SCREENING OF BIOLOGICALLY ACTIVE COMPOUNDS FROM *MEGACARPAEA POLYANDRA* BENTH ROOT: A TRADITIONAL MEDICINAL PLANT OF THE HIMALAYAS

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ABSTRACT

Megacarpaea polyandra Benth belonging to the Brassicaceae family is a medicinal plant found in alpine meadows and open forests between 3000-4300 meters in E. Asia-Himalayas. Traditionally, the plant has been used to treat various illnesses, including fever, diarrhea, asthma, and gastrointestinal problems. The root is used for relieving stomach aches, pneumonia, and fever. This study aimed to apply gas chromatography and mass spectroscopy analysis (GC-MS) to analyze the phytochemical components present in *M. polyandra* root. In the current study, this plant has been worked for the first time in terms of chemicals. The ethanolic root extract of the plant derived 207 phytochemicals. Of them, 47 were recorded as highly bioactive, among the recorded bioactive chemicals some compounds, viz furaneol; catechol; 2H-Imidazole-2-thione, 1,3-dihydro-1-methyl; undecanoic acid; n-Hexadecanoic acid; heptadecanoic acid; oleic Acid; Pyridine-4-carboxylic acid, 2-amino-3-cyano-5,6-dimethyl-, ethyl; .beta.-Sitosterol and pilocarpine have several biological properties. This includes antioxidant, anti-microbial, anti-cancer, anti-inflammatory, cure nervous system disorders, blood pressure regulators, anti-diabetic, and anti-inflammatory qualities. The chemicals were identified by interpreting the mass spectra and comparing their peak area and retention time with those in the literature. According to the current study's findings and conclusions, plant roots may be a useful resource for the development of herbal drugs due to the presence of various bioactive molecules responsible for curing the above-mentioned illnesses. The use of plant roots to treat a variety of illnesses with fewer adverse effects is justified by the existence of bioactive chemicals, which also suggests that the plant is of medicinal relevance. However, further research is required to fully understand its toxicity profile and bioactivity and clarify its vast potential for pharmacological application.

Keywords: *Phytochemicals, Bioactive compounds, GC-MS analysis, Brassicaceae, Megacarpaea polyandra*.

INTRODUCTION

Since the beginning, plants have been utilized for human and animal care. According to several scientists, there are approximately 25,000 biologically active chemicals. People continue to treat many illnesses with plants and their decoctions (Abid *et al.,* 2025; Kiran *et al.,* 2025; Zahra *et al.,* 2025; Afsar *et al.,* 2024; Amara *et al.,* 2017). The traditional source of chemical compounds used in biotechnology for the development of herbal medicine is medicinal plants. These plants provide the secondary metabolites needed by most pharmaceutical companies to develop drugs (Aziz *et al.,* 2024; Ejaz *et al.,* 2024; Farah *et al.,* 2024; Gomathi *et al.*, 2015). The demand for materials derived from plants is rising globally because of their safety concerns and therapeutic qualities. The World Health Organization estimates that almost 80% of people receive their primary medical care from plant-based customary medicines and almost 30% of medications produced worldwide are made from plants (Ijaz *et al.,* 2022). One plant species or mixtures of multiple plant species are used to make traditional medicinal systems. Every part of the plant, including the leaves, roots, bark, flowers, fruits, and seeds, can provide the bioactive chemicals (Gordon and David 2001). These phytochemicals are bioactive substances with distinct and intricate structure that are used to treat a range of illnesses (Zahra *et al.,* 2023). Chromatographic screening of plants yields information about their pharmacological properties, which aids in choosing the plants with therapeutic value (Juszczak *et al*., 2019). The exact approach used to identify and detect functional groups in a variety of bioactive therapeutic chemicals found in medicinal plants is gas chromatography-mass spectrometry (GC–MS) (Fan *et al.,* 2018). Therefore, the GC–MS technique was used in this work to identify the phytochemical components found in the medicinal plant.

M. polyandra belongs to the Brassicaceae family; numerous plants of the Brassicaceae family have significant scientific and therapeutic value in addition to their commercial and agronomic relevance. Furthermore, the pharmacological potential of certain Brassicaceae species is being investigated. Secondary metabolites produced by members of this family are species- and genus-specific in addition to being family-specific. The family includes several significant genera with a range of pharmaceutical applications as model plants for knowledge exploration (Raza *et al.,* 2020). *M. polyandra* plant is native to the Hindu Kush Himalayan region and can be found in alpine meadows and sub-alpine forests in China, India, Pakistan, and Nepal at elevations between 2800 and 4000 meters above sea level. Plant has been used to treat a wide range of illnesses, including rheumatism, stomachaches, fever, dysentery, asthma, and gastrointestinal problems. It has ethnoveterinary significance as well. Its pharmacological activity and bioactive contents are still unknown, despite its widespread ethnomedicinal significance. This indicates that the species may be a potential target for pharmacological research and the extraction of new bioactive constituents (Malik *et al*., 2024). To fill the aforementioned research gap, this study has been designed to record bioactive substances by GC-MS analysis from the plant root.

MATERIALS AND METHODS

Collection of root and plant specimen

The root and specimen of *M. polyandra* (Figure 1) were collected during July 2022 from Arang-Kel district Neelum Azad Jammu & Kashmir. During root collection, the specimen was also collected in order to identify plant accurately.

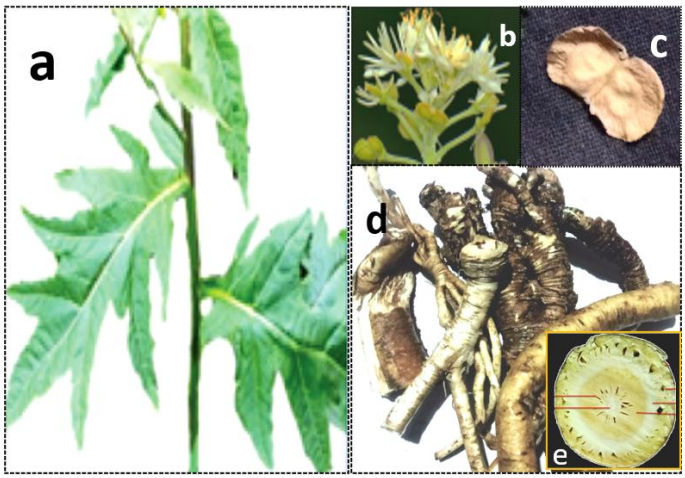

Figure 1. (a). *M. polyandra* plant, (b). flower, (c). seed, (d). roots, (e). transverse section of root.

Identification of plant

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Identification of plant was done by searching ''Flora of Pakistan'' family Brassicaceae Vol. 55, written by Jafri, (1973) and, ''World Flora Online database'' was searched for authenticity https://www.worldfloraonline.org/ Accessed January, 2025.

Submission of specimen

Identified plant was placed on standard herbarium sheet, labeled and assigned voucher number (KUH-373) and deposited in S.I.Ali Herbarium, Center for Plant Conservation, University of Karachi.

Extraction of the Powdered Root

After weighing the root powder (10g) and adding 100 ml of ethanol to a conical flask, the flask was shaken, corked, placed on a stirrer, and left to stand at room temperature for 48 hours. The extract was then filtered through Whatman No. 1 filter paper and left to stand until the solvent had completely evaporated. The dried extract was then calculated using an electrical weighting device to weigh the sample, per Evans' recommended method (1997) for calculating the extraction value (Evans, 1997).

GCMS Methodology Used

GC-MS analysis was conducted using an Agilent (7890B) gas chromatograph fitted with a DB-5MS GC column (30m length, 0.25mm internal diameter, 0.25µm film thickness) and an inert mass selective detector (5977B). With an injector temperature of 250°C and an interface temperature of 280°C, a split-less sample injection (2uL) was carried out. The oven's temperature was ramped up to 340°C at a rate of 20°C per minute for one minute after starting at 100°C for half a minute. In full-scan mode, electron impact ionisation was employed at –70 eV with helium serving as the carrier gas. It took 30 minutes to run. The search report was created using NIST Library 20.0.

RESULTS

Since GC-MS is the most effective method for identifying the bioactive components found in plant species, including long-chain hydrocarbons, alcohols, acids, esters, alkaloids, steroids, amino, and nitro compounds, gas chromatography (GC) and mass spectroscopy (MS) in conjunction with specific detection techniques have developed into sophisticated methods for analyzing a wide range of compounds with therapeutic significance.

The peaks in the GC-MS chromatogram of the ethanolic root extract of *M. polyandra*, which show the presence of 207 phytochemical compounds Table 1, and their complete spectra is included in Figure 2. The compounds along with their area percentage, molecular formula, and retention time (RT), **Area %** are listed in Table 1.

Table 1. List of total identified phytochemicals from the root of *M. polyandra* Benth through GC-MS analysis.

S.No	Pk#	Compound Name	Formula	Retention time	Peak Area %	Ref#	CAS#	Qual
1	1	Nitrous oxide	N_2O	1.275	0.05	95	010024-97-2	2
2	2	2-Pentanone, 4-hydroxy-	$C_5H_{10}O_2$	1.359	2.24	4804	004161-60-8	38
3	2	6,7-Dioxabicyclo[3.2.1]octane, 1-methyl-	$C_7H_{12}O_2$	1.359	2.24	14131	1000124-18-0	38
4	2	2-(tert-Butylamino) ethanol	$C_6H_{15}NO$	1.359	2.24	9711	004620-70-6	32
5	3	4,5-Diamino-2-hydroxypyrimidine	$C_6H_{15}NO$	1.546	0.88	12549	023899-73-2	35
6	3	4,5-Diamino-6-hydroxypyrimidine	$C_4H_6N_4O$	1.546	0.88	12548	001672-50-0	12
7	3	1H-Imidazol-1-ylacetic acid	$C_5H_6N_2O_2$	1.546	0.88	12616	022884-10-2	9
8	4	Furaneol	$C_6H_8O_3$	1.631	1.06	13908	003658-77-3	90
9	4	2,5-Dimethylfuran-3,4(2H,5H)-dione	$C_6H_8O_3$	1.631	1.06	13925	068755-49-7	78
10	4	Barbituric acid	$C_4H_4N_2O_3$	1.631	1.06	13735	000067-52-7	45
11	5	Phenol, 2-methoxy-	$C_7H_8O_2$	1.740	2.60	11909	000090-05-1	95
12	6	4H-Pyran-4-one, 2,3-dihydro-3,5-di hydroxy-6-methyl-	C6H8O4	2.018	1.62	23823	028574-83-2	97
13	8	8-Nonene-1-nitrile	$C_9H_{15}N$	2.441	0.34	19332	005048-34-0	78
14	8	2-Aminocyclohex-1-ene-1-carbonitrile, N-acetyl-	$C_7H_{10}N_2$	2.441	0.34	40384	500896-58-2	14
15	9	Catechol	$C_6H_6O_2$	2.610	0.46	6512	000120-80-9	49
16	10	5-Hydroxymethylfurfural	$C_6H_6O_3$	2.882	5.99	12709	000067-47-0	19
17	11	2-Methyl-8-nitroisoxazolizidine	$C_6H_{10}N_2O_4$	3.281	0.12	49253	004328-96-5	9
18	11	Pentanoic acid, 3-hydroxy-4-methyl-, methyl ester	$C_7H_{14}O_3$	3.281	0.12	25443	065596-31-8	9
19	11	Caracemide	$C_6H_{11}N_3O_4$	3.281	0.12	63945	081424-67-1	9
20	12	9-Decene-1-nitrile	$C_{10}H_{17}N$	3.353	0.03	28536	061549-49-3	47
21	12	2-Pyridinamine, 3,6-dimethyl-	$C_7H_{10}N_2$	3.353	0.03	11212	000823-61-0	43
22	12	1H-Pyrrole, 3,4-diethyl-2-methyl-	$C_9H_{15}N$	3.353	0.03	19344	034874-30-1	43
23	13	1,2-Benzenediol, 3-methyl-	$C_7H_8O_2$	3.462	0.20	11928	000488-17-5	46
24	13	1,2-Benzenediol, 4-methyl-	$C_7H_8O_2$	3.462	0.20	11926	000452-86-8	46
25	14	2-Methoxy-4-vinylphenol	$C_9H_{10}O$	3.697	0.50	28303	007786-61-0	76
26	14	Phenol, 2-(1,1-dimethylethyl)-	$C_{10}H_{14}O$	3.697	0.50	27544	000088-18-6	52
27	15	Phenol, 2,6-dimethoxy-	$C_8H_{10}O_3$	4.078	0.21	31859	000091-10-1	93
28	16	Acetamide, N-n-heptyl-	$C_9H_{19}NO$	4.308	0.08	34440	1000406-45-2	35
29	16	Acetamide, N-hexyl-	$C_8H_{17}NO$	4.308	0.08	23426	007501-79-3	35
30	16	2-Acetamido-2-deoxy-.alpha.-D-glucopyranose	$C_8H_{15}NO_6$	4.308	0.08	100572	010036-64-3	30
31	17	Piperidine, 2-pentyl-	$C_{10}H_{15}N$	4.386	0.03	32359	033354-97-1	58
32	17	4-Methylproline methyl ester	$C_7H_{13}NO_2$	4.386	0.03	23336	145730-69-4	53
33	17	DL-Proline, 5-oxo-, methyl ester	$C_6H_9NO_3$	4.386	0.03	23298	054571-66-3	53

34	18	Glycine, N,N-dipropyl-, ethyl este	$C_8H_{17}NO_2$	4.537	0.24	61748	002644-22-6	22
35	18	2H-Imidazole-2-thione, 1,3-dihydro-1-methyl-	$C_4H_6N_2S$	4.537	0.24	8041	000060-56-0	22
36	18	1-Propanamine, N, N-dipropyl-	$C_9H_{21}N$	4.652	1.77	23517	000102-69-2	38
37	19	Cyclopentanecarboxamide, N-propyl-	$C_9H_{17}NO$	4.652	1.77	32770	1000419-70-1	38
38	20	trans-Isoeugenol	$C_{10}H_{12}O_2$	5.208	0.26	39176	005932-68-3	64
39	20	Phenol, 2-methoxy-4-(1-propenyl)-	$C_{10}H_{12}O$	5.208	0.26	39366	000097-54-1	64
40	20	Phenol, 2-methoxy-6-(1-propenyl)-	$C_{10}H_{12}O_2$	5.208	0.26	39352	001076-55-7	55
41	21	2-Oxoacetamide, 2-[N'-(4-methylben zylidene)hydrazino]-N-(4-pentyloxy phenyl)-	$C_{21}H_{25}N_3O_3$	5.552	0.24	276046	1000295-79-2	12
42	21	(E)-.beta.-Farnesene	$C_{15}H_{24}$	5.552	0.24	80208	018794-84-8	12
43	21	Diethylmalonic acid, monochloride, 2,4-dichloro-6-formylphenyl ester	$C_{14}H_{13}Cl_3O_4$	5.552	0.24	259054	1000370-07-6	9
44	22	Bicyclo[3.3.1]non-2-en-9-one	$C_9H_{14}O$	5.716	0.26	18923	004844-11-5	27
45	22	Ethyl 2-amino-4-methylpyrimidine-5-carboxylate	$C_8H_{11}N_3O_2$	5.716	0.26	56085	081633-29-6	22
46	23	1[5'(Hydroxymethyl)furfuryl] pyrrolidine	$C_{10}H_{15}NO_2$	5.879	0.83	55773	061481-02-5	87
47	23	4(1H)-Pyridinone, 2,3-dihydro-1-methyl-	C_6H_7NO	5.879	0.83	6925	035488-00-7	38
48	24	2-Hydroxy-1-(1'-pyrrolidiyl)-1-buten-3-one	$C_8H_{13}NO_2$	5.969	1.32	32660	184427-18-7	94
49	24	1H-1,2,4-Triazol-3-amine, 1-ethyl-	C_4H_8N	5.969	1.32	7053	042786-04-9	49
50	25	3-Heptanol, 2-methyl-	$C_8H_{18}O$	6.326	0.93	15730	018720-62-2	37
51	26	2-Vinyl-9-[.beta.-d-ribofuranosyl] hypoxanthine	$C_{12}H_{14}N_4O_5$	6.646	1.31	190779	110851-56-4	10
52	26	Succinic acid, monochloride 2-ethylbutyl ester	$C_{10}H_{17}ClO_3$	6.646	1.31	98196	1000349-21-7	10
53	26	Butyramide, 4-chloro-N-propyl-	$C_7H_{14}ClNO$	6.646	1.31	38876	1010419-94-2	9
54	27	Pilocarpine	$C_{11}H_{16}N_2O_2.ClH$	6.821	0.36	84597	000092-13-7	22
55	27	2H-Pyran, 2-[2-(1,3-cyclohexadien- 1-yl)-1-methylethoxy]-3,4,5,6-tetrahydro-	$C_{14}H_{22}O_2$	6.821	0.36	101783	1000141-98-3	16
56	27	Valeric acid, undec-2-enyl ester	$C_{16}H_{30}O$	6.821	0.36	140856	1000292-49-1	14
57	28	2-Thiophenecarboxylic acid, 5-meth yl-, methyl ester	$C_6H_6O_2S$	6.954	0.13	33495	019432-69-0	27
58	28	Methyl 3-amino-2-thiophenecarboxylate	$C_6H_7NO_2S$	6.954	0.13	34223	022288-78-4	16
59	28	2-Fluoro-5-methylaniline	C_7H_8FN	6.954	0.13	12422	000452-84-6	14
60	29	Tricyclo[5.2.1.0(2,6)]decane, 2-acetoxy-	$C_{12}H_{18}O_2$	7.286	4.54	69078	1000195-77-8	10
61	29	Cyclopentanone, 2-(2-octenyl)-	$C_{13}H_{22}O$	7.286	4.54	69269	1000131-94-9	10
62	30	(E)-4-(3-Hydroxyprop-1-en-1-yl)-2-methoxyphenol	$C_{10}H_{12}O_3$	7.770	0.13	54491	032811-40-8	64
63	30	4-(1-Hydroxyallyl)-2-methoxyphenol	$C_{10}H_{12}O_3$	7.770	0.13	54362	112465-50-6	58
64		Phenol, 4-(3-hydroxy-1-propenyl)-2-methoxy-	$C_{10}H_{12}O_3$	7.770	0.13	54448	000458-35-5	52
65	31	Undecanoic acid	$C_{11}H_{22}O_2$	8.120	0.14	60690	000112-37-8	27
66	31	.beta.-D-Glucopyranose, 1,6-anhydro-	$C_6H_{10}O_5$	8.120	0.14	38155	000498-07-7	22
67	31	.alpha.-L-Galactopyranoside, methy l 6-deoxy-	$C_7H_{14}O_6$	8.120	0.14	53245	014687-15-1	22
68	32	1,3,5-Trithiane, 2,4,6-trimethyl-	$C_6H_{12}S_3$	8.567	2.20	55210	002765-04-0	32
69	32	Methyl-.beta.-D-thiogalactoside	$C_7H_{14}O_5S$	8.567	2.20	69610	001824-94-8	30
70	32	Hexanoic acid	$C_6H_{12}O_2$	8.567	2.20	9149	000142-62-1	22
71	33	Ethyl .alpha.-d-glucopyranoside	$C_8H_{16}O_6$	8.767	1.57	85607	019467-01-7	49
72	33	.beta.-D-Glucopyranoside, methyl	$C_7H_{14}O$	8.767	1.57	69611	000709-50-2	46
73	34	.alpha.-D-Glucopyranoside, methyl	$C_7H_{14}O_6$	8.833	0.38	69616	000097-30-3	59
74	34	Dodecanoic acid	$C_{12}H_{24}O_2$	8.833	0.38	75718	000143-07-7	47
75	34	n-Decanoic acid	$C_{10}H_{20}O$	8.8333	0.38	46961	000334-48-5	47

76	35	Nonanoic acid, 3-methylbutyl ester	$C_{14}H_{28}O_2$	9.184	0.38	109352	007779-70-6	14
77	35	1-Amino-3-methyl-2-butene	$C_5H_{11}N$	9.184	0.38	1780	013822-06-5	10
78	36	l-Valine, n propargyloxy-carbonyl-, nonyl ester	$C_{18}H_{35}NO_4$	9.383	36.39	230314	1000323-31-2	27
79	36	2,2-Dipropyl-N-ethylpiperidine	$C_{13}H_{27}N$	9.383	36.39	72680	089214-89-1	16
80	36	Carbonic acid, monoamide, N-propyl -N-(2-ethylhexyl)-, propargyl ester	$C_{12}H_{25}NO_2$	9.383	36.39	139414	1010438-68-5	16
81	37	Ethanediamide	$C_2H_4N_2O_2$	10.241	0.82	2179	000471-46-5	43
82	37	3-Deoxy-d-mannonic acid	$C_6H_{12}O_6$	10.241	0.82	55206	001518-59-8	42
83	37	1,3-Dioxolane, 2,4,5-trimethyl-	$C_6H_{12}O_2$	10.241	0.82	9272	003299-32-9	32
84	38	6-Pentadecenoic acid, 13-methyl-, (6Z)-, O-methyl	$C_{16}H_{30}O_2$	10.332	0.19	158459	1000505-96-4	99
85	38	9-Hexadecenoic acid, methyl ester, (Z)-	$C_{17}H_{32}O_2$	10.332	0.19	158446	001120-25-8	99
86	38	7-Hexadecenoic acid, methyl ester, (Z)-	$C_{17}H_{32}O_2$	10.332	0.19	158437	056875-67-3	99
87	39	1H-Purine, 6-methyl-	$C_6H_6N_4$	10.422	0.07	17362	002004-03-7	43
88	39	1-{[4 (Dimethylamino) benzyl] amino}-2-propanol	$C_{12}H_{20}N_{2O}$	10.422	0.07	84963	007467-44-9	43
89	40	Hexadecanoic acid, methyl ester	$C_{17}H_{34}O$	10.561	.79	161203	000112-39-0	99
90	41	6-Pentadecenoic acid, 13-methyl-,(6Z)-	$C_{16}H_{30}O_2$	10.791	1.53	140884	682751-34-4	97
91	41	Palmitoleic acid	$C_{16}H_{30}O_2$	10.797	1.53	140796	000373-49-9	96
92	42	n-Hexadecanoic acid	$C_{16}H_{32}O_2$	11.081	3.74	143511	000057-10-3	99
93	43	Sulforaphane nitrile	$C_6H_{11}NOS$	11.165	0.14	26491	061121-66-2	27
94	43	S-Methyl n-propylphosphonamidothioate	$C_5H_{10}N_2O_2S$	11.165	0.14	30463	1000306-04-5	14
95	44	Hexadecanoic acid, ethyl ester	$C_{18}H_{36}O_2$	11.353	0.80	179131	000628-97-7	99
96	45	1H-Indole, 4-methoxy-3-cyanomethyl	$C_{11}H_{10}N_2O$	11.437	0.05	60655	004837-74-5	86
97	45	4'-(Imidazol-1-yl)acetophenone	$C_{11}H_{10}N_2O$	11.437	0.05	60643	010041-06-2	64
98	46	3-Chloro-2-fluorobenzoic acid, 2-methylbutyl ester	$C_{13}H_{16}ClFO_3$	11.709	0.11	127751	1000357-32-8	35
99	46	1H-1,2,4-Triazole, 1-octadecanoyl-	$C_{20}H_{37}N_3O$	11.709	0.11	242940	060718-55-0	16
100	47	1-Decene	$C_{10}H_20$	11.878	0.07	20640	000872-05-9	45
101	47	Methanal, (5-methyl-3-isoxazolyl)amino-, oxime	$C_5H_7N_3O_2$	11.878	0.07	20640	000872-05-9	45
102	47	2,4(1H,3H)-Pyrimidinedione, 6-amino-1-methyl-	$C_5H_7N_3O_2$	11.878	0.07	21701	002434-53-9	30
103	48	1,2-ethanediamine, N2-(2,2-dimethoxyethyl)-N1,N1-dimethyl-	$C_4H_{12}N_2$	11.963	0.09	51421	1000404-73-5	47
104	48	26-Deoxy-26-ethylaminodihydroneoti gogenin	$C_{29}H_{51}NO_2$	11.963	0.09	324073	1000256-67-5	43
105	49	Allo-Inositol	$C_6H_{12}O_6$	12.102	0.24	55198	000643-10-7	16
106	49	Methyl d-glycero-.beta.-d-gulo-heptoside	$C_8H_{16}O_7$	12.102	0.24	104780	1000130-15-2	13
107	49	Xylose	$C_5H_{10}O_5$	12.102	0.24	27858	000058-86-6	12
108	50	Heptadecanoic acid	$C_{17}H_{34}O_2$	12.289	0.11	161155	000506-12-7	93
109	50	Octadecanoic acid	$C_{18}H_{36}O_2$	12.289	0.11	179089	000057-11-4	50
110	51	9-Oxononanoic acid	$C_9H_{16}O_3$	12.507	0.05	48029	002553-17-5	35
111	51	D-Glucuronic acid, .gamma.-lactone	$C_6H_8O_6$	12.507	0.05	87829	1000130-14-6	27
112	51	d-Glycero-l-gluco-heptose	$C_7H_{14}O_7$	12.507	0.05	87829	1000130-14-6	27
113	52	9,12-Octadecadienoic acid, methyl ester	$C_{19}H_{34}O$	12.754	0.18	191900	002462-85-3	99
114	52	9,12-Octadecadienoic acid (Z,Z)-, methyl ester	$C_{19}H_{34}O$	12.754	0.18	191917	000112-63-0	99
115	53	9,12,15-Octadecatrienoic acid, methyl ester, (Z,Z,Z)-	$C_{19}H_{32}O_2$	12.857	1.46	189451	000301-00-8	99
116	54	11-Octadecenoic acid, methyl ester	$C_{19}H_{36}O_2$	12.984	0.41	194425	052380-33-3	99
117	54	9-Octadecenoic acid, methyl ester,(E)-	$C_{19}H_{36}O_2$	12.984	0.41	194450	001937-62-8	99
118	54	10-Octadecenoic acid, methyl ester	$C_{19}H_{36}O_2$	12.984	0.41	194419	013481-95-3	99
119	55	3-Heptadecen-5-yne, (Z)-	$C_{17}H_{30}$	13.069	0.10	116384	074744-55-1	83
120	55	3-Tetradecen-5-yne, (E)-	$C_{14}H_{24}$	13.069	0.10	66977	074744-44-8	47
121	56	2-(3-Chloro-2-oxopropyl)-1H-isoindole-1,3(2H)-dione	$C_{11}H_8ClNO_3$	13.359	0.23	119353	035750-02-8	43

122	56	1,3-Benzoxazole-7-carboxylic acid, 2-methyl-, 4-nitrophenyl ester	$C_9H_7NO_3$	13.359	0.23	196287	1000337-18-5	38
123	56	Propionic acid, 3-(6-methyl-2-oxo-2H-benzo[1,4]oxazin-3-yl)-	$C_{12}H_{11}NO_4$	13.359	0.23	114633	1000302-49-1	38
124	58	Oleic Acid	$C_{18}H_{34}O_2$	13.927	0.94	176207	000112-80-1	96
125	59	Methyl 2-hydroxy-octadeca-9,12,15-trienoate	$C_{19}H_{32}O_3$	13.993	0.34	209535	100066-39-1	93
126	59	Methyl 8,11,14-heptadecatrienoate	$C_{18}H_{30}O_2$	13.993	0.34	171206	1000336-35-5	93
127	59	9,12,15-Octadecatrienoic acid, (Z,Z,Z)-	$C_{18}H_{30}O_2$	13.993	0.34	171210	000463-40-1	90
128	60	9,12,15-Octadecatrienoic acid, ethyl ester, (Z,Z,Z)-	$C_{20}H_{34}O_2$	14.150	1.83	207371	001191-41-9	99
129	61	Ethyl Oleate	$C_{20}H_{38}O_2$	14.313	1.02	212138	000111-62-6	96
130	62	Octadecanoic acid, ethyl ester	$C_{20}H_{40}O_2$	14.797	0.03	214944	000111-61-5	99
131	63	Cyclohexane, 1,1'-(1,2-dimethyl-1, 2-ethanediyl)bis-	$C_{16}H_{30}$	14.875	0.10	102205	074663-71-1	43
132	63	Triallylsilane	$(C_2H_5)_3SiH$	14.875	0.10	30341	001116-62-7	32
133	63	1,1,4-Trimethylcyclohexane	C_9H_{18}	14.875	0.10	13237	007094-27-1	27
134	64	Benzoic acid, 2-(5-pyrazolylcarbonylamino)-	C_6H_5COOH	15.141	0.06	112397	1000277-53-0	35
135	64	naphtho[1,2-d]thiazole, 4,5-dihydro-8-methoxy-2-methyl-	$C_{13}H_{13}NOS$	15.141	0.06	112636	1000401-82-8	30
136	64	Quinoline, 4-styryl-	$C_{17}H_{13}N$	15.141	0.06	112872	004594-84-7	30
137	65	Neomenthylamine	$C_{10}H_{21}N$	15.673	0.46	32351	007231-40-5	22
138	66	Pyridine-4-carboxylic acid, 2-amino-3-cyano-5,6-dimethyl-, ethyl ester	$C_{13}H_{12}N_4$	16.241	0.04	97398	1000277-56-6	64
139	66	2-Furancarboxaldehyde, 5-[(5-methy l-2-furanyl)methyl]-	$C_{11}H_{10}O_3$	16.241	0.04	64479	034995-74-9	59
140	67	Methapyrilene	$C_{14}H_{19}N_3S$	16.809	0.08	149251	000091-80-5	43
141	67	Desacetyldiltiazem	$C_{20}H_{24}N_2O_3S$	16.809	0.08	281060	042399-40-6	38
142	68	Oxacyclotetradecan-2-one	$C_{13}H_{24}O_2$	17.062	0.04	89798	001725-04-8	25
143	68	2,6-Octadiene, 2,6-dimethyl-	$C_{10}H_{18}$	17.062	0.04	19451	002792-39-4	25
144	69	7-Tetradecenal, (Z)-	$C_{14}H_{26}O$	17.280	0.04	87551	065128-96-3	25
145	69	9-Oxabicyclo[3.3.1]nonan-3-one, 8- acetoxy-	$C_{10}H_{14}O_4$	17.280	0.04	73184	1010197-59-0	20
146	70	3-Chloro-2-fluorobenzoic acid, 3-methylbutyl ester	$C_{12}H_{14}ClFO_2$	17.727	0.19	127749	1000368-58-0	35
147	70	4-Fluoro-1-nitro-2-(pentan-2-yloxy) benzene	$C_{11}H_{14}FNO_3$	17.727	0.19	107651	1314987-41-1	25
148	70	L-Proline,1-acetyl-,methylester	$C_8H_{13}NO_3$	17.727	0.19	46775	0274460-51-1	18
149	71	9-Octadecenoic acid (Z)-, methyl ester	$C_{19}H_{36}O$	18.168	0.08	194441	000112-62-9	80
150	71	7-Hexadecyn-1-ol	$C_{16}H_{32}O$	18.168	0.08	121281	000822-21-9	78
151	71	trans-Geranylgeraniol	$C_{20}H_{34}O$	18.168	0.08	187026	024034-73-9	60
152	72	Pyrrolidine, 1-(1-oxo-7,10-hexadec adienyl)-	$C_{20}H_{35}NO$	18.972	0.05	205965	056666-41-2	25
153	72	N4,N4'-Dipropyl-biphenyl-4,4'-diamine	$C_{24}H_{20}N_2$	18.972	0.05	158552	017576-22-6	20
154	72	Isothiazole, 3,4-dimethyl-	C_5H_7NS	18.972	0.05	7812	027330-46-7	18
155	73	2-Methoxyethyl benzoate	$C_{10}H_{12}O_3$	19.413	0.05	54282	1000366-98-0	47
156	73	Hexanal, 2-methyl-	$C_7H_{14}O$	19.413	0.05	8456	000925-54-2	38
157	74	Benzamide, 4-tert-butyl-N-[2-(2-is opropyl-5-methylphenoxy)ethyl]-	$C_{20}H_{25}NO$	19.540	0.04	262818	1000303-41-9	35
158	74	Tetracyano-p-quinodimethane	$C_{12}H_4N$	19.540	0.04	79828	001518-16-7	15
159	75	N-(2-Trifluoroacetyloxyethyl)-9Z-hexadecenamide, N-trifluoroacetyl-	$C_{22}H_{33}F_6NO_4$	19.751	0.18	336097	1000452-06-9	94
160	75	8-Cyclohexadecen-1-one	$C_{16}H_{28}O$	19.751	0.18	118832	003100-36-5	86
161	75	Bicyclo[4.3.1]decan-10-one	$C_{10}H_{16}O$	19.751	0.18	29170	020440-21-5	64
162	76	Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl)ethyl ester	$C_{19}H_{38}O$	20.017	0.68	236865	023470-00-0	91
163	76	Glycerol 1-palmitate	$C_{19}H_{38}O_4$	20.017	0.68	236855	000542-44-9	59
164	77	Dibenzo[b,f]oxepin-3-amine, 6-methoxy-	$C_{15}H_{15}NO_2$	20.120	0.05	122278	1000338-08-4	27
165	77	9,10-Anthracenedione, 1-amino-4-hydroxy-	$C_{14}H_9NO_3$	20.120	0.05	122219	000116-85-8	11
166	78	Bis(2-ethylhexyl) phthalate	$C_{24}H_{38}O_4$	20.235	0.36	295608	000117-81-7	91
167	79	Ethamivan	$C_{12}H_{17}NO_3$	20.676	0.03	102855	000304-84-7	59

168	79	Benzenepentanoic acid, 3,4-dimethoxy-, methyl ester	$C_{12}H_{16}O_4$	20.676	0.03	137946	131699-18-8	59
169	79	4'-Hydroxy-3'-methoxy-acetophenone, butyl ether	$C_{13}H_{18}O_3$	20.676	0.03	101486	1000395-32-7	59
170	80	cis,cis,cis-7,10,13-Hexadecatriena	$C_{16}H_{26}O$	20.990	0.06	116339	056797-43-4	38
171	80	Heneicosapentaenoic Acid methyl ester	$C_{22}H_{34}O_2$	20.990	0.06	237204	065919-53-1	35
172	80	(Z)6,(Z)9-Pentadecadien-1-ol	$C_{15}H_{28}O$	20.990	0.06	104530	077899-11-7	30
173	81	Pyrrolidine, 1-(1-oxo-11-octadecenyl)-	$C_{22}H_{41}NO$	21.086	0.06	243045	052380-35-5	38
174	81	Pyrrolidine, 1-(1-oxo-6-octadecenyl)-	$C_{22}H_{41}NO$	21.086	0.06	243023	052380-34-4	38
175	82	(E)-3,3'-Dimethoxy-4,4'-dihydroxys tilbene	$C_{16}H_{16}O_4$	21.370	0.10	163555	007329-69-3	99
176	82	2-(4-Hydroxybenzyl)phenol, TMS derivative, isomer 1	$C_{16}H_{20}O_2Si$	21.370	0.10	163667	1000492-44-9	90
177	82	5,7-dimethoxy-9,10-dihydrophenanthrene-3,4-diol	$C_{16}H_{16}O_4$	21.370	0.10	163570	1000440-23-6	83
178	84	2,3-Dihydroxypropyl elaidate	$C_{21}H_{40}O$	21.944	0.67	265792	002716-53-2	49
179	84	9-Octadecenoic acid (Z)-, 2,3-dihydroxypropyl ester	$C_{21}H_{40}O_4$	21.944	0.67	266028	000111-03-5	47
180	85	Octadecanoic acid, 2,3-dihydroxypropyl ester	$C_{21}H_{42}O$	22.126	0.43	268015	000123-94-4	94
181	85	2-Dodecylcyclohexanone	$C_{18}H_{34}O$	22.126	0.43	155923	015674-94-0	49
182	86	Isoamyl laurate	$C_{17}H_{34}O$	22.398	0.05	161154	006309-51-9	18
183	86	Benzeneethanamine, N-(1-methylethylidene)-	$C_{10}H_{13}N$	22.398	0.05	37107	010433-34-8	18
184	87	13-Docosenamide, (Z)-	$C_{22}H_{43}NO$	22.621	0.10	245085	000112-84-5	97
185	88	(9Z,12Z,15Z)-1-Hydroxy-3-methoxypr opan-2-yl octadeca-9,12,15-trienoate	$C_{22}H_{38}O_4$	22.754	0.05	275378	1000412-84-7	94
186	88	omega.-3 Arachidonic Acid methyl ester	$C_{21}H_{34}O_2$	22.754	0.05	222611	132712-70-0	64
187	89	Squalene	$C_{30}H_{50}$	22.953	0.35	308258	000111-02-4	99
188	89	Supraene	$C_{30}H$	22.953	0.35	308259	007683-64-9	99
189	90	Tetra hydro demethoxycurcumin	$C_{20}H_{22}O_5$	23.395	0.03	250930	149579-07-7	64
190	90	Capsaicin	$C_{18}H_{27}NO_3$	23.395	0.03	205739	000404-86-4	59
191	91	9-Vinylcarbazole	$C_{14}H_{11}N$	24.077	0.04	68077	001484-13-5	25
192	91	Iminostilbene	$C_{14}H_{11}N$	24.077	0.04	68064	00256-96-2	25
193	92	Fumaric acid, decyl 3,5-difluorophenyl ester	$C_{20}H_{26}F_2O_4$	24.240	0.03	276869	1010339-37-6	37
194	92	Glutaric acid, di(2-methyl-4-chlorophenyl) ester	$C_{19}H_{18}Cl_2O_4$	24.240	0.03	287396	1000359-02-5	35
195	93	Stigmastan-3,5,22-trien	$C_{29}H_{46}$	24.796	0.04	298439	1000214-18-1	46
196	93	Glutaric acid, ethyl 1-phenylpropyl ester	$C_{16}H_{22}O_4$	24.796	0.04	170821	1000358-94-7	18
197	94	26-Nor-5-cholesten-3.beta.-ol-25-one	$C_{26}H_{42}O_2$	25.153	0.14	292861	007494-34-0	95
198	95	Pinoresinol	$C_{20}H_{22}O_6$	25.727	0.05	267789	000487-36-5	46
199	95	3-Ethoxy-4-methoxybenzaldehyde	$C_{10}H_{12}O_3$	25.727	0.05	54330	001131-52-8	38
200	96	Campesterol	$C_{28}H_{48}O$	25.932	0.21	302693	000474-62-4	99
201	97	.gamma.-Sitosterol	$C_{29}H_{50}O$	26.651	0.59	310597	000083-47-6	99
202	97	.beta.-Sitosterol	$C_{29}H_{50}O$	26.651	0.59	310595	000083-46-5	95
203	98	1,2,3,4-Tetrahydro-9-methyl-6-cyclohexyl-1-carbazolone	$C_{19}H_{23}NO$	26.760	0.04	174903	1000223-09-4	45
204	98	2-Amino-6-bromo-3-fluorobenzoic acid	$C_7H_5BrFNO_2$	26.760	0.04	115156	1153974-98-1	41
205	98	6-Azaestra-1,3,5(10),6,8-pentaen-1 7-one, 3-methoxy-	$C_{18}H_{19}NO_2$	26.760	0.04	174733	005144-20-7	18
206	100	Methyl 3-acetoxy-12-keto-18-norcholanate	$C_{26}H_{40}O_5$	29.582	0.03	318993	1000251-87-8	43
207	100	Cholestan-3-one, 4,4-dimethyl-, (5.alpha.)	C29H50O	29.582	0.03	310614	002097-85-0	22

The root of *M. polyandra* holds lot of phytochemical (Table 1) and various compounds (Table 2) that have great medicinal value. Several detected compounds has great medicinal value such as nitrous oxide; 1h-imidazol-1-ylacetic acid; furaneol; phenol, 2-methoxy-; 4h-pyran-4-one, 2,3-dihydro-3,5-di hydroxy-6-methyl-; catechol; 5-hydroxymethylfurfural; caracemide; 2-methoxy-4-vinylphenol; phenol, 2-(1,1-dimethylethyl)- ; dl-proline, 5-oxo-, methyl ester; 2h-imidazole-2-thione, 1,3-dihydro-1-methyl-; trans-isoeugenol; pilocarpine; methyl 3-amino-2-thiophenecarboxylate; (e)-4-(3-hydroxyprop-1-en-1-yl)-2-methoxyphenol; 4-(1-hydroxyallyl)-2-methoxyphenol; undecanoic acid; palmitoleic acid; n-hexadecanoic acid; hexadecanoic acid, ethyl ester; heptadecanoic acid; 9-oxononanoic acid; 9,12-octadecadienoic acid (z,z)-, methyl ester; 9,12,15-octadecatrienoic acid, methyl ester, (z,z,z)- ; 11-octadecenoic acid, methyl ester; 9-octadecenoic acid, methyl ester,(e) ;- oleic acid; 9,12,15-octadecatrienoic acid, ethyl ester, (z,z,z)- ; pyridine-4-carboxylic acid, 2-amino-3-cyano-5,6-dimethyl-, ethyl ester; methapyrilene; desacetyldiltiazem; oxacyclotetradecan-2-one; 7-hexadecyn-1-ol; hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl)ethyl ester; 9,10-anthracenedione, 1-amino-4-hydroxy-; ethamivan; (z)6,(z)9-pentadecadien-1-ol; 2,3-dihydroxypropyl elaidate; squalene; capsaicin; iminostilbene; 26-nor-5-cholesten-3.beta.-ol-25-one; pinoresinol; campesterol; .gamma.-sitosterol and .beta.-sitosterol (Table. 2).

Table 2. Bioactive phytochemicals identified from the root of *M. polyandra* Benth

S.No	Pk#	Compound Name	Chemical nature	Formula	Retention time	Peak Area %	Biological activities/ References
1	1	Nitrous oxide	Inorganic Compound	N_2O	1.275	0.05	Analgesic and anxiolytic (Emmanouil and Quock, 2007).
2	3	1H-Imidazol-1-ylacetic acid	Alpha amino acid	$C_5H_6N_2O_2$	1.546	0.88	Treat bone-related issues in cancer patients (Nagy *et al*., 2018).
3	4	Furaneol	Cyclic ketone	$C_6H_8O_3$	1.631	1.06	Antifungal, antimicrobial (Woo-Sang and Hyun-Jun , 2006).
4	5	Phenol, 2-methoxy-	Phenols	$C_7H_8O_2$	1.740	2.60	Its derivatives treat metabolic disorders, cancer, and cardiovascular diseases (Aqeel *et al.,* 2023).
5	6	4H-Pyran-4-one, 2,3-dihydro-3,5-di hydroxy-6-methyl-	Phenolic acid	$C_6H_8O_4$	2.018	1.62	Antioxidant, anti-inflammatory (Yu *et al*., 2013).
6	9	Catechol	Benzene derivative	$C_6H_6O_2$	2.610	0.46	Anti-cancer, antioxidant, anti-inflammatory, anti-diabetic, antiviral, antimicrobial, and antifungal, cure nervous system disorders (Surana *et al.,* 2023).
7	10	5-Hydroxymethylfurfural	Versatile molecule	$C_6H_6O_3$	2.882	5.99	Cure sickle cell disease, hypoxia, neurodegenerative diseases, enhancing the antiviral immune response (Choudhary *et al*., 2019; Zou *et al*., 2021).
8	11	Caracemide	Lipids	$C_6H_{11}N_3O_4$	3.281	0.12	Cure renal carcinoma (Witte *et al*., 1996).
9	14	2-Methoxy-4-vinylphenol	Phenols	$C_9H_{10}O$	3.697	0.50	Induces apoptosis in HT-29 colorectal cancer cells (Jeong and Jeong, 2010).
10	14	Phenol, 2-(1,1-dimethylethyl)-	Phenols	$C_{10}H_{14}O$	3.697	0.50	Antimicrobial, antifungal, anti-inflammatory (Devi *et al*, 2021).
11	17	DL-Proline, 5-oxo-, methyl ester	Alpha-amino acid ester	$C_6H_9NO_3$	4.386	0.03	Anti-inflammatory and antioxidant (Amala and Jeyaraj, 2014).
12	18	2H-Imidazole-2-thione, 1,3-dihydro-1-methyl-	Amino acid	$C_4H_6N_2S$	4.537	0.24	Antimicrobial, antifungal, cardiotonic, antithyroid, antioxidant, antihypertensive, anti-HIV, and Dopamine β-Hydroxylase (DBH) inhibitory (Savjani and Gajjar, 2011).
13	20	trans-Isoeugenol	Phenolic compound	$C_{10}H_{12}O$	5.208	0.26	Anti-infective **(**Ahmad *et al*., 2021).
14	27	Pilocarpine	Alkaloid	$C_{11}H_{16}N_2O_2.ClH$	6.821	0.36	Manage and treat xerostomia and glaucoma Panarese (Panarese *et al*., 2021).
15	28	Methyl 3-amino-2-thiophenecarboxylate	Thiophene	$C_6H_7NO_2S$	6.954	0.13	Anti-hypertensives, anti-HIV-1 integrase, antitumors, hepatitis C virus inhibitors (Tao *et al*., 2020).
16	30	(E)-4-(3-Hydroxyprop-1-en-1-yl)-2-methoxyphenol	trans-coniferyl alcohol	$C_{10}H_{12}O_3$	7.770	0.13	Anti-platelet, anti-thrombotic (Kumar *et al.,* 2023).
17	30	4-(1-Hydroxyallyl)-2-methoxyphenol	Phonols	$C_{10}H_{12}O_3$	7.770	0.13	Drug is known as eugenol, it has antimicrobial, anti-inflammatory, analgesic, antioxidant, and anti-cancer potential (Barboza *et al.,* 2018).
18	31	Undecanoic acid	Saturated fatty acid	$C_{11}H_{22}O_2$	8.120	0.14	Antivirulence and antifungal agent (Rossi *et al*., 2021).
19	41	Palmitoleic acid	Unsaturated fatty acid	$C_{16}H_{30}O_2$	10.797	1.53	Reduced inflammation, anti-microbial agent, and improved skin health (Bermudez *et al.,* 2022).
20	42	n-Hexadecanoic acid	Fatty acid	$C_{16}H_{32}O_2$	11.081	3.74	Anti-inflammatory, anticancer, antifungal, antioxidant, antibacterial (Ganesan *et al.,* 2024).

21	44	Hexadecanoic acid, ethyl ester	Fatty acid esters	$C_{18}H_{36}O_2$	11.353	0.80	Hepatoprotective, anti-inflammatory, anti-arthritic, anti-ulcer, anti-diuretic, neuroprotective and antioxidant (Gupta *et al.,* 2023).
22	50	Heptadecanoic acid	Fatty acid	$C_{17}H_{34}O_2$	12.289	0.11	Treat pancreatic cancer (Kim *et al.,* 2023).
23	51	9-Oxononanoic acid	Medium-chain fatty acids	$C_9H_{16}O_3$	12.507	0.05	Decrease hepatic lipogenesis (Minamoto *et al*., 1988).
24	52	9,12-Octadecadienoic acid (Z,Z)-, methyl ester	Fatty acid	$C_{19}H_{34}O$	12.754	0.18	Pain reliever, antioxidant, kidney toner, and to treat asthma, anti-inflammatory and analgesic (Hadi *et al*., 2016).
25	53	9,12,15-Octadecatrienoic acid, methyl ester, (Z,Z,Z)-	Polyunsaturated fatty acid methyl ester	$C_{19}H_{32}O_2$	12.857	1.46	Anti-inflammatory, hypocholesterolemic, anti-arthritic, antioxidant, hepatoprotective, antibiotic, antihyperglycemic, and antihistamine (Tangavelou *et al*., 2018).
26	54	11-Octadecenoic acid, methyl ester	Fatty acid methyl ester	$C_{19}H_{36}O_2$	12.984	0.41	Antidiarrheal (Shoge and Amusan, 2020).
27	54	9-Octadecenoic acid, methyl ester,(E)-	Monounsaturated fatty acid methyl ester	$C_{19}H_{36}O_2$	12.984	0.41	Antibacterial and antifungal potential. It may also have antioxidant and anti-cancer (Hadi *et al.,* 2016).
28	58	Oleic Acid	Monounsaturated omega-9 fatty acid	$C_{18}H_{34}O_2$	13.927	0.94	Heart disease and cholesterol, anti-inflammatory, Immune response, gastric-duodenal ulcers, blood pressure and regulate pancreas and liver activity (Pravst, 2014).
29	60	9,12,15-Octadecatrienoic acid, ethyl ester, (Z,Z,Z)-	Ethyl ester.	$C_{20}H_{34}O_2$	14.150	1.83	Anti-inflammatory, cell preservation, hypocholesterolemic, hepatoprotective, anti-arthritic (Guerrero *et al*., 2017).
30	66	Pyridine-4-carboxylic acid, 2-amino-3-cyano-5,6-dimethyl-, ethyl ester	Pyridine	$C_{13}H_{12}N_4$	16.241	0.04	Anti-inflammatory, anticancer, analgesic, antioxidant, acaricidal, anthelmintic, antiviral, antimitotic, insecticidal and antimicrobial (Mehany *et al.,* 2024).
31	67	Methapyrilene	Pyridine	$C_{14}H_{19}N_3S$	16.809	0.08	Antihistamine, hypersensitivities and sedative (Shapiro, 1956).
32	67	Desacetyldiltiazem	Benzothiazepine	$C_{20}H_{24}N_2O_3S$	16.809	0.08	Treatment of hypertension and angina pectoris (Abrams *et al*., 2007).
33	68	Oxacyclotetradecan-2-one	Macrolides short-chain fatty acids	$C_{13}H_{24}O_2$	17.062	0.04	Treat dermatosis (Achakzai *et al*., 2019).
34	71	7-Hexadecyn-1-ol	long-chain fatty alcohol	$C_{16}H_{32}O$	18.168	0.08	Anti-inflammatory, anti-microbial, antioxidant (Kumar *et al.,* 2022).
35	76	Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl)ethyl ester	Fatty acids	$C_{19}H_{38}O$	20.017	0.68	Antimicrobial properties (Thejashree *et al*., 2023).
36	77	9,10-Anthracenedione, 1-amino-4-hydroxy-	Anthracycline	$C_{14}H_9NO_3$	20.120	0.05	Anti-cancer (Mondal *et al.,* 2015).
37	79	Ethamivan	Methoxyphenol	$C_{12}H_{17}NO_3$	20.676	0.03	Ethamivan was used intravenously to treat severe barbiturate poisoning (Wheeldon and Perry, 1963).
38	80	(Z)6,(Z)9-Pentadecadien-1-ol	Fatty acid	$C_{15}H_{28}O$	20.990	0.06	Antioxidant and antimicrobial (Venkataravana *et al*., 2024).
39	84	2,3-Dihydroxypropyl elaidate	Glyceride	$C_{21}H_{40}O$	21.944	0.67	Antioxidant, anti-inflammatory, and anti-cancer agent (Khan and Javaid. 2023).
40	89	Squalene	Triterpene	$C_{30}H_{50}$	22.953	0.35	Anticancer, antioxidant, drug carrier, skin hydrating, detoxifier, and emollient activities (Kim and Karadeniz, 2012).
41	90	Capsaicin	Phenylpropanoid	$C_{18}H_{27}NO_3$	23.395	0.03	Cancer preventive agent (Bode and Dong, 2011).
42	91	Iminostilbene	Dibenzazepine	$C_{14}H_{11}N$	24.077	0.04	The antiepileptic drug omazepine (Wan et al., 2024).
43	94	26-Nor-5-cholesten-3.beta.-ol-25-one	Steroid	$C_{26}H_{42}O_2$	25.153	0.14	Antimicrobial, anti-asthma diuretic, and anti-inflammatory (Ahamad *et al.,* 2021).
44	95	Pinoresinol	Phenolic compound	$C_{20}H_{22}O_6$	25.727	0.05	Hypoglycemic agent and treat diabetes mellitus (Wikul *et al.,* 2012).
45	96	Campesterol	Phytosterol	$C_{28}H_{48}O$	25.932	0.21	Anti-inflammatory,and cure rheumatoid arthritis (Nazir *et al.,* 2023).
46	97	.gamma.-Sitosterol	Phytosterol	$C_{29}H_{50}O$	26.651	0.59	Anti-inflammatory and antiasthma (Sharma *et al.,* 2015).
47	97	.beta.-Sitosterol	Phytosterol	$C_{29}H_{50}O$	26.651	0.59	Anti-cancers such as prostate, colon, and lung cancer (Bin-Sayeed and Ameen. 2015).

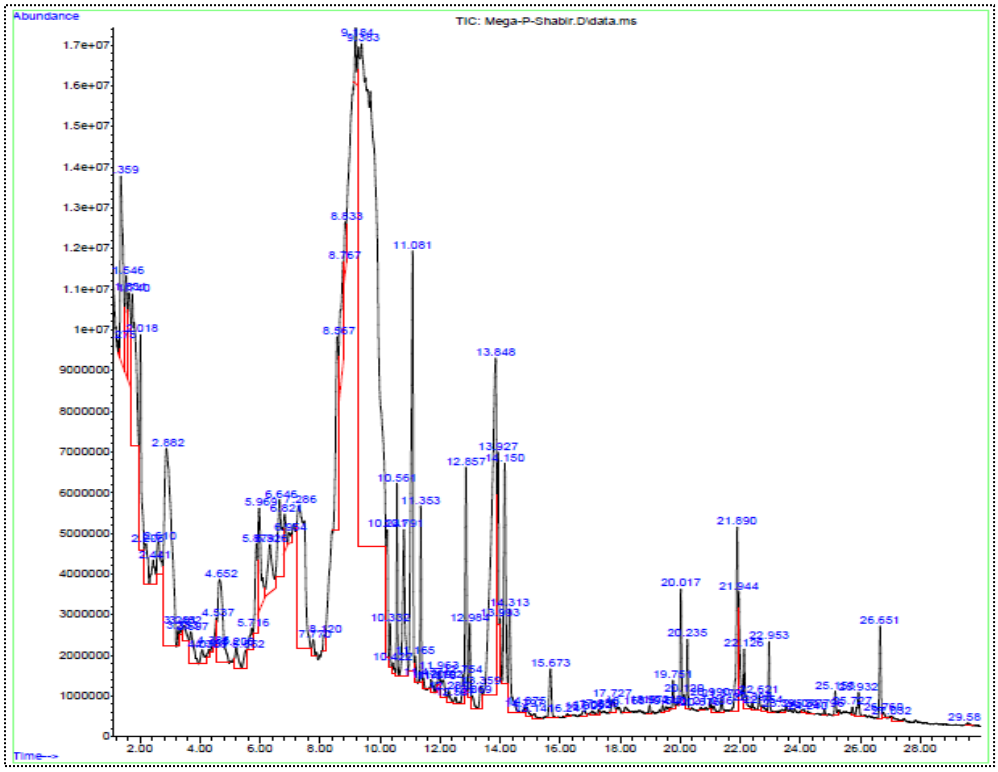

Figure 2. GC-MS complete Spectra of ethanolic root extract of *M. polyandra* Benth.

DISCUSSION

Pakistani scientists concentrate on new facets of medical plants such as bioactive components and unique molecules. The top research and academic institutions in Pakistan that study medicinal plants have been encouraged to increase their capabilities through workshops (Shinwari and Qaiser, 2011). *M. polyandra* have been well explored by its traditional uses; The root of this plant has a therapeutic importance the root's tea is used to cure Pneumonia (Ijaz *et al*., 2022) and also used to heal fever and gastric pain, Singh *et al*, (2017). Leaf of this plant holds various photochemical and medicinally important Ijaz *et al,* (2023). Because of historical and cultural factors, the usage and acceptance of medicinal herbs has become more significant. World Health Organization WHO, (2002) stated that due to insufficient regulations or a lack of data concerning safety, efficacy, and control, medically significant plants have emerged as the industry's main issue. The public and medical professionals want up-to-date, precise information about the safety and effectiveness of medicinal plants (WHO, 2002). The results obtained in the current study specifically bioactive compounds have great therapeutic potential. Such as nitrous oxide have analgesic and anxiolytic properties (Emmanouil and Quock, 2007). 1H-Imidazol-1-ylacetic acid is effective to treat bone-related issues in cancer patients (Nagy *et al*., 2018). Furaneol have antimicrobial and antifungal potential (Woo-Sang and Hyun-Jun, 2006). Phenol, 2-methoxy- derivatives are taken against cancer, metabolic disorders, and cardiovascular diseases (Aqeel *et al.,* 2023). The 4H-Pyran-4-one, 2,3-dihydro-3,5-di hydroxy-6-methyl- is known for antioxidant and anti-inflammatory (Yu *et al*., 2013). Catechol has vital role as anti-cancer, anti-inflammatory, anti-diabetic, antioxidant, antimicrobial, antiviral, and antifungal, and cure nervous system disorders (Surana *et al.,* 2023). The 5-Hydroxymethylfurfural compound is anti-cancer, anti-inflammatory, anti-diabetic, antioxidant, antimicrobial, antifungal, antiviral, and cures nervous system disorders (Choudhary *et al*., 2019; Zou *et al*., 2021). Caracemide treat unrespectable renal carcinoma (Witte *et al*., 1996). The 2-Methoxy-4-vinylphenol induces apoptosis in HT-29 colorectal cancer cells (Jeong and Jeong, 2010). Phenol, 2-(1,1-dimethylethyl)-possess antifungal, antimicrobial, anti-inflammatory activity (Devi *et al*, 2021). DL-Proline, 5-oxo-, methyl ester used as antioxidant and anti-inflammatory (Amala and Jeyaraj, 2014). There is a wide medicinal application of 2H-Imidazole-2-thione, 1,3-dihydro-1-methyl-, it is used as antimicrobial, antifungal, antithyroid, antioxidant, antihypertensive, anti-HIV, cardiotonic, and Dopamine β-Hydroxylase (DBH) inhibitory (Savjani and Gajjar, 2011). trans-Isoeugenol is an anti-infective (Ahmad *et al*., 2021) and pilocarpine is suggested for manage and treat xerostomia and glaucoma (Panarese *et al*., 2021). Methyl 3-amino-2-thiophenecarboxylate considered as an anti-hypertensive, antitumors, anti-HIV-1 integrase and hepatitis C virus inhibitors (Tao *et al*., 2020). (E)-4-(3-Hydroxyprop-1-en-1-yl)-2-methoxyphenol useful as anti-thrombotic and anti-platelet (Kumar *et al.,* 2023). The 4-(1-Hydroxyallyl)-2-methoxyphenol drug is known as Eugenol, it has antimicrobial, anti-inflammatory, antioxidant, analgesic, anti-cancer potential (Barboza *et al.,* 2018). Undecanoic acid is also known as antivirulence, and antifungal agent (Rossi *et al*., 2021). Palmitoleic acid is unsaturated fatty acid and reduced inflammation, act as an anti-microbial agent, improve skin health as well (Bermudez *et al.,* 2022). n-Hexadecanoic acid has great therapeutic importance and act as an anti-inflammatory, anticancer, antifungal, antioxidant, antibacterial (Ganesan *et al.,* 2024). Hexadecanoic acid, ethyl ester is known for anti-arthritic, hepatoprotective, anti-ulcer, anti-inflammatory, anti-diuretic, neuroprotective and antioxidant (Gupta *et al.,* 2023) and heptadecanoic acid cures of pancreatic cancer (Kim *et al.,* 2023). The 9-Oxononanoic acid decreases hepatic lipogenesis (Minamoto *et al*., 1988); 9,12-Octadecadienoic acid (Z,Z)-, methyl ester is pain reliever, act as an anti-inflammatory, antioxidant, analgesic, kidney toner, and to treat asthma (Hadi *et al*., 2016). 9,12,15-Octadecatrienoic acid, methyl ester, (Z,Z,Z)- used as anti-inflammatory, antibiotic, anti-arthritic, hepatoprotective, antioxidant, antihyperglycemic, hypocholesterolemic, and antihistamine (Tangavelou *et al*., 2018)) and 11-Octadecenoic acid, methyl ester is antidiarrheal (Shoge and Amusan, 2020). 9-Octadecenoic acid, methyl ester, (E)- have antifungal and antibacteria potential, it may also have antioxidant and anti-cancer (Hadi *et al.,* 2016). Oleic Acid control heart disease and cholesterol, act as an anti-inflammatory, immune response, pancreas and liver activity regulation, treat gastric-duodenal ulcers and blood pressure (Pravst, 2014). Vast Medicinal properties of 9,12,15-Octadecatrienoic acid, ethyl ester, (Z,Z,Z)- viz hypocholesterolemic, anti-inflammatory, hepatoprotective, and anti-arthritic have been reported by (Guerrero *et al*., 2017). Pyridine-4-carboxylic acid, 2-amino-3-cyano-5,6-dimethyl-, ethyl ester possess anti-inflammatory, antiviral, antioxidant, analgesic, anthelmintic, anticancer, antimitotic, acaricidal, and antimicrobial activities (Mehany *et al.,* 2024). Antihistamine, hypersensitivities associated with methapyrilene (Shapiro, 1956), and desacetyldiltiazem treat hypertension and angina pectoris (Abrams *et al*., 2007). Oxacyclotetradecan-2-one treat dermatosis (Achakzai *et al*., 2019). Another compound 7-Hexadecyn-1-ol has anti-inflammatory, anti-microbial, antioxidant properties (Kumar *et al.,* 2022).

Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl) ethyl ester is an anti-microbial compound (Thejashree *et al*., 2023). and 9,10-Anthracenedione, 1-amino-4-hydroxy is treat cancer (Mondal *et al.,* 2015). Ethamivan used intravenously to treat severe barbiturate poisoning (Wheeldon and Perry, 1963). (Z)6, (Z) 9-Pentadecadien-1-ol work as antioxidant and antimicrobial (Venkataravana *et al*., 2024). 2,3-Dihydroxypropyl is an antioxidant, anti-inflammatory, and anti-cancer agent (Khan and Javaid. 2023). Numerous biological activities were credited to squalene such as anticancer, antioxidant, detoxifier, skin hydrating, and emollient (Kim and Karadeniz, 2012) Capsaicin is a cancer-preventive molecule (Bode and Dong, 2011) and the antiepileptic drug ''omazepine'' has been prepared from iminostilbene (Wan *et al.,* 2024). Antimicrobial, diuretic, anti-inflammatory, anti-asthma properties have been linked to 26-Nor-5-cholesten-3. beta.-ol-25-one (Ahamad *et al.,* 2021). Pinoresinol is hypoglycemic agent and treat diabetes mellitus (Wikus *et al.,* 2012). Campesterol is anti-inflammatory chemical and also therapeutic agent for rheumatoid arthritis (Nazir *et al.,* 2023). Anti-inflammatory and antiasthma activities are associated with. gamma. -Sitosterol (Sharma et al*.,* 2015). . beta.-Sitosterol is renowned to cure different types of cancer (breast, prostate, colon and lung cancer) (Bin-Sayeed and Ameen. 2015). In the plant root, 18 different compounds have been identified as anti-inflammatory, 17 as anti-cancer agents used in many types of cancer, and 15 as an antioxidant. 13 different compounds have antimicrobial (virus and bacteria) potential. Similarly, 7 antifungals; 5 hepatoprotective; 4 analgesics; 3 cardiovascular diseases, antiasthma and anti-arthritic were recorded. The two dissimilar compounds for each biological activity like sedative, antihistamine, neuroprotective, diuretic, and cure rheumatoid arthritis were identified. For diseases like hypertension, angina pectoris, thrombotic, anthelmintic, HIV-1, acaricidal, metabolic disorders, epilecy, anxiolytic, and xerostomia and glaucoma, each treated with one molecule. Every molecule that has been identified has a special, vital ability to treat a range of illnesses. However, the identification of novel phyto-compounds with pharmacological action opens up novel opportunities for drug research.

CONCLUSION

In the root of *M. polyandra* plant, bioactive substances include alkaloid, amino acids, anthracycline, benzene derivatives, and cyclic ketone, fatty acids fatty acid esters, glyceride, lipids, short-chain fatty acids, medium-chain fatty acids, methoxyphenol monounsaturated fatty acid methyl ester, monounsaturated omega-9 fatty acid, phenolic compound, phonols, phytosterol polyunsaturated fatty acid methyl ester, triterpene, unsaturated fatty acid were detected by GC-MS analysis of an ethanolic root extract. The main molecules that may contribute to biological activities including antioxidant, anti-microbial, anti-cancer, cure nervous system disorders, blood pressure regulators, anti-diabetic, and anti-inflammatory qualities are catechol; 9,12,15-octadecatrienoic acid, methyl ester, (Z,Z,Z)-; eugenol; 2H-Imidazole-2-thione, 1,3-dihydro-1-methyl-; caracemide; n-Hexadecanoic acid; oleic Acid; pinoresinol; squalene; heptadecanoic acid and furaneol. Thus, based on the findings of this study, *M. polyandra* may be a powerful source of therapeutic chemicals that give it its pharmacological properties. To identify, explain, and purify the active ingredients causing the therapeutic action, more research is necessary. This might aid in the isolation and purification of compounds with potential medical applications.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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