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IDENTIFICATION OF BIOLOGICAL COMPONENTS FROM POTENTIAL BONE HEALER MEDICINAL PLANTS

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ABSTRACT

Nature has been a wellspring of therapeutic for a vast number of years and a great number of present day drugs have been separated from plant resources. It has been evaluated that natural prescriptions serve around 80% of the total population wellbeing requirement for many individuals throughout the world. *Cissus quadrangularis* a member of the family Vitaceae, *Cardiospermum halicacabum* and *Dodonea viscosa* members of the family Sapindaceae are well known for its utilization in the treatment of skin contaminations, blockage, piles, lack of health, weight loss, ant-inflammatory, anti-ulcer and bone crack healing. In the present study, based on GC-MS methanolic extract of stem and leaf of these three plants showed and identified fifteen major compounds with pharmacological activities. The FT-IR analysis showed similar functional groups of compounds related their medicinal properties such as Bone healing and wound healing activities.

Key words: *C. quadrangularis*, *C. halicacabum*, *D. viscosa*, GC-MS and FT-IR, Bone healing

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INTRODUCTION

Traditional Indian Medicine (TIM) is a noteworthy wellspring of possibly valuable new constituent for the improvement of chemotherapeutic specialists [1]. It has been evaluated that natural prescriptions serve around 80% of the total worldwide population [2]. The utilization of plants in the administration and treatment of sicknesses and natural products are considered organically dynamic mixes. *Cissus quadrangularis* L, belong to the family Vitaceae and distributed in India, Sri Lanka, Malaysia, Thailand and Africa. The stem portion of *C. quadrangularis* is utilized for the treatment of skin contaminations, blockage, heaps, frailty, asthma, sporadic feminine cycle, consumes, wounds and anti-ulcer[3] anti-oxidant, hostile to malignancy activity[4], microbial activities[5], against osteoporotic activity[6], weight loss[7], ant-inflammatory[8] and bone crack healing[9]. *Cardiospermum halicacabum* belong to with the family Sapindaceae is a climber. These two species are widely distributed in tropical and subtropical Asia and Africa [10]. The entire plant has been used in the treatment of stiffness, lumbago, diuretic, stomachic, ear infection, cough, emetic, purgative and rheumatic. The seeds are utilized a diaphoretic [11], anti-malarial [12], anti-oxidant and anti-inflammatory [13,14]. *C. halicacabum* roots have been utilized for the treatment of epilepsy and tension disorders [15]. *D. viscosa* is placed in the family Sapindaceae and distributed in India and Nepal. It is utilized for different therapeutic purposes such as diuretic, anti-inflammatory, anti-ulcer [16-17], snake bites [18] and anti-oxidant [19].

This study is mainly focus on to compare the divergence of biological compounds identification investigated by GC-MS and FT-IR analyses. GC-MS investigation was made by a typical library search (NIST, WILEY) and literature comparison and the biological activities of these compounds were studied for possible drug development of active compounds.

MATERIALS AND METHODS

Collection and preparation of plant material

The plants were collected from natural habitats and the herbarium specimen of the same was prepared and deposited in the Department of Botany, Annamalai University with the accession number for *C. quadrangularis* (AUBOT343), *C. halicacabum* (AUBOT347) and *D. viscosa* (AUBOT340). The plants were washed completely in running tap water to remove soil particles and the plant parts were separated and shade dried. The shade dried plant parts were separately and stored in air tight container for further analysis.

Chemicals

The chemicals were obtained from Himedia, Mumbai, India and the solvents used were of phytochemical analyses

Equipment

Equipment's used on this experiment consist of GC-MS and FT-IR. GC-MS was used for the identity of compounds in samples and FT-IR becomes used for identification of functional agencies provided within the species of *C. quadrangularis, D. viscosa and C. halicacabum.*

Plant sample extraction

Shade dried and powdered plant materials were successively extracted with methanol with gentle stirring for 72 hours. The extraction were passed through Whatmann No. 1 paper and collected.

Gas Chromatography- Mass Spectrum Analysis (GC-MS)

25 gm of the stem and leaves powder *C. quadrangularis*, *C. halicacabum* and *D. viscosa* were soaked in 95 % methanol for 12 hours. The extracts were then filtered through Whatmann filter No. 1 along with 2 gm Sodium sulphate to remove the sediments and traces of water in the filtrate. Then the filtrate was concentrated by introducing bubbling nitrogen gas into the solution. The plant extract contains both polar and non-polar phytochemicals. 2 µl of the plant methanolic extract filtrate was used for GC-MS analysis. GC-MS analysis of the methanolic extract of the plant samples taken for this study was performed by using a Perkin- Elmer GC clarus- 500 system comprising an AOC 20°C auto sampler and a Gas chromatograph intergraded to a mass spectrometer equipped with Elite – 5MS fused capillary column. Helium gas was used as a carrier gas at a constant flow rate of 1 ml/min, and an injector where of 2 µl was employed. The inject temperature was maintained at 250°C, the ion source temperature was 200°C and oven temperature was programmed from 110°C, with an increase of 10°C/min to 200°C, then 5°C/min 280°C ending with a 9 min isothermal at 280°C. The solvent delay was 0 to 2 min, and the total GC/MS running time was 36 min. The relative percentage amount of each component was calculated by comparing its average peak area to the total areas. The Mass detector used in this analysis was turbo- Mass gold Perkin- Elmer and the software adopted to handle Mass spectra and chromatogram was a Turbo – Mass Ver.5.2.

FT-IR analysis

The FT-IR analysis was done by utilizing Perkin Elmer Spectrum Version 10.03.09 framework, which was utilized to identify the practical gatherings of the compound. A little measure of concentrate was set specifically on the zinc solenoid piece and consistent weight. Information of infrared retentive, gathered over the wave number extended from 4000 cm^{-1} to 400 cm^{-1} utilizing spectra programming. Tests were keep running in triplicate and every one of them were embraced inside a day time span.

RESULTS AND DISCUSSION

GC-MS

The phytochemical constituents present in the stem methanolic extract of *C. quadrangularis* showed fifty four constituents. Out of these fifty four constituents five constituents were majorly present such as 3-O-Methyl-D-glucose, D-Allose, 9,12,15-Octa decatrienoic acid, Phytol and Pentadecanoic Acid. Based on GC-MS spectrum confirmed the compounds with retention time 23.574, 19.237, 28.706, 25.037and 26.250 respectively (Figure 1). Apart from the above mentioned compounds, the 3-O-Methyl-D-glucose was containing the percentage of 51.85 and it was identified as active compound of the species *C. quadrangularis*. The molecular formula of the compound was $C_7H_{14}O_6$ (Table 1).

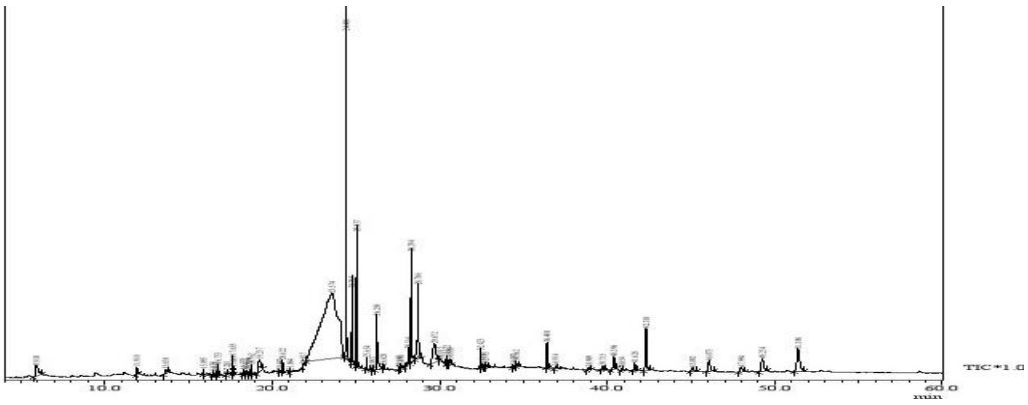

Figure 1: GC-MS Chromatogram of methanolic Stem extract of *C. quadrangularis*

Table 1: GC-MS report of methanolic Stem extract of *C. quadrangularis*

Peak	R. Time	Area%	Name of the compounds	Molecular formula	Molecular weight
1	5.910	1.48	1H-Pyrrole	C_4H_5N	67
2	11.910	0.32	2,3-Dihydro-3,5-Dihydroxy-6-Methyl-4h-Pyran-One	$C_6H_8O_4$	144
3	13.630	0.31	2h-Pyran-2-One, 5,6-Dihydro-6-Pentyl-	$C_{10}H_{16}O_2$	168
4	15.895	0.12	2.Alpha.,7,8-trimethylacenaphthylene	$C_{15}H_{24}$	204
5	16.439	0.04	2-(3-Isopropyl-4-Methyl-3-Penten-1-Ynyl)-2-Methycyclobutanone	$C_{14}H_{20}O$	204
6	16.663	0.04	3,6,6,7-Tetramethyl-3-Vinyl-2,3,3a,4,5,6-Hexahydro-1h-Indene	$C_{15}H_{24}$	204
7	16.753	0.25	Tricyclo[4.4.0.0(2,7)]Dec-3-Ene, 1,3-Di Methyl -8-(1-Methylethyl)	$C_{15}H_{24}$	204
8	17.281	0.04	Aromadenrene	$C_{15}H_{24}$	204
9	17.635	0.36	Trans (.beta.)-caryophyllene	$C_{15}H_{24}$	204
10	17.689	0.07	Isoledene	$C_{15}H_{24}$	204
11	18.272	0.11	1,4,8-Cycloundecatriene ,2,6,6,9-Tetra Methyl	$C_{15}H_{24}$	204
12	18.412	0.09	1H-Cycloprop [E]Azulene,	$C_{15}H_{24}$	204
13	18.634	0.10	6.Alpha.-Cadina-4,9-Diene, (-)-	$C_{15}H_{24}$	204
14	18.762	0.20	Beta.-ylangene	$C_{15}H_{24}$	204
15	19.237	9.28	D-Allose	$C_6H_{12}O_6$	180
16	20.443	0.03	1-Tridecanol	$C_{13}H_{28}O$	200
17	20.622	0.31	(-)-5-Oxatricyclo [8.2.0.0(4,6)]Dodecane,,	$C_{15}H_{24}O$	220
18	21.064	0.05	Humulene Oxide	$C_{15}H_{24}O$	220
19	21.837	0.07	(1ar-(1aalpha, 5abeta, 9ar(*)))-5a,9,9-Trimethyloctahydrobenzo(D)Cycloprop(C)Oxepin-2,4	$C_{14}H_{20}O_3$	236
20	23.574	51.85	3-O-Methyl-d-glucose	$C_7H_{14}O_6$	194
21	24.406	1.55	2,6,10-Trimethyl,14-Ethylene-14-Pentadecne	$C_{20}H_{38}$	278
22	24.765	2.15	Neophytadiene	$C_{20}H_{38}$	278
23	25.037	3.41	Phytol	$C_{20}H_{40}O$	296
24	25.654	0.37	Hexadecanoic Acid,	$C_{17}H_{34}O_2$	270
25	25.993	0.05	Isophytol	$C_{20}H_{40}O$	296
26	26.250	3.39	Pentadecanoic Acid	$C_{15}H_{30}O_2$	242
27	26.628	0.08	14B-Pregnane	$C_{21}H_{36}$	288
28	27.597	0.05	Methyl 4-o-benzyl-.alpha.-l-rhamnopyra noside	$C_{14}H_{20}O_5$	268
29	27.690	0.04	1H-Indene, 3-Methyl-	$C_{10}H_{10}$	130
30	28.116	0.63	9,12,15-Octadecatrie noic Acid, (Z,Z,Z)-	$C_{19}H_{32}O_2$	292
31	28.294	2.72	3,7,11,15-Tetramethyl-, [R-[R*,R*-(E)]]	$C_{20}H_{40}O$	296
32	28.706	3.83	9,12,15-Octadecatrienoic Acid,	$C_{18}H_{30}O_2$	278
33	29.672	2.93	Cyclohexanol, 4-[(Tri Methylsilyl) Oxy] -, Cis-	$C_9H_{20}O_2$	188
34	30.015	0.25	Decanoic Acid	$C_{10}H_{20}O_2$	172
35	30.422	0.20	Octanoic acid, 2-di methylaminoethyl ester	$C_{12}H_{25}NO_2$	215
36	30.630	0.33	5-Phenyl-Pentanoic Acid, Ethyl Ester	$C_{17}H_{24}O_5$	308
37	32.423	0.42	Fumaric acid, 2-di methyl aminoethylnonyl ester	$C_{17}H_{31}NO_4$	313
38	32.610	0.06	3-Cyclopentylpropionic Acid,	$C_{12}H_{23}NO_2$	213
39	32.715	0.13	2-Ethylbutyric Acid, Eicosyl Ester	$C_{26}H_{52}O_2$	396
40	34.397	0.10	1-Penten-3-One, 4-Methyl-1-Phenyl-	$C_{12}H_{14}O$	174
41	34.562	0.20	Ethyl linolate	$C_{19}H_{32}O_2$	292
42	36.408	0.79	Squalene	$C_{30}H_{50}$	410
43	36.914	0.18	TriacontylPentafluoropropionate	$C_{33}H_{61}F_5O_2$	584
44	38.909	0.15	Chol-5-ene-3,24-diol	$C_{24}H_{40}O_2$	360
45	39.715	0.30	Ergost-5-En-3-Ol, (3.Beta.)-	$C_{28}H_{48}O$	400
46	40.396	0.89	Gamma.-tocopherol	$C_{28}H_{48}O_2$	416
47	40.854	0.10	5-chlorostigmastan-3-yl acetate	$C_{31}H_{53}C_1O_2$	492
48	41.626	0.42	Stigmast-5-En-3-Ol, (3.Beta.)-	$C_{29}H_{50}O$	414
49	42.318	2.70	Vitamin E	$C_{29}H_{50}O_2$	430
50	45.092	0.40	24- Epicampesterol	$C_{28}H_{48}O$	400
51	46.073	1.05	Stigmasta-5,22-Dien-3-ol	$C_{29}H_{48}O$	412
52	47.994	0.52	Beta-di hydrofucosterol	$C_{29}H_{50}O$	414
53	49.254	1.50	,14,14a,14b-Octadbctadecahyro-2h-Picen-3-One	$C_{30}H_{48}O$	424
54	51.398	2.98	D:B-Friedo-B':A'-Neogammacer-5-En-3-one	$C_{30}H_{48}O$	424
		100.00			

GC-MS analysis of Methanolic extract of *C. halicacabum* leaves demonstrates nearness of forty two constituents. Out of these forty two constituents five constituents were majorly present such as Calix[4]arene, Epi-Psi-Taraxastanonol, Beta-Sitosterol, Tetradecanoic corrosive and Iso Longifolol with their respective retention time such as 43.196, 50.113, 48.078, 23.291 and 56.873 respectively (Figure 2). Based on the spectrum percentage area, Calix[4]arene (24.85) was identified as major active compound and the molecular formula was $C_{28}H_{24}O_4$ (Table 2).

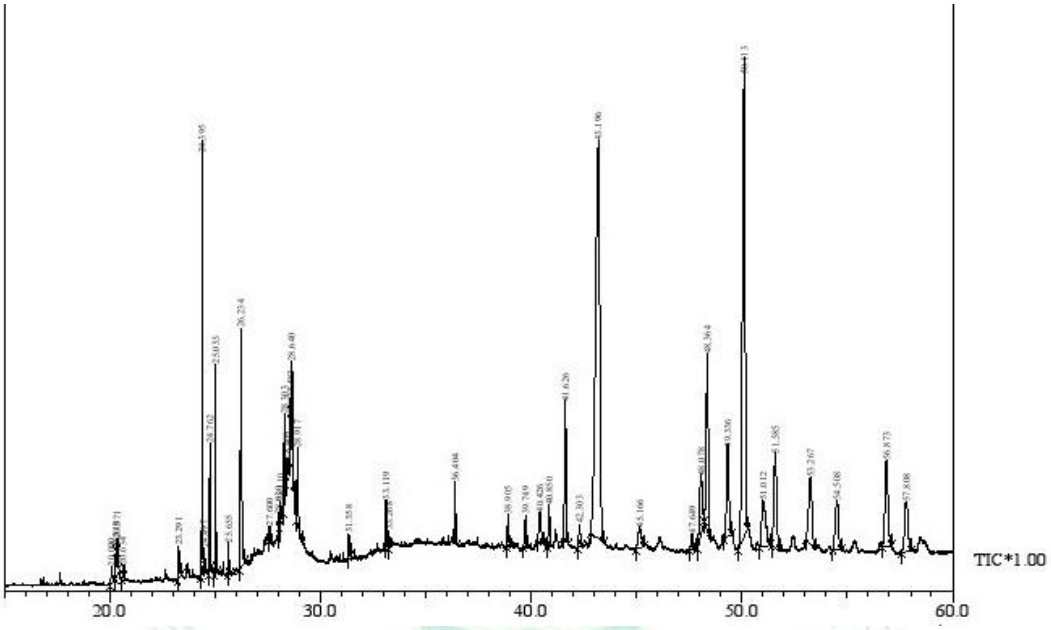

Figure 2: GC-MS Chromatogram of methanolic Leaf extract of *C. halicacabum*

Table 2: GC-MS report of methanolic Leaf extract of *C. halicacabum*

Peak	R. Time	Area%	Name of the compounds	Molecular formula	M.W.
1	20.090	0.25	Dodecanoic acid	$C_{12}H_{24}O_2$	200
2	20.310	0.15	Glutaric acid, 2-(4-fluorophenyl)ethyl 2-methylhex-3-yl ester	$C_{20}H_{29}FO_4$	352
3	20.371	0.15	1,2-Benzenedicarboxy lic acid,bis(2-methyl propyl) ester	$C_{16}H_{22}O_4$	278
4	20.634	0.12	1,2-Benzenedicarboxy lic acid, diethyl ester	$C_{12}H_{14}O_4$	222
5	23.291	3.88	tetradecanoic acid	$C_{14}H_{28}O_2$	228
6	24.395	0.49	2,6,10-Trimethyl,14-ethylene-14-pentadecne	$C_{20}H_{38}$	278
7	24.497	0.17	2-Pentadecanon, 6,10,14-trimethyl-	$C_{18}H_{36}O$	268
8	24.762	1.18	Neophytadine	$C_{20}H_{38}$	278
9	25.033	1.95	3,7,11,15-Tetramethyl-2-hexadecen-1-ol,3,7,11,15-tetramethyl	$C_{20}H_{40}O$	296
10	25.655	0.31	Hexadecanoic acid, methyl ester	$C_{17}H_{34}O_2$	270
11	26.234	3.76	Pentadecanoic acid	$C_{15}H_{30}O_2$	242
12	27.600	0.21	9-Octadecenoic acid (z)	$C_{18}H_{34}O_2$	282
13	28.020	0.15	9,12-Octadecadienoic acid, methyl ester	$C_{19}H_{34}O_2$	294
14	28.110	0.25	9,12,15-Octadecatrienoic acid, methyl ester, (z,z,z)-	$C_{19}H_{32}O_2$	292
15	28.303	1.02	Phytol isomer	$C_{20}H_{40}O$	296
16	28.409	0.21	Tetradecanoic acid, methyl ester	$C_{15}H_{30}O_2$	242
17	28.583	0.29	9,12-Octadecadienoic acid (z,z)-	$C_{18}H_{32}O_2$	280
18	28.640	1.49	Cis-vaccenic acid	$C_{18}H_{34}O_2$	282
19	28.917	1.02	Octadecanoic acid	$C_{18}H_{36}O_2$	284
20	31.358	0.32	Eicosanoic acid	$C_{20}H_{40}O_2$	312
21	33.119	0.55	1,2-Benzene di carboxylic acid	$C_{24}H_{38}O_4$	390
22	33.268	0.17	Bis(2- Ethylhexyl) Phthalate	$C_{24}H_{38}O_4$	390
23	36.404	0.68	Squalene	$C_{30}H_{50}$	410
24	38.905	0.53	Beta –sitosterin	$C_{29}H_{50}O$	414
25	39.749	0.72	24-Epicampesterol	$C_{28}H_{48}O$	400
26	40.426	0.97	Gamma.-tocopherol	$C_{28}H_{48}O_2$	416
27	40.850	0.81	Fucosterol, beta- dihydro	$C_{29}H_{50}O$	414

28	41.626	3.10	Stigmast-5-en-3-ol, oleate	$C_{47}H_{82}O_2$	678
29	42.303	0.56	Vitamin E	$C_{29}H_{50}O_2$	430
30	43.196	24.85	Calix[4]arene	$C_{28}H_{24}O_4$	424
31	45.166	0.96	Ergost-5-en-3-ol, (3.beta.,24r)-	$C_{28}H_{48}O$	400
32	47.649	0.49	D-Friedoolean-14-en-3-one	$C_{30}H_{48}O$	424
33	48.078	5.68	Beta-Sitosterol	$C_{29}H_{50}O$	414
34	48.364	2.66	4,4,6a,6b,8a,11,11,14b-Octamethyl-1,4,4a,5,6,6a, 6b	$C_{30}H_{48}O$	424
35	49.336	3.24	tetramethyltricyclo[5.4.0.0(4,11)]	$C_{16}H_{28}O$	236
36	50.113	18.24	Epi-.Psi.- Taraxastanonol	$C_{30}H_{50}O_2$	442
37	51.012	2.67	Methyl commate D	$C_{31}H_{50}O_4$	486
38	51.585	3.86	D:A-Friedoolean-6-ene	$C_{30}H_{50}$	410
39	53.267	3.21	Stigmast-4-en-3-one	$C_{29}H_{48}O$	412
40	54.508	2.30	Dimethyl{bis[(4,8,8-trimethyldecahydro-1,4 methanoazulen-9-y)	$C_{32}H_{56}O_2$	500
41	56.873	3.91	IsoLongifolol	$C_{15}H_{26}O$	222
		100.00			

Methanolic leaves extract of *D. viscosa* indicates fifty two constituents. There are five major constituents were present likely 7-methanoazulen-6-ol, Alpha-Methyl gluco furanoside, Pregn-4-Ene-3, 20-Dione, Palmitic acid and Alpha-Ionol. Based on GC-MS spectrum confirmed the compounds with retention time 39.058, 27.459, 35.870, 37.685 and 26.577 respectively (Figure 3). Apart from the above mentioned compounds, the 7-methanoazulen-6-ol, Alpha-Methyl gluco furanoside, Pregn-4-Ene-3, 20-Dione was containing the percentage of 28.32, 20.00 and 10.54. The 7-methanoazulen-6-ol was identified as active compound of the species *D. viscosa*. The molecular formula of the compound was $C_{15}H_{26}O$ (Table 3).

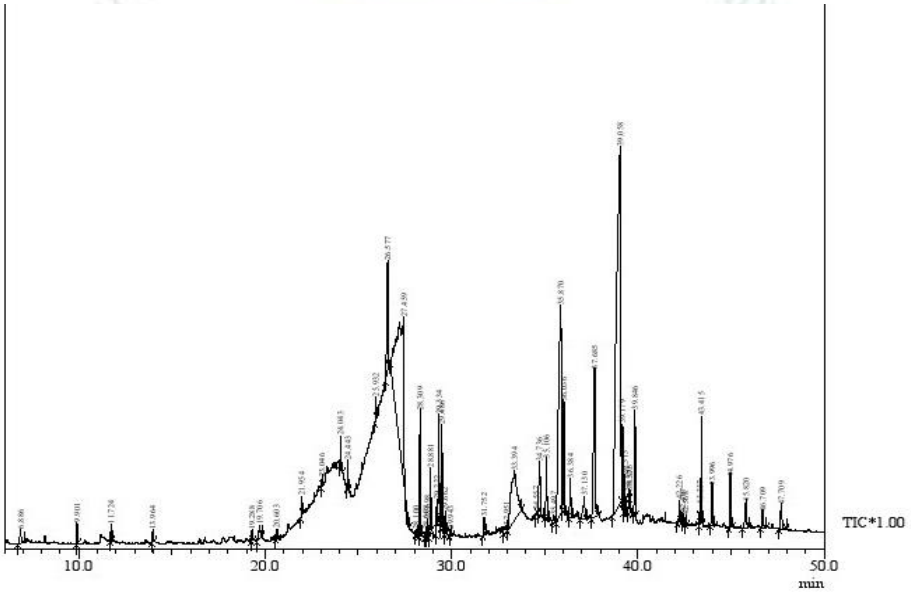

Figure 3: GC-MS Chromatogram of methanolic Leaf extract of *D.viscosa*

Table 3: GC-MS report of methanolic Leaf extract of *D. viscosa*

Peak	R. Time	Area%	Name of the Compounds	Molecular Formula	M.W.
1	6.886	0.36	Monomethylmalonate	$C_4H_6O_4$	118
2	9.901	0.28	4H-Pyran-4-one,2,3-dihydro-3,5-dihydroxy-6-methyl-	$C_6H_8O_4$	144
3	11.724	0.22	2,3-Dihydro-Benzofuran	C_8H_8O	120
4	13.964	0.15	2-Methoxy-4-Vinylphenol	$C_9H_{10}O_2$	150
5	19.288	0.14	3',5'-Dimethoxyacetophenone	$C_{10}H_{12}O_3$	180
6	19.706	0.43	2,3-Di-O-methyl-D-xylopyranose	$C_7H_{14}O_5$	178
7	20.603	0.14	Megastigmatrienone	$C_{13}H_{18}O$	190
8	21.954	0.28	2H-1-Benzopyran-5-ol, 3,4-Dihydro-2,2-dimethyl-	$C_{11}H_{14}O_2$	178
9	23.046	0.09	Tetradecanoic acid	$C_{14}H_{28}O_2$	228
10	24.043	0.47	2,4,6-Cycloheptatrien-1-one, 2-Hydroxy-5-(3-Methyl-2-But	$C_{15}H_{18}O_2$	230

11	24.443	0.31	2,6,10-Trimethyl,14-Ethylene-14-Pentadecne	$C_{20}H_{38}$	278
12	25.932	0.27	Hexadecanoic Acid, Methyl Ester	$C_{17}H_{34}O_2$	270
13	26.577	5.91	Palmitic acid	$C_{16}H_{32}O_2$	256
14	27.459	20.00	Alpha-Methylglucofuranoside	$C_7H_{14}O_6$	194
15	28.100	0.05	Heptadecamonoenoic Acid	$C_{17}H_{32}O_2$	268
16	28.309	1.67	Diallylphenylvinylsilane	$C_{14}H_{18}$	214
17	28.608	0.08	9,12-Octadecadienoic acid (Z,Z)-, methyl ester	$C_{19}H_{34}O_2$	294
18	28.698	0.24	9,12,15-Octadecatrienoic acid, methyl ester, (Z,Z,Z)-	$C_{19}H_{32}O_2$	292
19	28.881	0.89	Phytol	$C_{20}H_{40}O$	296
20	29.222	0.44	9,12-Octadecadienoic acid (Z,Z)-	$C_{18}H_{32}O_2$	280
21	29.334	1.63	Dichloroacetic acid, tridec-2-ynyl ester	$C_{15}H_{24}C_{l2}O_2$	306
22	29.486	1.45	(3aS,4R,7R)-1,4,9,9-Tetramethyl-5,6,7,8-tetrahydro-4H-3a,7-methanoazulene	$C_{15}H_{22}$	202
23	29.662	0.29	Octadecanoic acid	$C_{18}H_{36}O_2$	284
24	29.943	0.08	(1R,4aR,4bS,7S,10aR)-1,4a,7-Trimethyl-7-vinyl-1,2,3,4,4a,4b,5,6,7,8,10,10a-	$C_{20}H_{30}O$	286
25	31.752	0.41	Lup-20(29)-Ene-3,28-Diol, (3.Beta.)-	$C_{30}H_{50}O_2$	442
26	32.951	0.23	Benzene, Hexaethyl-	$C_{18}H_{30}$	246
27	33.394	2.49	Cycloprop[e]indene-1a,2(1H)-dicarboxaldehyde, 3a,4,5,6,6a,6b-hexahydro-5,5,6b-	$C_{15}H_{20}O_2$	232
28	34.557	0.06	Cyclopropanecarboxylic acid, 2-[4-(1,1-dimethylethyl)phenyl]-, ethyl ester-	$C_{16}H_{22}O_2$	246
29	34.736	1.87	Pregn-5-en-20-one, 3-(acetyloxy)-16,17-epoxy-6-methyl-, (3.beta.,16.alpha.)-	$C_{24}H_{34}O_4$	386
30	35.106	1.15	4,5-Secocholest-6-en-4-oic acid, 5-oxo-	$C_{27}H_{44}O_3$	416
31	35.497	0.16	5-Isopropylidene-6-methyldeca-3,6,9-trien-2-one	$C_{14}H_{20}O$	204
32	35.870	10.54	Pregn-4-Ene-3,20-Dione, 14-Hydroxy-	$C_{21}H_{30}O_3$	330
33	36.036	2.26	Costunolide	$C_{15}H_{20}O_2$	232
34	36.384	0.88	Bicyclo[5.3.0]decane, 2-methylene-5-(1-methylvinyl)-8-methyl-	$C_{15}H_{24}$	204
35	37.130	0.87	2(1H)-Naphthalenone, 4A,5,6,7,8,8A-Hexahydro-6-[1-(Hydroxymethyl)	$C_{15}H_{22}O_2$	234
36	37.685	4.87	Alpha-Ionol	$C_{13}H_{22}O$	194
37	39.058	28.32	7-methanoazulen-6-ol	$C_{15}H_{26}O$	222
38	39.179	1.25	Decahydronaphtho[2,3-b]furan-2-one, 3-[[2-(1H-imidazol-4-yl)ethylamino]methyl]-	$C_{20}H_{29}N_3O_2$	343
39	39.313	0.64	4,14-Dimethyl-11-isopropyltricyclo[7.5.0.0(10,14)]tetradec-4-en-8-one	$C_{19}H_{30}O$	274
40	39.520	0.16	5-(3-Buten-1-Ynyl)-2,2'-Bithienyl	$C_{12}H_8S_2$	216
41	39.575	0.12	7-Methoxy-3-(4-pentylcyclohexyl)-1,2-dihydronaphthalene	$C_{22}H_{32}O$	312
42	39.846	1.76	Pregnan-20-one, 3,5-dihydroxy-6-methyl-, (3.beta.,5.alpha.,6.beta.)-	$C_{22}H_{36}O_3$	348
43	42.226	0.26	Spiro(9,9'-Bis(2-Methyl-9H-Fluorene))	$C_{15}H_{25}I$	332
44	42.407	0.10	(R)-6-Methoxy-2,8-dimethyl-2-((4R,8R)-4,8,12-trimethyltridecyl)chroman	$C_{27}H_{20}$	344
45	42.568	0.11	.gamma.-Tocopherol	$C_{28}H_{48}O_2$	416
46	43.337	0.16	Ethyl 5,8,11,14,17-icosapentaenoate	$C_{22}H_{34}O_2$	330
47	43.415	1.49	Vitamin E	$C_{29}H_{50}O_2$	430
48	43.996	0.81	(3S,3aR,6R,8aS)-7,7-Dimethyl-8-methyleneoctahydro-1H-3a,6-methanoazulene-	$C_{15}H_{22}O$	218
49	44.976	1.10	Stigmasterol	$C_{29}H_{48}O$	412
50	45.820	0.85	.gamma.-Sitosterol	$C_{29}H_{50}O$	414
51	46.709	0.44	25-Homo-24-Ketocholesterol	$C_{28}H_{46}O_2$	414
52	47.709	0.77	2,2-Dimethylcholest-7-En-3-Ol	$C_{29}H_{50}O$	414
		100.00			

FT-IR

FT-IR range was utilized to distinguish the utilitarian gathering of the dynamic segments in view of the peak an incentive in the point of infrared radiation. The FT-IR analysis results showed that the methanolic stem extract of *C. quadrangularis* having the presence of Alcohol, Aldehyde, Iso cyanides, Alkane, Primary alcohol, Chloro constituent (Table 4), which shows major peaks at 3420.91, 2924.27, 2846.85, 2076.74, 1647.04, 1454.75, 1409.96, 1053.44, 1032.56, 1017.56, 718.75 and 666.26 respectively (Figure 4). The FT-IR analysis of methanolic leaves extract of *C. halicacabum*,

the presence of Alcohol, Iso cyanides, Alkyl Compound, Alkane, Primary alcohol, Chloro constituent (Table 5). Constituent which shows major peaks at 3402.43, 2926.05, 2226.24, 2077.15, 1644.48, 1454.30, 1412.48, 1055.44, 1033.07, 1018.25, 906.19 and 655.71 respectively (Figure 5). The FT-IR analysis methanolic leaves extract of *D. viscosa* showed Alcohol, Aldehyde, Nitrite, Alkane, Primary alcohol (Table 6). Constituent which shows high peaks at 3336.61, 2835.87, 1650.80, 1451.41, 1263.33 and 1018.19 (Figure 6).

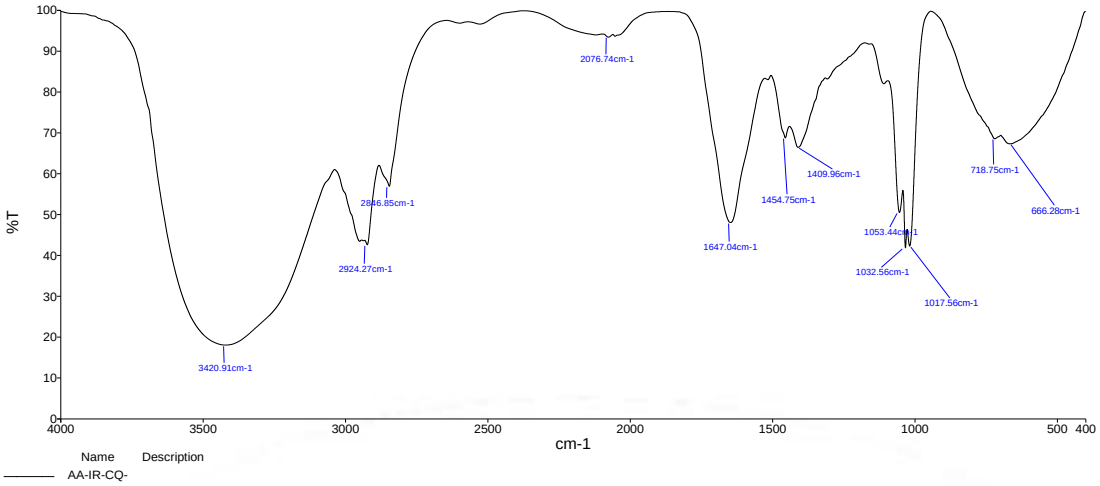

Figure 4: FT-IR Spectrum of methanolic Stem extract of *C. quadrangularis*

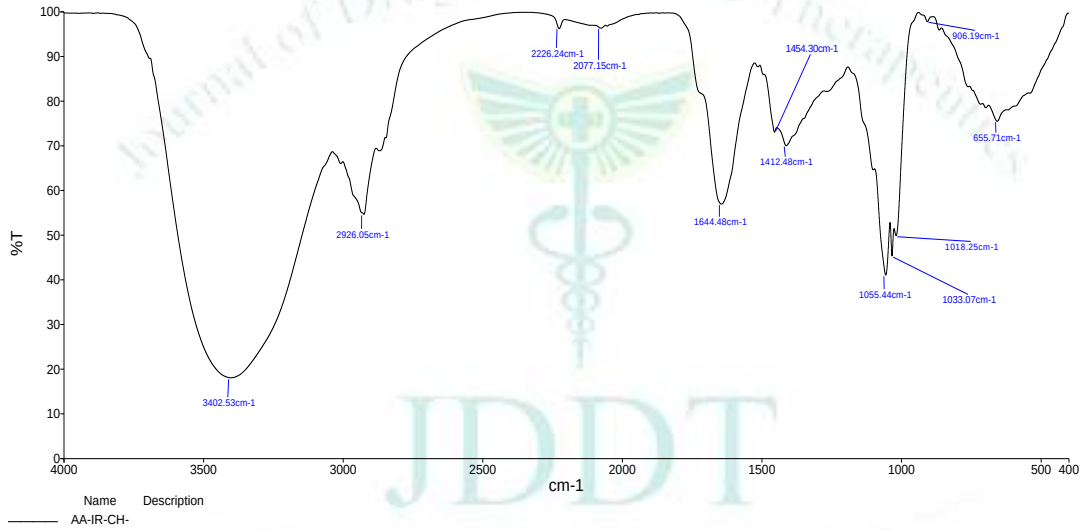

Figure 5: FT-IR Spectrum of methanolic Leaf extract of *C. halicacabum*

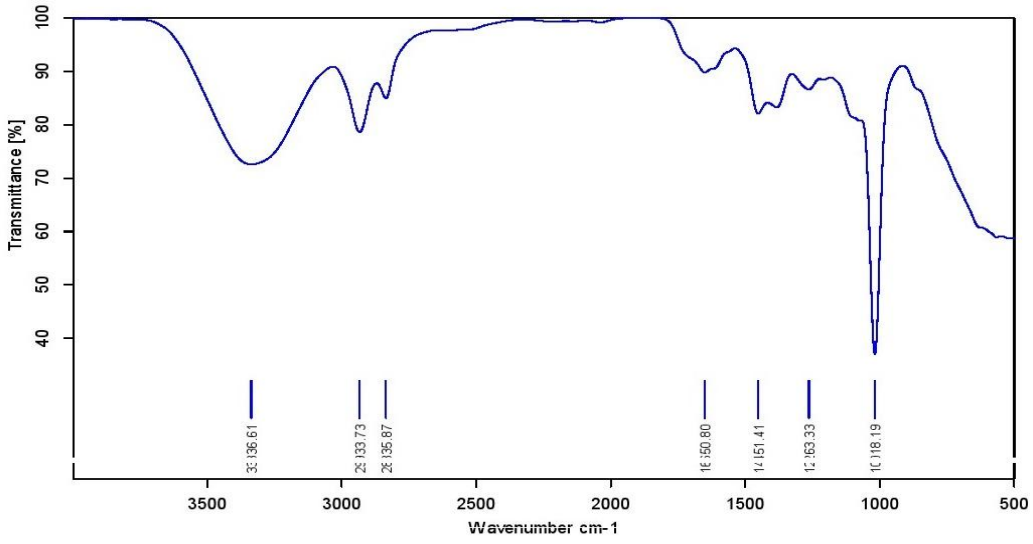

Figure 6: FT-IR Spectrum of methanolic Leaf extract of *D.viscosa*

Table 4: FT-IR absorption and functional groups of Stem extract of *C. quadrangularis*

S. No	Wave No.	Molecular Motion	Functional group	Absorption intensity
1	3420.91cm-1	O-H	Alcohol	Strong
2	2924.27 cm-1	O-H	Alcohol	Medium
3	2846.85 cm-1	C=O	Aldehyde	Weak
4	2076.74 cm-1	C=N	Iso cyanides	Medium
5	1647.04 cm-1	O-NO	Nirite	Strong
6	1454.75 cm-1	C-H	Alkane	Medium
7	1409.96 cm-1	C-H	Alkane	Medium
8	1053.44 cm-1	C-O	Primary alcohol	Strong
9	1032.56 cm-1	C-O	Primary alcohol	Strong
10	1017.56 cm-1	C-O	Primary alcohol	Strong
11	718.75 cm-1	C-Cl	Chloro compound	Strong
12	666.26 cm-1	C-Cl	Chloro compound	Strong

Table 5: FT-IR absorption and functional groups of Leaf of *C. halicacabum*

S. No	Wave No.	Molecular Motion	Functional group	Absorption intensity
1	3402.53 cm-1	O-H	Alcohol	Strong
2	2926.05 cm-1	O-H	Alcohol	Medium
3	2226.24 cm-1	C=N	Iso cyanides	Medium
4	2077.15 cm-1	C=N	Iso cyanides	Medium
5	1644.48 cm-1	C=N	Alkyl compound	Strong
6	1454.30 cm-1	C-H	Alkane	Medium
7	1412.48 cm-1	C-H	Alkane	Medium
8	1055.44 cm-1	C-O	Primary alcohol	Strong
9	1033.07 cm-1	C-O	Primary alcohol	Strong
10	1018.25 cm-1	C-O	Primary alcohol	Strong
11	906.19 cm-1	C-O	Primary alcohol	Strong
12	655.71 cm-1	C-Cl	Chloro compound	Strong

Table 6: FT-IR absorption and functional groups of Leaf of *D. viscosa*

S. No	Wave No.	Molecular Motion	Functional group	Absorption intensity
1	3336.61cm-1	O-H	Alcohol	Strong
2	2933.73 cm-1	O-H	Alcohol	Medium
3	2835.87 cm-1	C=O	Aldehyde	Weak
4	1650.80 cm-1	O-NO	Nitrite	Strong
5	1451.41 cm-1	C-H	Alkane	Medium
6	1263.33 cm-1	C-O	Alcohol	Medium
7	1018.19 cm-1	C-O	Primary alcohol	Strong

The biological therapeutic activities of identified major components of the stem extract of *C. quadrangularis*, leaves extracts of *C. halicacabum* and *D. viscosa* were given in Table 7. Therapeutic activities of these major components analysed by using Dr. Duke's Phytochemical and Ethno botanical data bases [20]

Table 7: Therapeutic activity of major compounds in *C. quadrangularis, C. halicacabum* and *D. viscosa*

S. No	Name of the Compound	Compound Nature	Therapeutic activity
1	3-O-Methyl-d-glucose	Alcohol	Osteoporosis, anaesthetics, anti-epileptics, anti-convulsants and anti-parkinson drugs.
2	D-Allose	Allose	Treating wounds, ulcers, burns, scars, keloids, anti-pruritic, anti-psoriatic, arthritis and carthorses.
3	9,12,15-Octadecatrienoic acid	Fatty acid	Anti-psoriatic, joint disorders, anti-pyretic, anti-inflammatory, wounds healing, anti-Tumor activities.
4	Phytol	Acyclicditerpene alcohol	Anti-tubercular activity, allergic disorders and anti-microbial activities.
5	Pentadecanoic Acid	Fatty acid	Anti-cancer drug, anti-asthmatics and anti-abortive.

6	Calix[4]arene	Calixarene	Anti-cancer (cancer immunotherapy)
7	Epi-Psi-Taraxastanonol	Terpenoids	Cardiovascular disease
8	Beta-Sitosterol	Sterol	Swelling, bladder infections, urinary tract infections, anti-carcinogenic and anti-atherogenic properties, Anti-asthmatics and throat disorders.
9	Tetradecanoic acid	Fatty acid	Antitumor activity, anti-spasmodic, anti-asthmatics and throat disorders.
10	IsoLongifolol	Ketone	Anti-microbial activities and anti-inflammatory
11	7-methanoazulen-6-ol	Alcohol	Anti-perspirants and anti-pruritic
12	Alpha-Methylglucofuranoside	Glycoside	Treating bacterial and, fungal infections, anti-abortive, anti-bacterial, anti-viral and allergic disorders.
13	Pregn-4-Ene-3,20-Dione	Steroid	Sexualdisorders,baldness, anti-psoriatic, anti-pyretic, anti-inflammatory, Anti-bacterial and Anti-allergic.
14	Palmitic acid	Fatty acid	Throat disorders,anti-asthmatics, anti-pruritic, anti-psoriatic, anti-epileptics, anti-convulsantsand anti-migraine.
15	Alpha-Ionol	Alcohol	Anti-diabetics and anti-perspirants.

Source: J. A. Duke (1992) Database of Biologically Active Phytochemicals[20]

CONCLUSION

In the present study, the GC-MS analysis of the methanolic extract of *C. quadrangularis, C. halicacabum and D. viscosa* majorly present of fifteen compounds. Such as 3-O-Methyl-D-glucose, D-Allose, 9,12,15-Octadecatrienoic acid, Phytol, Pentadecanoic acid. Calix [4] arene, Epi-.Psi.- Taraxastanonol, Beta-Sitosterol,Tetradecanoic acid and Iso Longifolol,7-methanoazulen-6-ol, Alpha-Methylglucofuranoside, Pregn-4-Ene-3, 20-Dione, Alpha-Ionol and Palmitic acid. Presence of these compounds were justifies, wounds healing, arthritis, anti-inflammatory Anti-tubercular activity anti-microbial activities, anti-asthmatics, throat disorders, Sexual disorders, baldness, Anti-cancer drug and other pharmacological activities. We report the presence of some of the significant components decided by GC-MS analysis, FT-IR analysis. From these results, it could be concluded that *C. quadrangularis, C. halicacabum and D. viscosa* contains different bioactive compounds. Assessment of pharmacological activity is under progress. Hence, it is prescribed as a plant of Phyto pharmaceutical significance.

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