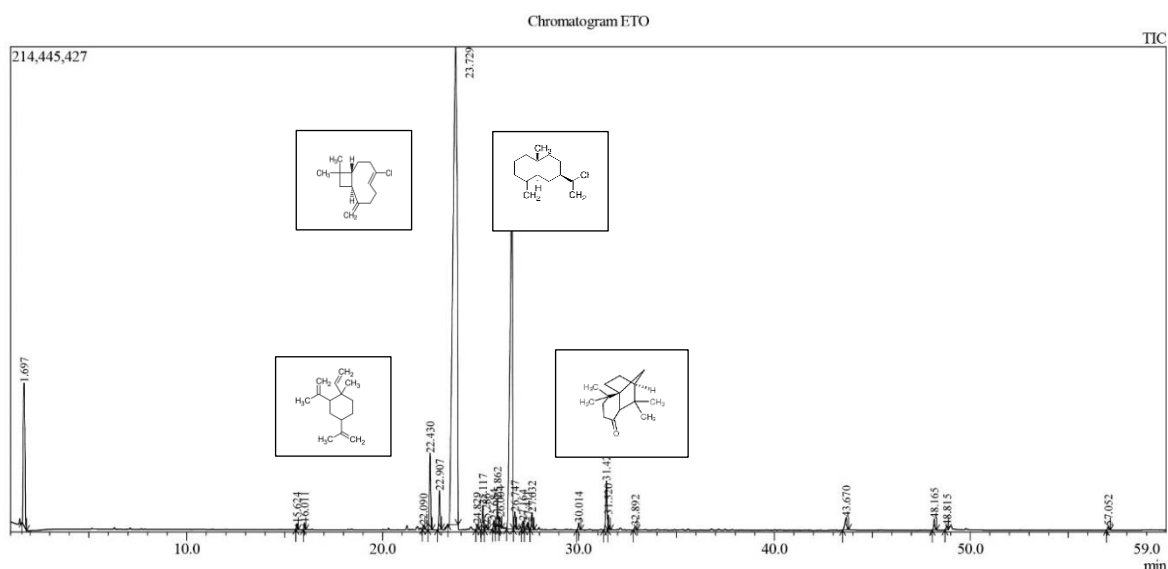


Figure: 1 GC-MS Spectra of Fresh plant of *Eupatorium triplinervis* vahl

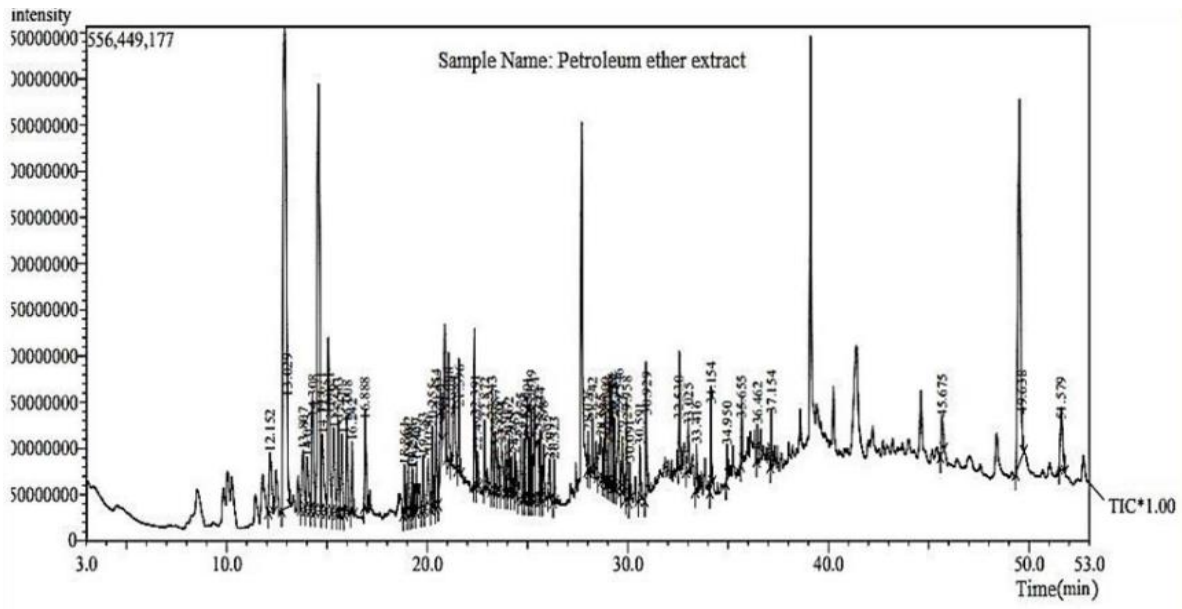


Figure: 2 GC-MS Spectra of Petroleum ether extract of *Eupatorium triplinervis vahl*

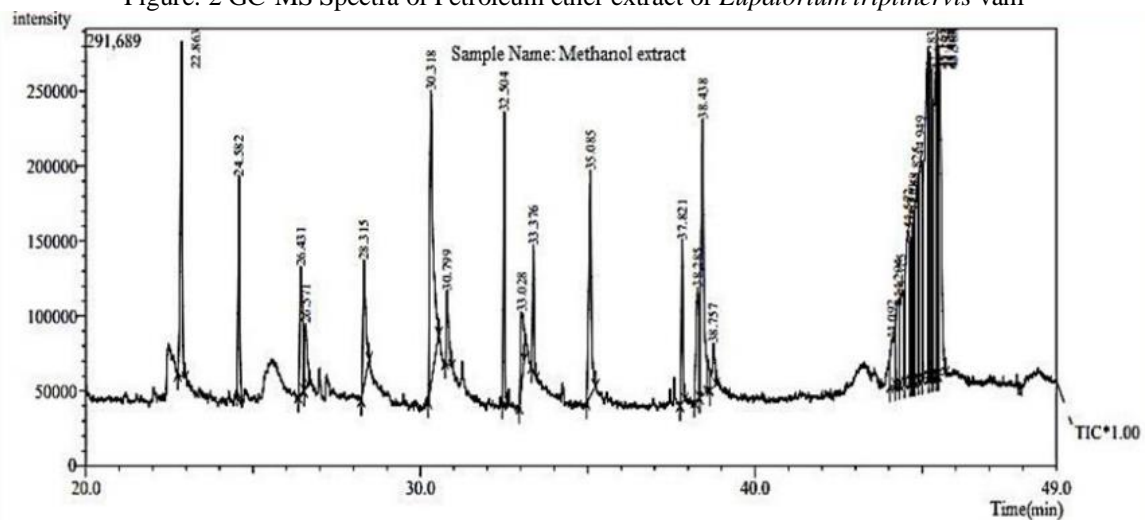


Figure: 3 GC-MS Spectra of methanolic extract of *Eupatorium triplinervis vahl*

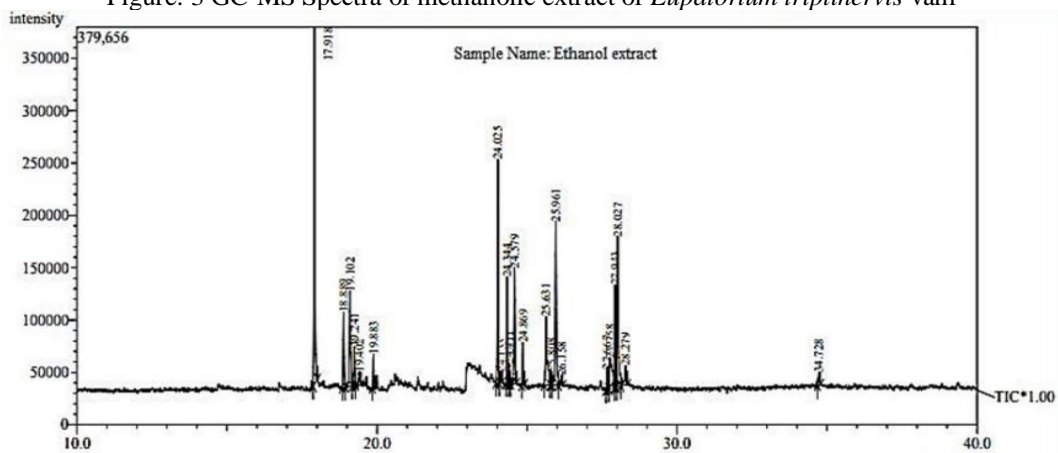
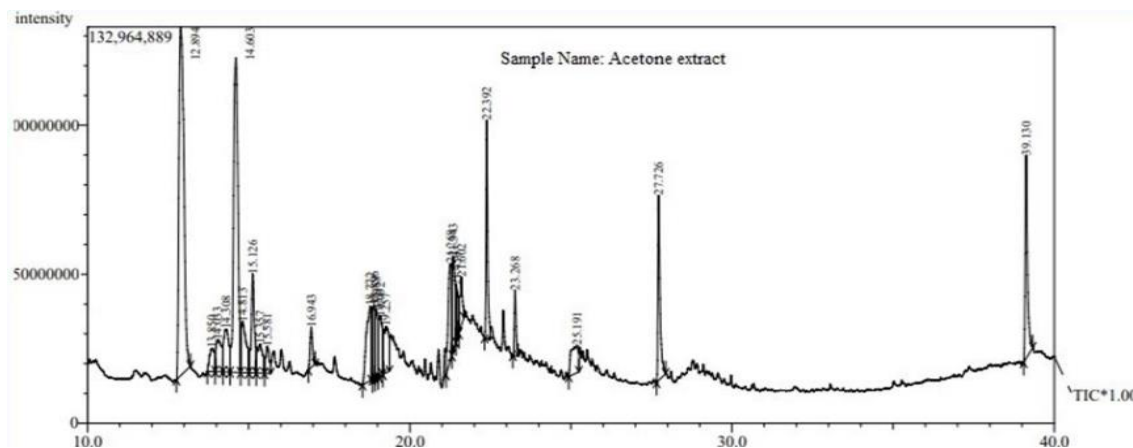
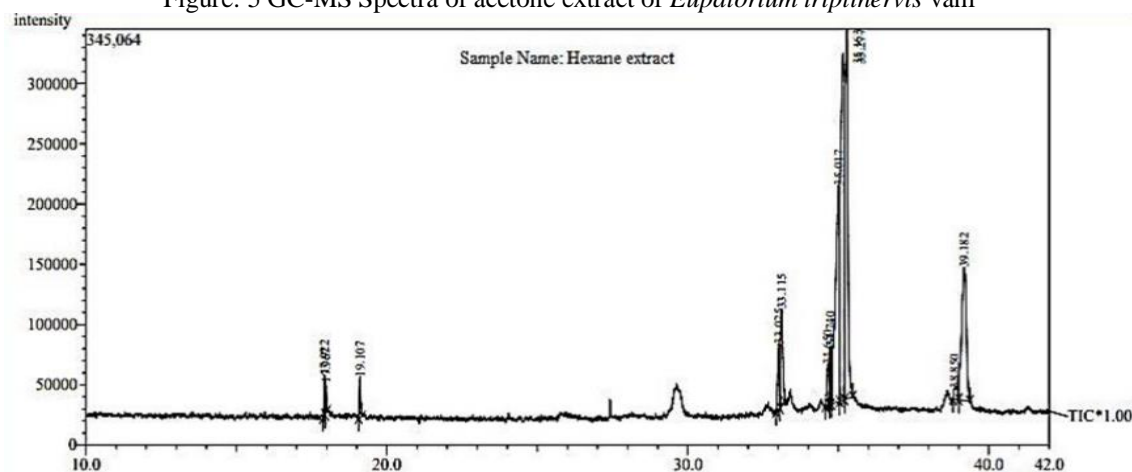


Figure: 4 GC-MS Spectra of ethanolic extract of *Eupatorium triplinervis vahl*

Figure 5 GC-MS Spectra of acetone extract of *Eupatorium triplinervis vahl*Figure 6 GC-MS Spectra of n-hexane extract of *Eupatorium triplinervis vahl*

The comparison of GC-MS spectra provided compound range of fresh plant and various extracts were 46% of petroleum ether, 21% methanol, 18% acetone, 14% of ethanol and 1% n-hexane fractions. The major compounds identified and characterized were Stigmasterol, 1-Isopropyl-2,5-Dimethoxy-4-Methylbenzene, β -Caryophyllene ($21.5 \pm 2.5\%$), α -Humulene ($15.6 \pm 1.8\%$), Eugenol ($12.8 \pm 1.2\%$), Germacrene D (8.5%) and Limonene (5.2%) which belongs to the compound classes such as Sesquiterpenes (55.6%), Monoterpenes (23.4%), Phenolic compounds (12.1%) and Oxygenated sesquiterpenes (6.5%). The dominance of β -caryophyllene and α -humulene in *E. triplinervis* essential oil and leaf extracts is consistent with previous reports on Asteraceae family members. The biological activity and inhibitory properties (Pa and Pi) values of the compounds found in the various solvent leaf extracts varies in their different biological activities ranging from cytotoxicity, anti-bleeding, inflammation, itching, and intra-abdominal pressure compared with previous literatures. The compounds

found to have anti-inflammatory, astringent, anti-hemorrhagic, antinephritic, antifibrinolytic,

antispasmodic activity, and other biological activities to express structural predicted target site for drug design and serves as a beneficial tool to assess the compounds, their side effects, and toxicity. By this the sesquiterpenes are known for their Antimicrobial properties, Anti-inflammatory activity and Antioxidant potential. Eugenol, a phenolic compound, contributes to the oil's antimicrobial and antioxidant properties. Germacrene D, a sesquiterpene, may enhance the oil's insecticidal and antifungal activities. The fresh plant oil and solvent leaf extracts of *Eupatorium triplinervis* Vahl for the GC-MS analysis and PASS prediction to reveal the presence of bioactive compounds. Among the identified bioactive components Stigmasterol, 1-ISOPROPYL-2,5-DIMETHOXY-4-METHYLBENZENE has the highest percent peak area. Stigmasterol (is an unsaturated phytosterol) has the role in antimicrobial, antioxidant, anti-diabetic, anticancer, immunomodulatory, anti-infective, anti-parasitic, neuroprotective, and anti-inflammatory activities and

able to reduce plasma cholesterol levels. 1-ISOPROPYL-2,5-DIMETHOXY-4-METHYLBENZENE has various biological functions including anti-eczematic, fibrinolytic, antineurotic, antifungal, antimicrobial, and antioxidant properties. The biological activities analysed with (Pa>850) and bar graph differentiated with pharmacological effects, molecular mechanisms, metabolisms-related action, and gene expression found based on structure-activity relationships.

CONCLUSION:

Fresh plant oil and the leaf extracts demonstrated a greater range of characteristic evaluation and phytochemical composition. By the primary and secondary metabolites have a variety of biological and therapeutic qualities, and it is anticipated that they will have a wide range of medical applications. The identification of bioactive compounds in *Eupatorium triplinerve* Vahl leaf extract was carried out by GC-MS characterization analysis which displays the presence of 90 compounds such as beta-caryophyllene, thymol methyl ether, n-hexadecanoic acid, octadecanoic acid, Squalene have roles in antioxidant, anticancer, antidiabetic and anti-inflammatory effects. By the review it can be concluded that the plant leaf extract may serve as a new potential source of novel drugs due to the presence of these phytochemicals and bioactive compounds.

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