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Kumari Ranjana
University Department of Botany Ranchi University, Ranchi, Jharkhand, India

Patnaik Amit
University Department of Botany Ranchi University, Ranchi, Jharkhand, India

Srivastava Anjani Kumar
University Department of Botany Ranchi University, Ranchi, Jharkhand, India

Correspondence
Kumari Ranjana
University Department of Botany Ranchi University, Ranchi, Jharkhand, India

GC-MS analysis of methanol extract from bark, flower, leaf and seed of *Madhuca indica* J.F. Gmel

Kumari Ranjana, Patnaik Amit and Srivastava Anjani Kumar

Abstract
The aim of this study is to detect the phytochemicals with bioactivity present in the methanol extract of bark, flower, leaf and seed of *Madhuca indica* by GC-MS analysis. The GC-MS analysis of the methanol extract of bark, flower, leaf and seed revealed the presence of 42, 38, 46 and 39 phytochemicals respectively. This study forms a basis for the biological depiction and prominence of the compounds identified.

Keywords: *Madhuca indica*, GC-MS, phytochemicals, Mahua, NTFP

Introduction
Madhuca indica is a plant belonging to the family Sapotaceae. It is found abundantly in forests of Jharkhand state of India. It is indigenous to the Indian subcontinent and abundantly distributed in the dry deciduous forests of central India (Madhya Pradesh, Orissa, Chattisgarh, Bihar, Jharkhand, and parts of Rajasthan, Gujarat, Andhra Pradesh and Tamil Nadu). It is commonly known as Mahua or Mowarh in North, Mahul in Orissa and Illipi in Southern part of India. It is also known as Madhuka', Madhudruma', Madhupuspa', Madhusakha' and `Gudapuspa' in Sanskrit. The name is derived from the Sanskrit word madhu, (meaning honey), due to its exceptionally sugar-rich (66-72 per cent of dry weight) flowers. It is a tree of high economic importance producing two most important non-timber forest products (NTFPs) - mahua flowers and mahua seeds. Mahua flowers are commonly used in preparation of alcoholic beverages. The flowers are produced during the sparest season of agriculture (March-May), and act as vibrant source of income and employment generation for the weakest section of the society. However, it has been noticed that quality and taste of alcohol deteriorates due to unhygienic collection and processing of flowers. Besides *Madhuca indica* plant is store house of many phytochemicals which are used by the tribes of Jharkhand to cure various ailments. The plant is also nutritious and is rich source of vitamins, sugars, amino acids, organic acids, enzymes and other compounds.
In view of this GC-MS analysis was made to find out important phytochemicals of Bark, Flower, Leaf and Seed which might lead to formulation and addition of many future drugs.

Materials and Methods
Extract Preparation and GC-MS analysis
The collected plants samples were shade dried and ground to fine powder with the help of mortar pestle. The finely ground powder was then suspended in methanol and was left for 3 days with occasional shaking. The filtrate was dried and final weighed. 5-10 mg of semi-solid filtrates were then dissolved in appropriate amount of methanol. Such extracts prepared from Bark, Flower, Leaf and Seed were sent to Advance Instrumentation Research Facility (AIRF), New Delhi for GC-MS analysis.

Results
GC-MS analysis (Fig. 1) of experimental plant parts - Bark, Flower, Leaf and Seed - showed 42 (Fig. 2, 3), 38 (Fig. 4, 5), 46 (Fig. 6, 7) and 39 (Fig. 8, 9) peaks, respectively, representing number of phytochemicals present in them.

D:\GCMS\GCMS METHOD\Organic\Extract.qgm

Method

[Comment]

===== Analytical Line 1 =====

[AOC-20i+s]

# of Rinses with Presolvent	:5
# of Rinses with Solvent(post)	:8
# of Rinses with Sample	:2
Plunger Speed(Suction)	:High
Viscosity Comp. Time	:0.2 sec
Plunger Speed(Injection)	:High
Syringe Insertion Speed	:High
Injection Mode	:Normal
Pumping Times	:5
Inj. Port Dwell Time	:0.0 sec
Terminal Air Gap	:No
Plunger Washing Speed	:High
Washing Volume	:6uL
Syringe Suction Position	:0.0 mm
Syringe Injection Position	:0.0 mm
Solvent Selection	:All A,B,C

[GC-2010]

Column Oven Temp.	:50.0 °C
Injection Temp.	:260.00 °C
Injection Mode	:Split
Flow Control Mode	:Linear Velocity
Pressure	:69.0 kPa
Total Flow	:16.3 mL/min
Column Flow	:1.21 mL/min
Linear Velocity	:39.9 cm/sec
Purge Flow	:3.0 mL/min
Split Ratio	:10.0
High Pressure Injection	:OFF
Carrier Gas Saver	:OFF
Splitter Hold	:OFF

Oven Temp. Program

Rate	Temperature(°C)	Hold Time(min)
-	50.0	4.00
10.00	250.0	0.00
15.00	280.0	14.00

< Ready Check Heat Unit >

Column Oven	: Yes
SPL1	: Yes
MS	: Yes

< Ready Check Detector(FTD) >
< Ready Check Baseline Drift >
< Ready Check Injection Flow >

SPL1 Carrier	: Yes
SPL1 Purge	: Yes

< Ready Check APC Flow >
< Ready Check Detector APC Flow >

External Wait	:No
Equilibrium Time	:1.0 min

[GC Program]

[GCMS-QP2010 Ultra]

IonSourceTemp	:230.00 °C
Interface Temp.	:270.00 °C
Solvent Cut Time	:3.50 min
Detector Gain Mode	:Relative
Detector Gain	:+0.00 kV
Threshold	:1000

[MS Table]

--Group 1 - Event 1--

Start Time	:4.00min
End Time	:39.98min
ACQ Mode	:Scan
Event Time	:0.20sec
Scan Speed	:3333
Start m/z	:40.00
End m/z	:650.00

Sample Inlet Unit :GC

[MS Program]

Use MS Program :OFF

1 / 1

Fig 1: Method of GC-MS analysis

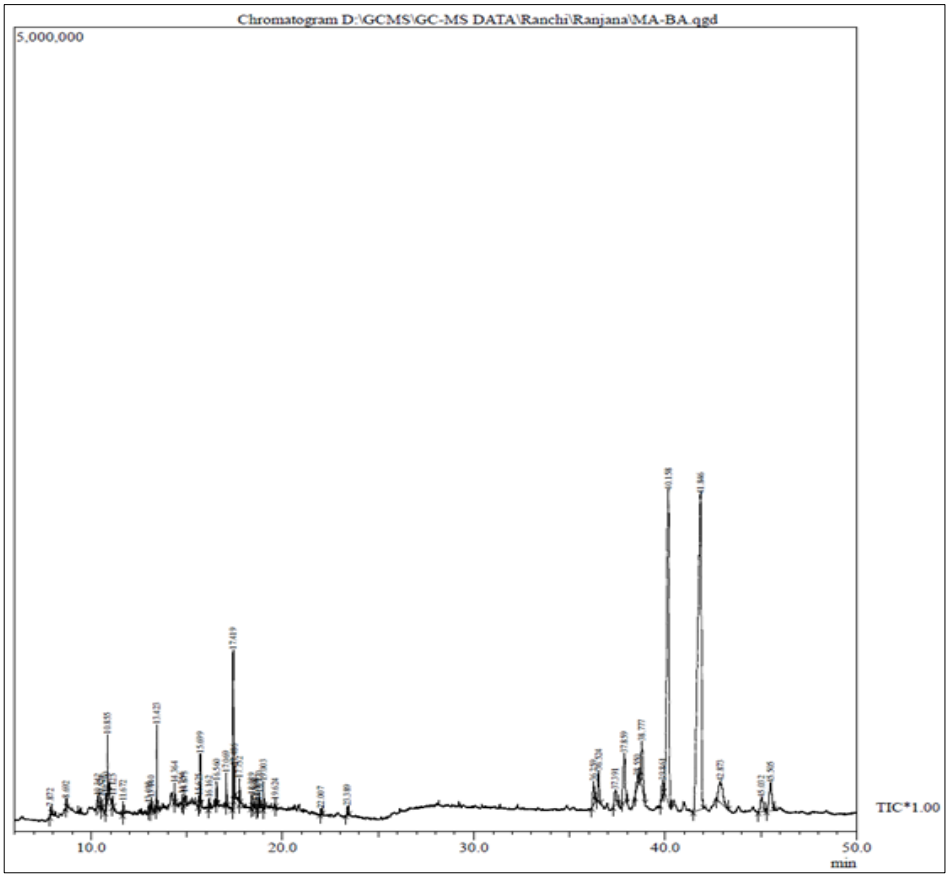


Fig 2: Chromatogram of methanol extract of bark

Peak Report TIC

Peak#	R.Time	Area	Area%	Name
1	7.872	101896	0.17	1-TRIDECENE
2	8.692	92902	0.15	CYCLOHEXANE, HEXYL-
3	10.342	180729	0.30	PHENOL, 2,6-DIMETHOXY-
4	10.524	110707	0.18	Cyclohexane, 1,1'-hexylidenebis-
5	10.760	299418	0.49	5-OXO-PYRROLIDINE-2-CARBOXYLIC ACID METHYI
6	10.855	855472	1.40	1-PENTADECENE
7	11.125	104076	0.17	1,7-DIMETHYL-4-(1-METHYLETHYL)CYCLODECANE
8	11.672	121788	0.20	CYCLOHEXANE, OCTYL-
9	13.018	80160	0.13	1H-2-Benzopyran-1-one, 3,4-dihydro-8-hydroxy-3-methyl-
10	13.140	184660	0.30	3,9-DIMETHYL-TRICYCLO[4.2.1.1 2,5]DECAN-9-OL
11	13.423	811320	1.33	E-14-Hexadecenal
12	14.364	198960	0.33	8-PENTADECANONE
13	14.754	114521	0.19	PHENOL, 2,6-DIMETHOXY-4-(2-PROPENYL)-
14	14.873	343095	0.56	5-Bromovaleric acid, 2-tridecyl ester
15	15.625	101213	0.17	CYCLOHEXANE, (1,1-DIMETHYLPROPYL)-
16	15.699	475884	0.78	3-Eicosene, (E)-
17	16.162	110375	0.18	2,6,10-TRIMETHYL,14-ETHYLENE-14-PENTADECNE
18	16.560	218993	0.36	8-Octadecanone
19	17.069	296194	0.49	HEXADECANOIC ACID, METHYL ESTER
20	17.419	1505986	2.47	Dibutyl phthalate
21	17.486	354519	0.58	HEXADECANOIC ACID
22	17.752	276923	0.45	1-OCTADECENE
23	18.389	131786	0.22	4-Oxazolecarboxylic acid, 4,5-dihydro-2-phenyl-, 1-methylet
24	18.538	54062	0.09	10-Nonadecanone
25	18.709	88753	0.15	7,10-Hexadecadienoic acid, methyl ester
26	18.770	155151	0.25	7-Hexadecenoic acid, methyl ester, (Z)-
27	19.003	246347	0.40	EICOSANOIC ACID, METHYL ESTER
28	19.624	66416	0.11	Trifluoroacetic acid, pentadecyl ester
29	22.007	75643	0.12	Pentadecanal-
30	23.389	135539	0.22	TETRADECANAL
31	36.259	825841	1.36	Chondrillasterol
32	36.524	988722	1.62	4,4,6A,6B,8A,11,11,14B-OCTAMETHYL-1,4,4A,5,6,6A,6E
33	37.391	716616	1.18	4,4,6a,6b,8a,11,11,14b-Octamethyl-1,4,4a,5,6,6a,6b,7,8,8a,9
34	37.859	2277096	3.74	METHYL COMMATE B
35	38.550	533028	0.87	4-(1-CYCLOHEXENYL)-2-TRIMETHYLSILYLMETHYL-
36	38.777	2040158	3.35	METHYL COMMATE B
37	39.861	623703	1.02	13,27-Cycloursan-3-ol, acetate, (3.beta.,13.beta.,14.beta.)-
38	40.158	15165881	24.89	4,4,6a,6b,8a,11,11,14b-Octamethyl-1,4,4a,5,6,6a,6b,7,8,8a,9
39	41.846	25316348	41.55	Dimethyl{bis[(4,8,8-trimethyldecahydro-1,4-methanoazulen-
40	42.873	2053193	3.37	5H-3,5A-EPOXYNAPHTH[2,1-C]OXEPIN, DODECAHYD
41	45.032	842797	1.38	(-)-Isolongifolol, acetate
42	45.505	1655441	2.72	14-Oxatricyclo[9..2.1.0(1,10)]tetradecane, 2,6,6,10,11-penta
		60932312	100.00	

Fig 3: Phytochemicals present in the methanol extract of Bark

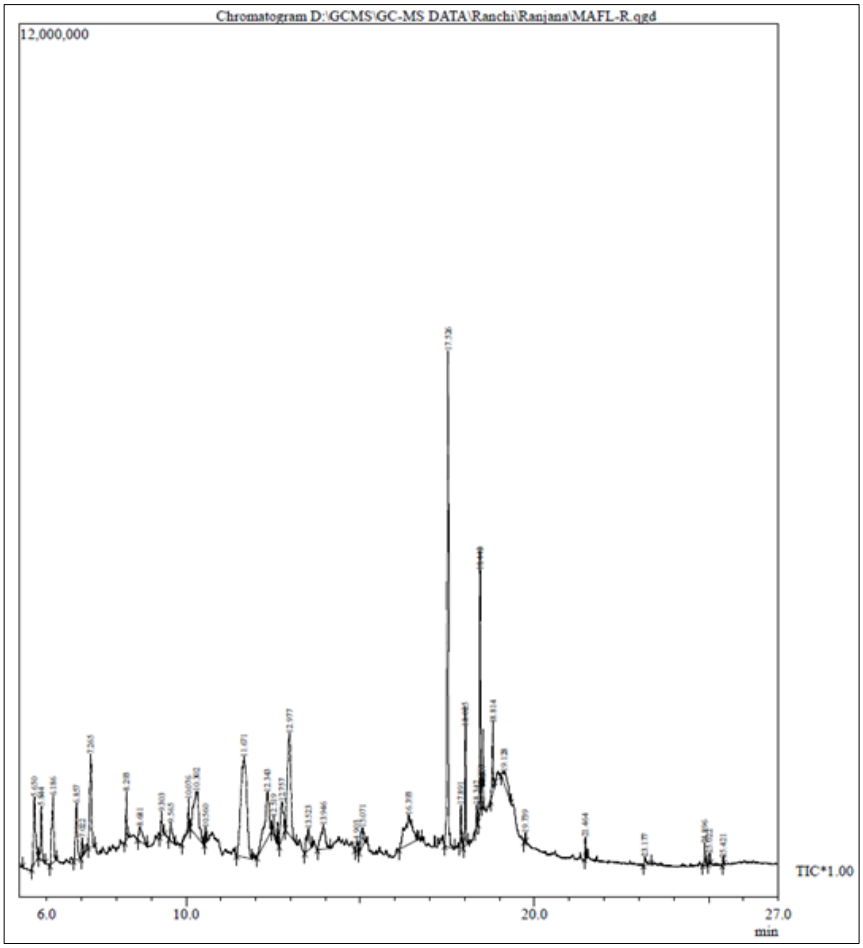


Fig 4: Chromatogram of methanol extract of flower

Peak Report TIC

Peak#	R.Time	Area	Area%	Name
1	5.002	4890748	4.08	Ethane, 1,2-bis[(4-amino-3-furazanyl)oxy]-
2	5.650	3668875	3.06	2-FURANMETHANOL
3	5.844	1955435	1.63	2-Propanone, 1-(acetyloxy)-
4	6.186	3633364	3.03	1,3-CYCLOPENTENEDIONE
5	6.857	3051780	2.55	CYCLOHEXANE, METHOXY-
6	7.022	577970	0.48	5-ISOPROPYL-2-METHYLBICYCLO[3.1.0]HEX-2-ENE
7	7.265	4656856	3.89	2(3H)-FURANONE, 5-METHYL-
8	8.293	1368098	1.14	2,4-Dihydroxy-2,5-dimethyl-3(2H)-furan-3-one
9	8.681	1521218	1.27	1,2-CYCLOHEXANEDIONE
10	9.303	953570	0.80	Ethanone, 1-(6-methyl-7-oxabicyclo[4.1.0]hept-1-yl)-
11	9.565	1081129	0.90	2,3-PENTANEDIONE
12	10.076	1034903	0.86	7-OCTEN-2-OL, 2,6-DIMETHYL-
13	10.302	6705049	5.60	2,5-ANHYDRO-1,6-DIDEOXYHEXO-3,4-DIULOSE
14	10.560	382449	0.32	3-OCTANOL, 3,7-DIMETHYL-
15	11.671	16523115	13.80	1,5-ANHYDRO-6-DEOXYHEXO-2,3-DIULOSE
16	12.343	6060714	5.06	Propanoic acid, 2-oxo-
17	12.519	643700	0.54	HEXANE, 1,1'-OXYBIS-
18	12.757	3057562	2.55	Isosorbide
19	12.977	9491580	7.93	5-Hydroxymethylfurfural
20	13.523	1783546	1.49	1,3-Benzenediol, 2-methyl-
21	13.946	2923261	2.44	1-(METHYLENCYCLOPROPYL)-ETHANOL
22	14.903	412862	0.34	2,2,6-TRIMETHYL-3,5-HEPTANEDIONE
23	15.071	1332476	1.11	1-Pyrrolid-2-one, N-carboxyhydrazide
24	16.393	6148594	5.13	BENZENEACETONITRILE, 4-HYDROXY-
25	17.526	16993152	14.19	1,2-BENZENEDICARBOXYLIC ACID, DIETHYL ESTER
26	17.891	1177635	0.98	Tetrahydroionyl acetate
27	18.025	3170319	2.65	Tetrahydroionyl acetate
28	18.342	449686	0.38	1-(4-ISOPROPYLPHENYL)-2-METHYLPROPYL ACETA
29	18.442	6231095	5.20	1-(4-ISOPROPYLPHENYL)-2-METHYLPROPYL ACETA
30	18.507	2158421	1.80	1-(4-ISOPROPYLPHENYL)-2-METHYLPROPYL ACETA
31	18.814	1945994	1.63	(7a-Isopropenyl-4,5-dimethyloctahydroinden-4-yl)methanol
32	19.128	1824943	1.52	Isosorbide Dinitrate
33	19.739	143230	0.12	E-15-Heptadecenal
34	21.464	416214	0.35	Dibutyl phthalate
35	23.177	415126	0.35	9-Octadecynoic acid
36	24.896	615442	0.51	1-PHENANTHRENECARBOXYLIC ACID, 7-ETHENYL-
37	25.022	226388	0.19	Methyl dehydroabietate
38	25.421	123374	0.10	1-PHENANTHRENECARBOXYLIC ACID, 1,2,3,4,4A,4B
		119749873	100.00	

Fig 5: Phytochemicals present in the methanol extract of flower

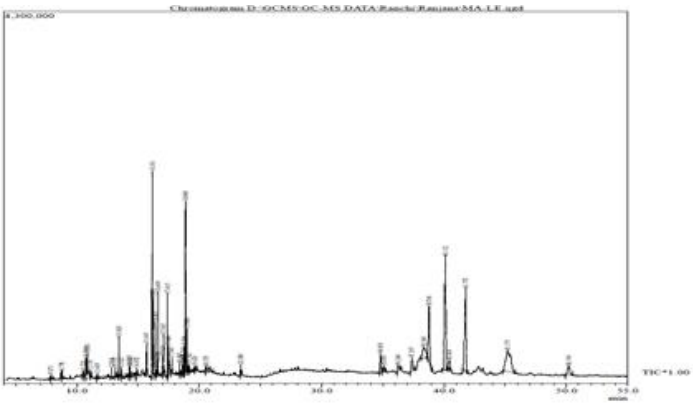


Fig 6: Chromatogram of methanol extract of Leaf

Peak Report TIC

Peak#	R.Time	Area	Area%	Name
1	7.871	88554	0.15	1-DODECANOL
2	8.778	141143	0.24	1,6-Octadien-3-ol, 3,7-dimethyl-, 2-aminobenzoate
3	10.520	54605	0.09	9-Eicosene, (E)-
4	10.749	689286	1.17	L-PROLINE, 5-OXO-, METHYL ESTER
5	10.851	302405	0.51	1-TRIDECENE
6	11.118	100884	0.17	1,7-DIMETHYL-4-(1-METHYLETHYL)CYCLODECANE
7	11.669	81810	0.14	CYCLOHEXANE, OCTYL-
8	12.834	157119	0.27	2(4H)-BENZOFURANONE, 5,6,7,7A-TETRAHYDRO-4,4,
9	13.137	183395	0.31	2H-PYRAN-2-ON, 5,6-DIHYDRO-4-(2,3-DIMETHYL-2-B
10	13.420	694205	1.18	E-14-Hexadecenal
11	13.627	226729	0.39	3-METHYL-2-PENTYL-2-CYCLOPENTEN-1-ONE #
12	14.263	257999	0.44	METHYL 3,3,8,8-TETRAMETHYLTRICYCLO[5.1.0.0~2,4
13	14.361	159784	0.27	8-PENTADECANONE
14	14.872	303575	0.52	Heptadecanal
15	15.695	579616	0.99	1-Octadecene
16	16.161	3535992	6.02	2,6,10-TRIMETHYL,14-ETHYLENE-14-PENTADECNE
17	16.220	1076724	1.83	2-Pentadecanone, 6,10,14-trimethyl-
18	16.413	1172575	2.00	2-HEXADECEN-1-OL, 3,7,11,15-TETRAMETHYL-, [R-[R
19	16.555	186644	0.32	8-Octadecanone
20	16.609	1482211	2.52	3,7,11,15-Tetramethyl-2-hexadecen-1-ol
21	17.024	227627	0.39	14-.BETA.-H-PREGNA
22	17.065	560931	0.95	HEXADECANOIC ACID, METHYL ESTER
23	17.415	1468981	2.50	Dibutyl phthalate
24	17.499	537960	0.92	HEXADECANOIC ACID
25	17.749	263777	0.45	3-Eicosene, (E)-
26	18.387	227879	0.39	4-Oxazolecarboxylic acid, 4,5-dihydro-2-phenyl-, 1-methyle
27	18.604	213290	0.36	Cyclopentanol, 2,4,4-trimethyl-
28	18.705	261674	0.45	9,12-Octadecadienoic acid, methyl ester
29	18.768	645943	1.10	HEXADECADIENOIC ACID, METHYL ESTER
30	18.880	3786785	6.45	2-HEXADECEN-1-OL, 3,7,11,15-TETRAMETHYL-, [R-[R
31	19.000	683351	1.16	OCTADECANOIC ACID, METHYL ESTER
32	19.162	145809	0.25	PALMITALDEHYDE, DIALLYL ACETAL
33	19.620	45930	0.08	9-TRICOSENE, (Z)-
34	20.555	75215	0.13	11-HYDROXYUNDECANOIC ACID, LACTONE
35	23.389	343611	0.58	OCTADECANAL
36	34.803	1309399	2.23	STIGMASTA-5,22-DIEN-3-OL
37	35.097	408312	0.70	D:A-FRIEDOOLEANAN-28-AL, 3-OXO-
38	36.240	595763	1.01	STIGMASTA-7,22-DIEN-3-OL, (3.BETA.,5.ALPHA.,22E,2
39	37.357	1206322	2.05	METHYL COMMATE C
40	38.340	2225018	3.79	.beta.-Amyrin
41	38.768	5158443	8.78	LUP-20(29)-ENE-3,28-DIOL, (3.BETA.)-
42	40.112	9996548	17.02	4,4,6a,6b,8a,11,11,14b-Octamethyl-1,4,4a,5,6,6a,6b,7,8,8a,9
43	40.414	775935	1.32	A-Norcholestane-3-carboxylic acid, 2-oxo-, methyl ester, (3.
44	41.773	8053882	13.71	LUP-20(29)-ENE-3,28-DIOL, (3.BETA.)-
45	45.175	6763121	11.51	03027205002 FLAVONE 4'-OH,5-OH,7-DI-O-GLUCOSIDE
46	50.190	1287837	2.19	13,15-Octacosadiyne
		58744598	100.00	

Fig 7: Phytochemicals present in the methanol extract of Leaf

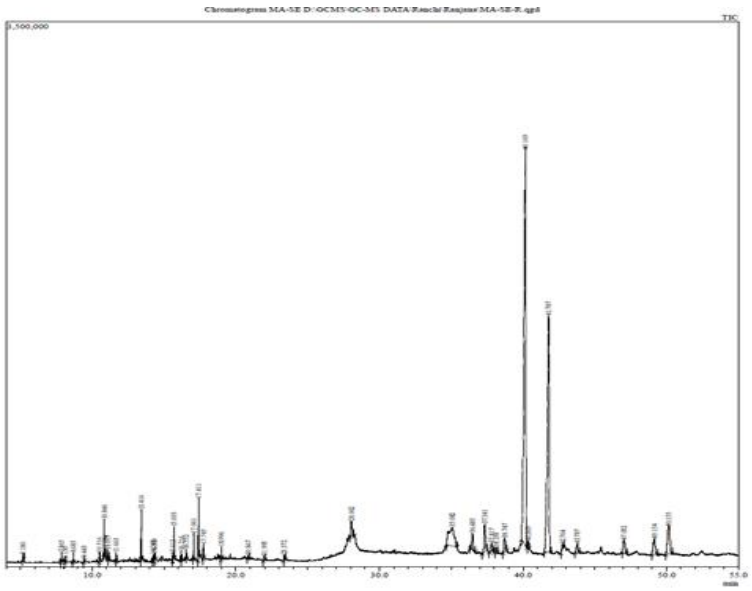


Fig 8: Chromatogram of methanol extract of Seed

Peak Report TIC

Peak#	R.Time	Area	Area%	Name
1	5.180	48169	0.09	CYCLOHEXENE, 1-METHYL-4-(1-METHYLETHENYL)
2	7.865	111266	0.22	CYCLODODECANE
3	8.130	38104	0.07	CYCLOHEXANE, 1,1'-(1,2-DIMETHYL-1,2-ETHANEDI
4	8.683	104377	0.20	CYCLOHEXANE, HEXYL-
5	9.443	39667	0.08	2-UNDECANONE
6	10.516	92179	0.18	Decane, 5-cyclohexyl-
7	10.846	347420	0.67	1-TRIDECENE
8	10.954	49415	0.10	1-Octanol, 2-methyl-
9	11.117	94547	0.18	1-Hexadecanol
10	11.663	81595	0.16	CYCLOHEXANE, OCTYL-
11	13.416	488643	0.95	E-14-Hexadecenal
12	14.242	59803	0.12	CYCLOHEXANE, UNDECYL-
13	14.359	82292	0.16	8-PENTADECANONE
14	15.613	67768	0.13	Cyclobutane, 1,1,2,3,3-pentamethyl-
15	15.693	312266	0.60	1-Octadecene
16	16.216	95288	0.18	2-Pentadecanone, 6,10,14-trimethyl-
17	16.552	80893	0.16	8-Octadecanone
18	17.061	267427	0.52	Pentadecanoic acid, 14-methyl-, methyl ester
19	17.411	614961	1.19	Dibutyl phthalate
20	17.745	154659	0.30	PHOSPHONIC ACID, DIOCTADECYL ESTER
21	18.996	121257	0.23	OCTADECANOIC ACID, METHYL ESTER
22	20.867	53556	0.10	TETRADECANAL
23	21.993	63027	0.12	TETRADECANAL
24	23.372	115121	0.22	TETRADECANAL
25	28.062	585133	1.13	4,4,6a,6b,8a,11,11,14b-Octamethyl-1,4,4a,5,6,6a,6b,7,8,8a,9
26	35.082	3116450	6.03	Farnesyl bromide
27	36.485	505531	0.98	4,4,6a,6b,8a,11,11,14b-Octamethyl-1,4,4a,5,6,6a,6b,7,8,8a,9
28	37.341	1303142	2.52	4,4,6a,6b,8a,11,11,14b-Octamethyl-1,4,4a,5,6,6a,6b,7,8,8a,9
29	37.817	316935	0.61	d-Norandrostane (5.alpha.,14.alpha.)
30	38.138	197239	0.38	2,5-FURANDIONE, 3-(DODECENYL)DIHYDRO-
31	38.747	729339	1.41	LUP-20(29)-ENE-3,28-DIOL, (3.BETA.)-
32	40.169	22997808	44.48	4,4,6a,6b,8a,11,11,14b-Octamethyl-1,4,4a,5,6,6a,6b,7,8,8a,9
33	40.369	240383	0.46	<NO NAME>
34	41.787	13455394	26.03	LUP-20(29)-ENE-3,28-DIOL, (3.BETA.)-
35	42.764	197855	0.38	1H-2,8a-Methanocyclopenta[a]cyclopropa[e]cyclodecen-11-
36	43.787	484324	0.94	LUP-20(29)-ENE-3,28-DIOL, (3.BETA.)-
37	47.032	809921	1.57	(-)-Globulol
38	49.154	1069317	2.07	Urs-12-en-28-al
39	50.155	2105675	4.07	LUP-20(29)-ENE-3,28-DIOL, (3.BETA.)-
		51698146	100.00	

Fig 9: Phytochemicals present in the methanol extract of the seed

Discussion

Madhuca indica J.F. Gmel. Plants are used by tribes of Jharkhand to cure many diseases [1] as shown in Table 1 below.

Table 1: Part Wise Use of *Madhuca indica* [2-5]

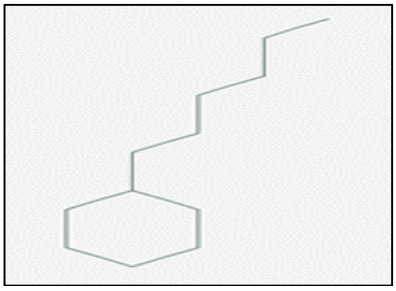
Plant Parts	Medicinal uses to cure different ailments
Bark	Rheumatism, Ulcer, Inflammation, Bleeding, Spongy Gums, Tonsillitis, Diabetic, Stomach Ache, Anti Snake Poisoning, Astringent, Emollient, Fracture, Itching.
Flower	Refrigerant, Liquor, Jelly, Sweet Syrup, Expectorant, Increase the production of milk in woman (galactogenic), Stimulant, Diuretics, Anthelmentic, Strangury, Verminosis, Hepatoprotective. Gastropathy, demulcent, laxative, cold and cough, pain relieving and vomiting inducing, Pneumonia, anti-estrogenic, anti-progestational activities, Blood pressure etc.
Leaf	Eczema, Wound Healing, Anti Burns, Bone Fracture, chronic bronchitis, head ache and hemorrhoids.

To screen phytochemicals of *Mahua* plant parts methanol was used in the present study. Water, another good solvent, being non-volatile is not suitable for GC-MS analysis, hence it was not considered [6, 7]. The extracts were subjected to GC-MS analysis in order to identify and quantify the chemical constituents present in the plant parts.

Gas chromatography mass spectrometry (GC-MS) is a method that combines the features of gas-liquid chromatography and mass spectrometry to identify different substances within a test sample.

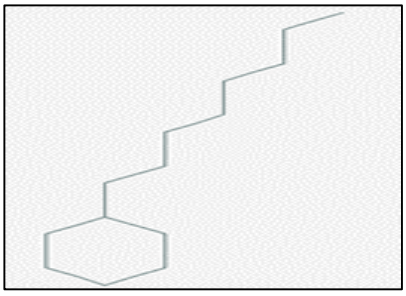
The important phytochemicals present in Leaf, Seed and Bark were Hexaylcyclohexane, Octylcyclohexane, E-14-Hexadecenal, Pentadecan-8-one, 8-Octadecanone and Dibutyl Phthalate. Their structural formula and other details as per GC-MS reports are as follows:

1. Hexaylcyclohexane - Mol. Wt. 168.324 g/mol, $C_{12}H_{24}$; present in both seed and bark. The compound shows the hemolytic activity *in vitro*



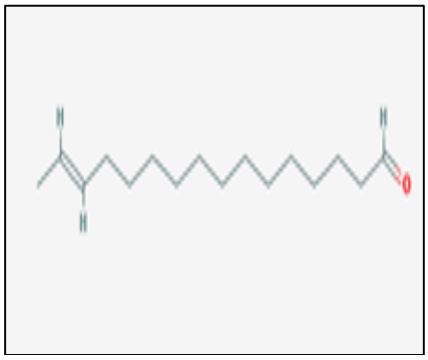
Hexaylcyclohexane

2. Octylcyclohexane - Mol. Wt. 196.378 g/mol, $C_{14}H_{28}$; present in leaf, seed and bark these are found in defensive secretion of some of the ants



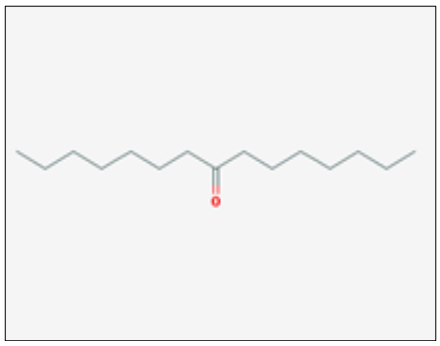
Octylcyclohexane

3. E-14-Hexadecenal - Mol. Wt. 238.415 g/mol, $C_6H_{30}O$; present in leaf, seed and bark and these are the active ingredients of the agricultural pheromones



E-14-Hexadecenal

4. Pentadecan-8-one - Mol. Wt. 226.404 g/mol, $C_{15}H_{30}O$; present in leaf, seed and bark and act as strong stimulants to the feeding of the aphids

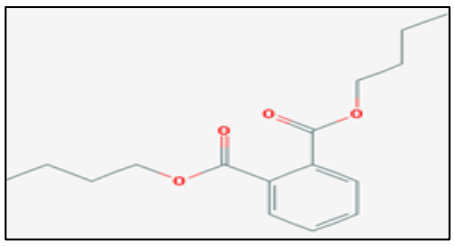


Pentadecan-8-one

5. 8-Octadecanone - Mol. Wt. 268.485 g/mol, $C_{18}H_{36}O$; present in leaf, seed and bark, this is very important anti-tumor compound*

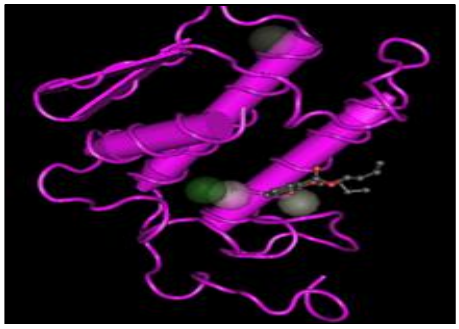
8-Octadecanone

6. Dibutyl Phthalate - 278.348 g/mol, $C_{16}H_{22}O_4$; present in leaf, seed, bark, flower, it blocks the Fanconi Anemia DNA Repair Pathway*. Scrub typhus, a rickettsial disease transmitted by larvae of Leptotrombidium deliense, is of special importance to the Armed Forces personnel, due to the heightened risk to this disease during movement in mite endemic areas during exercise/war. The disease is best prevented by the use of personal protective measures including repellents. Studies were undertaken to determine the relative efficacy of repellents: diethyl toulamide (DEET), dibutyl phthalate (DBP) with an indigenously developed repellent diethyl phenyl acetamide (DEPA) against the larval trombiculid mite. The findings of this study point towards the superiority of DEPA and DEET for impregnation of the uniform cloth as well as for topical application for the prevention of scrub typhus amongst the troops



Dibutyl Phthalate

It has been shown that the interaction of DBP with Porcine Pancreatic Pla2* stimulates Secretin Release from Secretin-producing Cells as present in figure below



Crystal Structure of Porcine Pancreatic Pla2 in Complex with DBP

***The properties of phytochemicals have been taken from the NCBI Pub Chem site**

The findings here also indicate that phytochemicals present in flower is different from the rest of the analyzed plant parts. Some phytochemicals present in flower like 2-Furanmethanol, -Cyclohexane, Methoxy are toxic in nature to human beings.

Conclusion

The GC-MS analysis of *M. indica* bark, leaves, flowers and seeds provided useful information with regard to identity and quantity of phytochemicals present in them. The urge in research on new drugs from natural sources is now moving out of the herbalists shop and shifting to drug research laboratories [8]. India is a home to a variety of traditional medicine systems that rely to a very large extent on native plant species for their raw drug materials [9-11]. More such studies are need of the hour.

Acknowledgement

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