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GCMS PROFILES OF LEAF AND STEM EXTRACT OF STROBILANTHUS CILIATUS NEES

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ABSTRACT

Strobilanthes ciliatus, a therapeutically significant plant from the Acanthaceae family, has been traditionally used for its anti-inflammatory, antioxidant, and anti-psoriatic properties. The present study aims to investigate the phytochemical composition of *S. ciliatus* through Gas Chromatography-Mass Spectrometry (GC-MS) analysis of different extracts. Petroleum ether and alcoholic extracts of the leaf, along with the alcoholic extract of the stem, were prepared and analyzed. The GC-MS profiling revealed a diverse range of bioactive compounds, including terpenoids, fatty acids, phenolics, and hydrocarbons. Key constituents identified include phytol, squalene, hexadecanoic acid, stigmasterol and octadecanoic acid—compounds known for their pharmacological relevance. This comprehensive chemical profiling supports the ethnopharmacological significance of *S. ciliatus* and provides a foundation for further research into its therapeutic applications and potential for drug development.

KEY WORDS: Strobilanthes ciliatus, GCMS, Phytol, Hexadecanoic acid.

INTRODUCTION

Medicinal plants have long been a cornerstone of traditional healthcare systems and continue to be a rich source of bioactive compounds for modern drug discovery. Among them, Strobilanthes ciliatus, has gained attention for its potential therapeutic properties, including anti-inflammatory, antioxidant, and anti-psoriatic activities.[1] Native to various regions of Asia, this plant is traditionally used in herbal remedies, yet its phytochemical composition remains underexplored.

Phytochemical investigations are essential to validate the traditional uses of medicinal plants and to isolate pharmacologically active constituents. Gas Chromatography-Mass Spectrometry (GC-MS) is a powerful analytical technique that enables the identification and characterization of volatile and semi-volatile compounds in complex plant matrices.[2] In this study, petroleum ether and alcoholic extracts of the leaf, as well as alcoholic extracts of the stem of S. ciliatus, were subjected to GC-MS analysis to profile their chemical constituents.[3]

The objective of this work is to provide a comprehensive phytochemical fingerprint of Strobilanthes ciliatus extracts, thereby contributing to the scientific understanding of its medicinal potential and supporting further pharmacological investigations.

MATERIAL AND METHODS

Collection of plant

Strobilanthes ciliatus Nees was collected from Kaduthuruthi area of Kottayam district and authenticated from Department of Botany, CMS College Kottayam. The collected plant materials were cleaned well and dried in shade. It was then coarsely powdered and stored in polypet jars at room temperature

Extraction of the plant material

About 1 Kg of the coarsely powdered leaf was extracted with petroleum ether (60^0 C-80^0 C) by soxhlation.

Filtered and the filtrate was concentrated and evaporated to dryness. Calculated the yield of the extract Leaf Petroleum Ether (LPE). The marc was then dried to remove the solvent and extracted with 95% ethanol by Soxhlet. The ethanolic extract was concentrated and evaporated to dryness. Calculated the yield of the extract and named it Leaf Alcoholic Extract (LAE).

The powdered stem was extracted with 95% ethanol by soxhlation and the yield of the ethanolic extract of the stem was calculated and named as Stem Alcoholic Extract (SAE).

GC-MS STUDIES

All the three extracts were subjected to GC-MS studies. The instrument was Shimadzu GC-MS model no. QP 2010 S equipped with an Rxi-5 Sil MS capillary column 30 m length, 0.25 mm internal diameter, 0.25 µm film thickness. The column oven temperature was 80^0 C for 2 minutes and the temperature was gradually increased to 280^o C at 5^o C per minute. 1 microliter sample was injected for analysis. Helium gas 99.9 % was used as carrier gas was 3 mL/min. Sample injected temperature was maintained at 260^o C and split ratio was 100 for LPE sample and 50 for the other two samples throughout the experiment period. The ionization mass was done at elution impact mode 70 eV. The mass spectrum was recorded for the mass range 50-500 m/z was scanned at a rate of 0.5 mL/sec. The total running time for GC-MS was 45 minutes. The compound separated on elution through column was detected in electronic signal. The m/z ratio obtained was calibrated through graph obtained which was called as mass spectrum which is the finger print of the molecule. The identification of the compound was done by GCMS software called GCMS solutions, based on the comparison of their mass spectra with NIST 11 and WILEY-8 Libraries. The relative percentage of each extract constituent was expressed as percentage with peak area normalization.

RESULT AND DISCUSSION

GC-MS Chromatogram of LPE

Fig. 1: GC-MS Chromatogram of LPE.

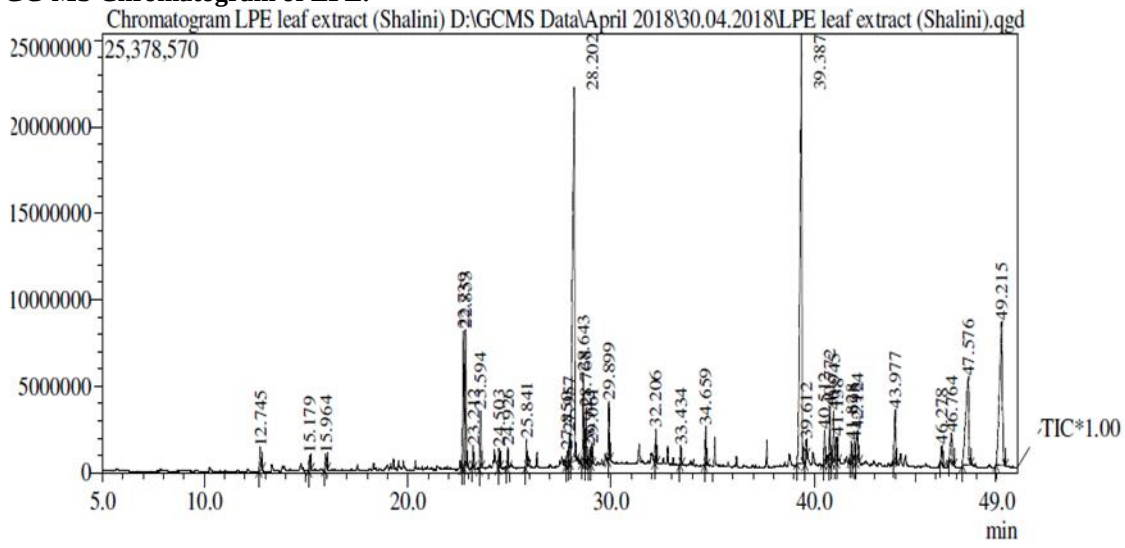

Table 1: GC-MS Profile of LPE.

Sl. No.	Compounds	Retention Time	Area %
1	Tetradecane	12.745	0.76
2	Hexadecane	15.179	0.41
3	2(4H)-Benzofuranone, 5,6,7,7a-tetrahydro-4,4,7a-trimethyl-	15.964	0.55
4	Neophytadiene	22.739	3.69
5	Hexahydrofarnesyl acetone	22.853	3.79
6	7-Octadecyne, 2-methyl-	23.212	0.46
7	9-Eicosyne	23.594	1.39
8	Hexadecanoic Acid, Methyl Ester	24.503	0.44
9	Isophytol	24.926	0.42
10	Hexadecanoic Acid, Ethyl Ester	25.841	0.77
11	9-Octadecenoic Acid (Z)-, Methyl Ester	27.850	0.46
12	2-Furanmethanol	27.957	0.76
13	**Phytol**	**28.202**	**21.68**

14	Palmitaldehyde, Diallyl Acetal	28.643	2.24
15	Pentadecanal-	28.768	1.21
16	Ethyl (9z,12z)-9,12-Octadecadienoate #	28.942	0.49
17	(E)-9-Octadecenoic acid ethyl ester	29.061	0.47
18	Phytol, acetate	29.899	1.36
19	4,8,12,16-Tetramethylheptadecan-4-olide	32.206	0.79
20	Trans-2-dodecen-1-ol	33.434	0.40
21	Octacosane	34.659	0.89
22	**Squalene**	**39.387**	**24.23**
23	(E,E,E)- .alpha.-Springene	39.612	0.40
24	Tetratetracontane	40.512	0.93
25	(E,E)-Geranyllinalool	40.772	1.76
26	Oxirane, 2,2-dimethyl-3-(3,7,12,16,20-pentamethyl-3,7,11,15,19-heneicosapentaenyl)-, (all-E)-	40.945	1.48
27	Tetraprenol	41.138	0.60
28	trans-Geranylgeraniol	41.828	0.59
29	Farnesol Isomer B	41.998	0.75
30	1,6,10,14,18,22-Tetracosahexaen-3-ol, 2,6,10,15,19,23-hexamethyl-, (all-E)-	42.124	1.39
31	Hexatriacontane	43.977	2.09
32	Pentacosane	46.278	0.71
33	Ergost-5-en-3-ol	46.764	1.60
34	**Stigmasterol**	**47.576**	**7.76**
35	1-chloroheptacosane	49.215	12.30

35 compounds were identified of which Neophytadiene (3.69%), Hexahydrofarnesyl acetate (3.79%), Phytol (21.68 %), Squalene (24.23%), Stigmasterol (7.76%), 1-Chloroheptacosane (12.30%) were the main components. Stigmasterol has medicinal properties like antioxidant, hyperglycemic inhibition, thyroid inhibitory action, hypocholesteromic and anti-inflammatory action.[4] Squalene is a poly unsaturated triterpene widely found in nature includes 6-isoprene units, a biochemical precursor of cholesterol, and other steroids and can not only be synthesized at cellular level but also be taken as dietary factor.[5] It has anti-cancer properties in skin disease as protector against lipid peroxidation and skin cancer. It has important role in cholesterol metabolism. Squalene is a strong anti-oxidant and prevents free radical induced oxidative injury particularly in the skin.[6]

Stigmasterol may be contributing to the anti-inflammatory property shown by the extract. Antioxidant activity of squalene can support the anti-inflammatory and in turn the anti-psoriatic activity. Therefore, the activities exhibited by the extract may be due to the presence of the above-mentioned compounds.

GC-MS chromatogram of LAE

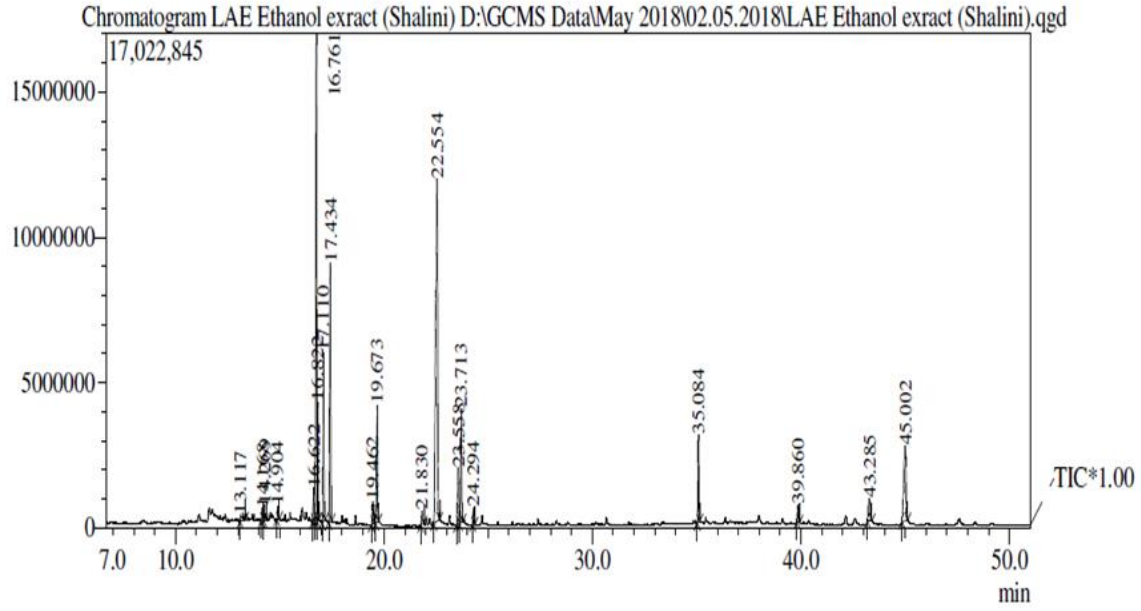

Fig 2: GC-MS Chromatogram of LAE.

Table 2: GC-MS Profile of LAE.

Sl. No.	Compounds	Retention time	Area%
1	2(4H)-Benzofuranone,5,6,7,7A-tetrahydro-4,4,7A-trimethyl	13.117	0.54
2	9,12-octadecadienal,dimethyl acetal	14.168	0.51
3	2,7-octadiene-1,6-diol,2,6-dimethyl-	14.269	0.69
4	Cyclohexene,1,5,5-trimethyl-6-acetylmethyl-	14.094	0.54
5	2-Hexadecene,3,7,11,15-tetramethyl-[R-[R*R*-(E)]]	16.622	1.03
6	**Neophytadiene**	**16.761**	**19.88**
7	2-pentadecanol,6,10,14-trimethyl-	16.822	3.13
8	9-Eicosyne	17.110	5.51
9	**Phytol acetate**	**17.434**	**10.41**
10	2H-Pyran-2-one,6-heptyltetrahydro-	19.462	0.97
11	Hexadecanoic acid, Ethyl ester	19.673	5.54
12	Pentadecanal-	21.830	0.61
13	**Phytol**	**22.554**	**28.44**
14	Ethyl(9Z,12Z)-9,12-octadecadienoate	23.558	2.55
15	9-methyl-Z,Z-10,12-hexadecadiene-1-ol acetate	23.713	5.55
16	Octadecanoic acid, Ethyl ester	24.294	0.72
17	Squalene	35.084	3.46
18	Hexatriacontane	39.860	0.93
19	Stigmasta-5,22-dien-3-ol	43.285	1.95
20	**Tetratetracontane**	**45.002**	**7.04**

20 compounds were identified of which Neophytadiene (19.88 %). 9-Eicosyne (5.51%), Phytoacetate (10.41%), Hexadecanoic acid ethyl ester (5.54%), Phytol (28.44%), Squalene (3.46%), Tetratetracontane (7.04%) were the main components. Phytol shows the highest percentage. It is an acyclic diterpene alcohol and is used as a precursor for the manufacture of synthetic form of Vit.E1 and Vit.K1. It has anti-inflammatory and anti-oxidant activity. It decreases MPO activity, TNF α and IL-1ß levels.[7] Neophytadiene has molecular weight $C_{20}H_{38}$. It is an anti-fungal terpenoid identified in the red algae. It is used as antioxidant, antibacterial, antipyretic, analgesic and anti-inflammatory, anti-atherosclerotic, anti-neoplastic role in skin aging etc.[8]

GC-MS chromatogram of SAE

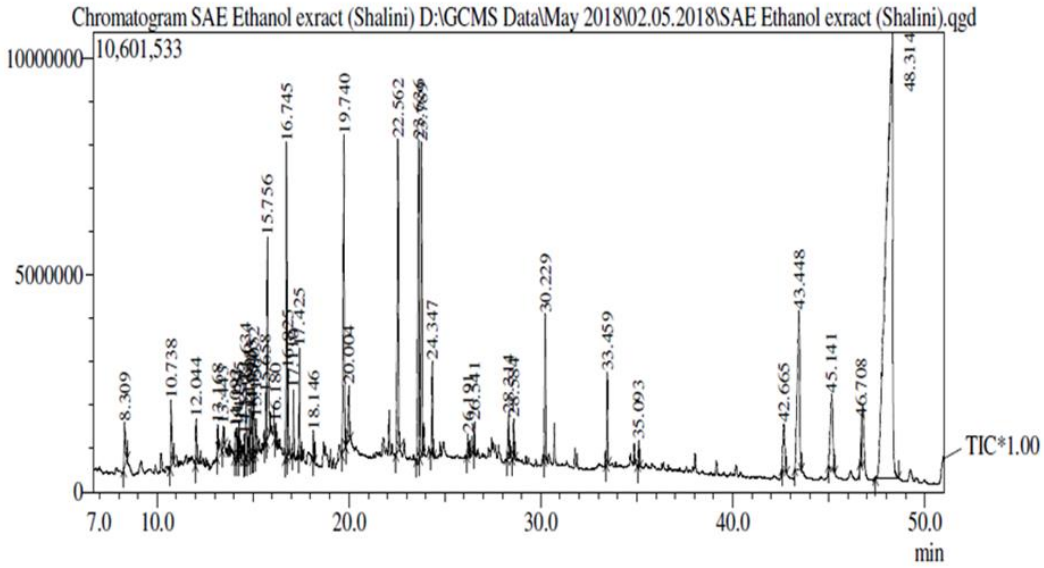

Fig. 3: GC-MS Chromatogram of SAE.

Table 3: GC-MS Profile of SAE.

Sl. No.	Compounds	Retention Time	Area %
1	dl-Glyceraldehyde diethylacetal	8.309	0.96
2	1,3,4-Eugenol	10.738	0.98
3	Iso-Eugenol	12.044	0.56
4	Elemicin	13.168	0.29
5	3',5'-Dimethoxyacetophenone	13.443	0.31
6	Phenol, 3,4,5-Trimethoxy-	14.092	0.57
7	9,12-Octadecadienal, Dimethyl Acetal	14.181	0.36
8	Nerolidol isobutyrate	14.285	0.40
9	Methyl-(2-hydoxy-3-ethoxy-benzyl)ether	14.550	0.41
10	Ar-tumerone	14.634	0.78
11	Santalol, cis,.alpha.-	14.823	0.84
12	9-Hexadecen-1-ol, (Z)-	14.915	0.82
13	2-methyltetracosane	14.950	0.40
14	Methoxyeugenol	15.052	1.01
15	Cyclododecanol	15.156	0.45
16	Xanthorrhizol	15.658	0.63
17	Ethyl p-methoxycinnamate	15.756	3.20
18	(-) Loliolide	16.180	0.25
19	Neophytadiene	16.745	3.15
20	Hexahydrofarnesyl acetone	16.825	0.94
21	9-Eicosyne	17.110	0.67
23	Dihydroedulan Ⅱ	18.146	0.33
24	**Hexadecanoic acid, Ethyl ester**	**19.740**	**5.86**
25	1,8-Cyclopentadecadiyne	20.004	0.93
26	**Phytol**	**22.562**	**4.97**
27	Ethyl (9z,12z)-9,12-Octadecadienoate	23.636	5.04
28	(E)-9-Octadecenoic acid ethyl ester	23.789	4.92
29	Octadecanoic Acid, Ethyl Ester	24.347	1.12
30	12-O-Acetylingol 8-tiglate	26.191	0.33
31	Tetracosane	26.541	0.30
32	Ethyl Nonadecanoate	28.314	0.60
33	2-Pentadecyn-1-ol	28.584	0.48
34	Octacosane	30.229	1.81

35	Tricosane	33.459	1.00
36	Squalene	35.093	0.26
37	Campesterol	42.665	1.30
38	**Stigmasterol**	**43.448**	**5.19**
39	Gamma -Sitosterol	45.141	2.75
40	Methyl 16-R/S-Hydroxy-Cleroda-3,13(14)-Z-Dien-15,16-Olide // P V - 3a	46.708	0.66
41	**Lupeol**	**48.314**	**43.12**

41 compounds were identified, of which Ethyl para methoxy cinnamate (3.20%), Hexadecanoic acid ethyl ester (5.86%), Phytol (4.97%), Ethyl 9,12 octadecadienoate (5.04%), Stigmasterol (5.19%), Gamma-sitosterol (2.75%), Lupeol (43.12%) are the main components. Lupeol is a pharmacologically active tritertpenoid with several potential medicinal properties. It displays anti-inflammatory, anti-tumour, antiprotozoal, anti-microbial.[9] As an anti-inflammatory agent it functions primarily on the Interlukin systems. It decreases IL-4 production by T-helper type 2 cells.[10]

CONCLUSION

The GC–MS profiling of the leaf and stem extracts of *Strobilanthes ciliatus* revealed the presence of diverse bioactive phytochemicals, including Phytol, Hexadecenoic Acid, Stigmasterol, Lupeol, and other important metabolites. These compounds are known for their antioxidant, anti-inflammatory, antimicrobial, and therapeutic properties, underscoring the medicinal potential of the plant. The study confirms that both leaf and stem extracts of *Strobilanthes ciliatus* are rich sources of biologically active secondary metabolites. Overall, GC–MS proved to be an effective tool for identifying and characterizing its chemical composition, providing a strong foundation for future pharmacological, nutraceutical, and medicinal applications.

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