ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

GC-MS Analysis Of Phytochemical Compounds Present In The Stembark Extracts Of Plant *Maytenus emarginata*.

Umesh Prabhakar Joshi *, and Rajendra Dayaram Wagh.

DCS's A. R. A. College of Pharmacy, Nagaon, Dhule, Maharashtra, India, 424006

ABSTRACT

Maytenus emarginata commonly known as Thorny staff tree is an evergreen tree that tolerates various types of stresses of the desert. stembark medicinal value is yet unexplored, hence this study forms a basis for the active components present in it and further isolation of the compound. The aim of this study is to screen the phytochemicals present in the stembark of Maytenus emarginata and further analysis of the components present in it by GC-MS analysis. The stembark were sequentially extracted based on the polarity viz., petroleum ether, chloroform, and methanol. The petroleum ether, chloroform, and methanol extract showed the presence of all phytoconstituents studied. The GC-MS analysis of the petroleum ether, chloroform, and methanol extract revealed the presence of 19, 17 and 20 compounds. GC-MS analysis forms a basis for the biological activity and importance of the compounds identified.

Keywords: Maytenus emarginata, Phytochemical screening, petroleum ether, chloroform, methanol, GC-MS analysis etc.

Corresponding author

ISSN: 0975-8585

INTRODUCTION

India is called as the largest producer of herbal medicine and is appropriately called as the botanical garden of the world [1]. Plants are having capability of biosynthesizing an overwhelming variety of organic compounds called as secondary metabolites, which are usually unique and complex structures. Many secondary metabolites have been found to possess interesting therapeutic activities and have applications like as pharmaceuticals, insecticides, dyes, colors, sweetners, flavors and fragrances. Plants used for traditional medicine contain a wide range of chemical constituents that can be used to treat acute, chronic and infectious diseases [2].

Plant secondary metabolites are called as phytochemicals that are naturally occurring and have potential disease inhibiting capabilities [3]. Phytochemicals are excellent sources of many bioactive compounds, like as volatile oils, steroids, triterpenoids, alkaloids and natural antioxidant compounds like as flavonoids, tannins and other phenolic compounds, with beneficial effects on human health. Hence, the screening of these chemically active compounds and antioxidant activity determination from plants have led to the discovery and development of novel drugs to be used against many diseases. Drugs obtained from plants are easily available, less expensive, safe and efficient and have less side effects [4]. There are many modern methods describing the identification, characterization and quantification of active chemical constituents in plant material may be useful for proper standardization of herbal drugs and their formulations. Mass spectrometry coupled with many chromatographic separations, like as gas chromatography (GC/MS), It is normally used for the direct analysis of the active constituents that exist in traditional medicines, herbal and medicinal plants. In recent years, hyphenated tool as GC-MS studies have been increasingly applied for the analysis of active constituents present in medicinal plants as this technique has proved to be a valuable method for the analysis of non-polar components and volatile essential oils, fatty acids, lipids and alkaloids [5]. The use of herbal plants as a source of medicine has been inherited and play an important role in to maintain the health care system. Plant extracts and bioactive chemical compounds which are isolated from medicinal plants are used for antioxidant, anti-inflammatory, antibacterial, antifungal and antiviral therapy [6]. The use of active constituents derived from medicinal plants has been in practice for a very long time [7]. The plants which are related to traditional medicinal system continues to provide primary health care to more than three quarters of the world's population. All over the world, these plant derived traditional medicines has an important role in the maintenance of health of peoples. Some major categories of plant derived products include personal care products, herbal medicines, natural health products, herbal cosmetics and phyto-pharmaceuticals [8]. Now a days GC-MS studies have been applied for the analysis of medicinal plants as this technique has applied to be a valuable method for the analysis of polar, semipolar and non polar components and volatile oil, fatty acids, lipids, alkaloids, flavonoids, tannins, terpenoids and steroids, and only few grams of plant material is required [9, 10, 11].

Maytenus emarginata (Willd.) belongs to the family Celastraceae. It is an evergreen plant that tolerates any types of stresses of the desert, locally called as "Kankero", "Baikal" in Hindi, and "Thorny staff tree" in English. Traditionally species of plant Maytenus has been used for fever, earthworms, ucer, asthama, inflammation, rheumatism and gastrointestinal disorders worldwide. Recently some biochemicals obtain from Maytenus species has been reported to be active against HIV-Protease [12] and MDR (Multi Drug Resistance) [13]. Roots are used in gastrointestinal diseases, especially in flatulence and dysentery. Stem of the plant useful for treatment for ulcer [14]. The bark of plant is ground to make a paste and it is applied for to kill lice in hair with mustard oil. Powdered leaves of plant Maytenus emarginata are given to children as a Anthelmentic with milk. Decoction form of the leaves is used as a mouthwash to relieve toothache. The leaves are used in treatment of heal sores [15]. The tender of leaves are chewed raw in the treatment of hepatitis and inflammation of liver.

MATERIALS AND METHODS

Plant Collection

The fresh stembarks of plant Maytenus emarginata were collected from region of Taluka Yawal, District Jalgaon, India. The plant was identified and authenticated by Dr. D. A. Dhale, Asst. Professor, PG & Research Dept. of Botany SSVPS's, L. K. Dr. P. R. Ghogrey Science College, Dhule, Maharashtra. Stembarks of plant were dried under sunlight and milled with the aid of grinding machine to make powder.

ISSN: 0975-8585

Preparation of Plant extract

The coarse powder of stembark of plant was extracted with increasing polarity of solvents like as Petroleum ether (60-80oC), Chloroform and Methanol by Continuous Soxhlet extraction method. Finally, the extracts were evaporated by vacuum evaporator and dried in tray dryer to obtain thick sticky extract (16).

Gas chromatography-mass spectrometry (GC–MS) profiling of Petroleum ether, chloroform and methanolic extracts of plant Maytenus emarginata.

The Petroleum ether, chloroform and methanolic extracts of plant Maytenus emarginata was analyzed by the Gas chromatography-mass spectrometry GC–MS technique and performed at SAIF Panjab University Chandigarh, India. The chemical composition of the Petroleum ether, chloroform and methanolic extracts was determined using an Thermo Scientific TSQ 8000 gas chromatograph-mass spectrometer with a direct capillary interface fused with silica capillary column TraceGOLD 5MS (30 m X 0.25 mm, 0.25 µm). Extracts were injected under the following conditions: Helium was used as carrier gas at constant rate 1 mL/min, pulsed splitless mode.

The solvent delay was 2-3 min and the injection size was 1.0 µL. The run time for GC was 21.76 min. The mass-spectrophotometric detector was operated in the electron impact ionization mode with an ionizing energy of 75 eV and scanning from m/z 50–700. The GC temperature program started at 60°C, then elevated to 300°C at a rate of 10°C/min, with a 10 min hold at 300°C. The injector, ion source and detector temperatures were set at 250, 230 and 300°C, respectively [17, 18]. The peaks which are separated in GC-MS were identified by NIST (National Institute of Standards and Technology) mass spectral databases.

The components present in plant extracts were identified based on comparison of their relative retention time and mass spectra. The Name of component, Molecular weight and structure of the components of the test material was ascertained.

RESULTS AND DISCUSSION

The components present in the petroleum ether, chloroform and methanolic extract of stembark of plant Maytenus emarginata were identified by hyphenated tool GC-MS analysis (Figure 1,2, and 3). The active chemical compounds with their retention time (RT), Molecular formula and Molecular weight (MW) in the petroleum ether, chloroform and methanolic extract extract of stembark of Maytenus emarginata. are presented in Table 1, 2 and 3. ,seventeen and twenty compounds were identified in petroleum ether, chloroform and methanolic extract of stembark of plant Maytenus emarginata. This type of hyphenated tool GC-MS analysis of samples is first step towards understanding the nature of active chemical constituents in this plant. Thus the plant Maytenus emarginata studied can be used as a potential source of active components as new useful drugs. The phytochemical characterization of the extracts, the isolation of responsible bioactive chemical compounds and their pharmacological activity are necessary for future studies.

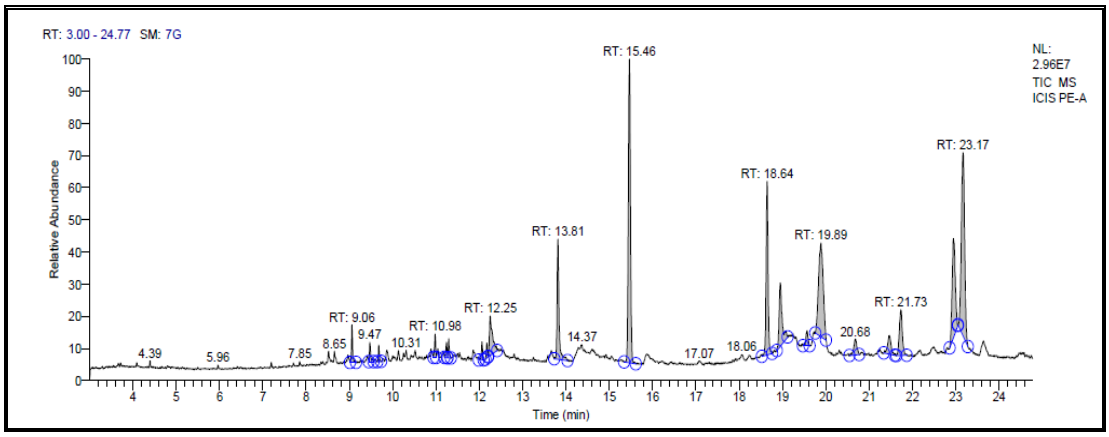

Figure 1: GC-MS chromatogram Petroleum ether extract of Maytenus emarginata

ISSN: 0975-8585

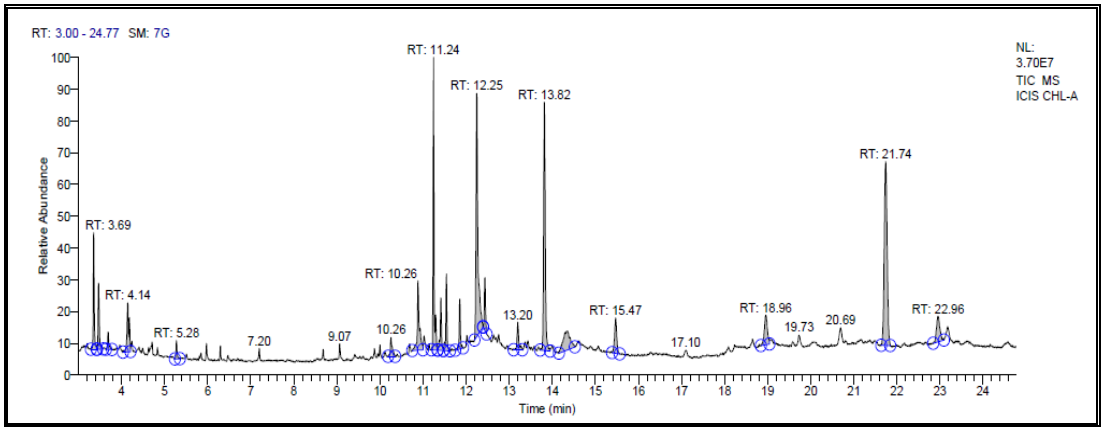

Figure 2: GC-MS chromatogram Chloroform extract of Maytenus emarginata

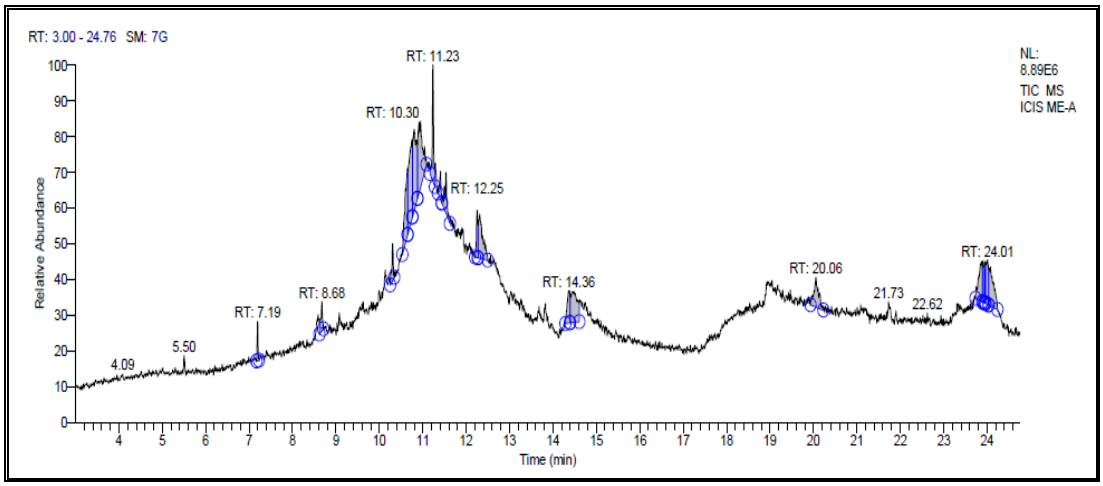

Figure 3: GC-MS chromatogram Methanolic extract of Maytenus emarginata

Table 1: Compounds present in Petroleum ether extract of Maytenus emarginata using GC-MS Profiling

Sr. No.	Rf (min)	Name of compound	Molecular formula	Molecular weight	Area %
1	9.06	6,6-Dimethyl-10-methylene-1-oxa-spiro[4.5]deca ne	C12H20O	180	1.32
2	9.47	11,13-Dihydroxy-tetradec-5-ynoic acid, methyl ester	C15H26O4	270	0.78
3	9.68	3-Buten-2-ol, 4-(2,6,6-trimethyl-2-cyclohexen-1-yl)-, (3E)-	C13H22O	194	0.49
4	10.98	Methyl 7,9-octadecadiynoate	C19H30O2	290	0.78
5	11.24	3,7,11,15-Tetramethyl-2-hexadecen-1-ol	C20H40O	296	0.57
6	11.29	2-Pentadecanone, 6,10,14-trimethyl-	C18H36O	268	0.61
7	12.06	1-Hexadecen-3-ol, 3,5,11,15-tetramethyl-	C20H40O	296	0.69
8	12.17	geranyl-p-cymene	C20H30	270	0.46
9	12.25	Phthalic acid, hexyl tetradecyl ester	C28H46O4	446	3.59
10	13.81	Oxirane, hexadecyl	C18H36O	268	6.81
11	15.46	Z-14-Octadecen-1-ol acetate	C20H38O2	310	19.32
12	18.64	Androstan-17-one, 3-ethyl-3-hydroxy-, (5à)-	C21H34O2	318	10.19
13	18.95	2-[4-methyl-6-(2,6,6-trimethylcyclohex-1-enyl)he xa-1,3,5-trienyl]cyclohex-1-en-1-carboxaldehyde	C23H32O	324	5.66
14	19.57	Ethyl iso-allocholate	C26H44O5	436	0.95
15	19.89	Z-(13,14-Epoxy)tetradec-11-en-1-ol acetate	C16H28O3	268	13.03

ISSN: 0975-8585

16	20.68	Octadecane, 3-ethyl-5-(2-ethylbutyl)-	C26H54	366	1.55
17	21.73	Phthalic acid, octyl oct-3-yl ester	C24H38O4	390	4.10
18	22.95	Bufa-20,22-dienolide,	C24H32O5	400	9.34
19	23.17	6-Octadecynenitrile	C18H31N	261	17.80

Table 2: Compounds present in Chloroform extract of Maytenus emarginata using GC-MS Profiling

Sr. No.	Rf (min)	Name of compound	Molecular formula	Molecular weight	Area %
1	3.35	Propane-2-chloro-2nitro	C3H6NO2	123	4.05
2	3.47	1-chloro-2-ethoxy-2-methoxypropane	C6H13CLO2	152	2.66
3	3.69	Dimethylcycloocta-2,4-Dienene	C10H14O	150	0.78
4	4.14	2-propenoic acid, pentadecyl ester	C18H34O2	282	3.26
5	5.28	1,5-Hexadiene 1,1,2,5,6,6-hexachloro	C6H4Cl6	286	0.68
6	10.26	1,6,6-Trimethyl-7-(3-oxobut-1-enyl)-3,8-dooxatricyl dooctan-5-one	C13H16O4	236	1.26
7	10.88	2-Pentyne-1,4-Diol-4-methyl-1-(2-thienyl)-propiolic acid	C10H12O2S	196	4.67
8	11.41	3-Ei cosyne	C20H38	278	2.26
9	11.54	Phytol acetate	C22H42O2	338	2.96
10	12.44	Dibutyl phthalate	C16H22O4	278	2.09
11	13.20	Dibutyl phthalate	C16H22O4	278	1.66
12	13.82	Phytol	C20H40O	280	14.28
13	14.35	9,12,15-Octadecatrienoic acid	C21H36O4	352	4.54
14	15.47	3,7,11,15-Tetramethyl-2-2hexadecan-1-ol	C20H40O	280	2.62
15	18.96	Octadecene-5,14-dibutyl	C26H54	366	3.10
16	21.74	Phthalic acid octyl oct-3yl ester	C24H38O4	390	18.02
17	22.96	9,12,15-octadecatrienoic acid-2,3-dihydroxypropyl ester	C21H36O4	352	2.92

Table 3: Compounds present in Methanolic extract of Maytenus emarginata using GC-MS Profiling

Sr. No.	Rf (min)	Name of compound	Molecular formula	Molecular weight	Area %
1	7.19	Cyclohexasiloxane, dodecamethyl-Heptasiloxane	C12H36O6Si6	444	1.24
2	8.68	3-Isopropoxy-1,1,1,7,7,7-hexamethyl-3,5,5 tris (trimethylsiloxy) tetrasiloxane	C18H52O7Si7	576	1.81
3	10.30	2,3-Dihydroxypropyl elaidate	C21H40O4	356	2.05
4	10.64	4-Ketoglucose, bis(O-methyloxime), tetrakis (trimethylsilyl)	C20H48N2O6Si4	524	6.76
5	10.75	1,3-Dioxolane-4-methanol, 2-pentadecyl-, acetate, trans	C21H40O4	356	10.68
6	10.80	5,19-Cycloandrost-6-en-3-one, 17,17-ethylenedioxy-	C21H28O3	328	10.90
7	10.92	4-Methoxycarbonylmethylundec-3-enedioic acid, dimethyl ester	C16H26O6	314	11.30
8	11.23	16-Octadecenal	C18H34O	266	5.69
9	11.41	Rhodopin	C40H58O	554	1.61
10	11.53	Bicyclo(3.1.0)hexane-2-undecanoic acid, methylester	C18H32O2	280	3.37
11	12.25	2,7-Diphenyl 1,6 dioxopyridazino (4,5:2',3') pyrrolo (4',5'-d) pyridazine	C20H13N5O2	355	2.38
12	12.31	Dasycarpidan-1-methanol, acetate (ester)	C20H26N2O2	326	6.95
13	14.36	Androstan-17-one, 3-ethyl-3-hydroxy-, (5à)-	C21H34O2	318	3.08
14	14.46	4H-Cyclopropa(5',6')benz[1',2':7,8(azuleno)5,6-boxiren-4-one,	C26H34O11	522	7.65
15	20.06	1,2-Propanediol, 3-(hexadecyloxy)-, diacetate	C23H44O5	400	5.00
16	23.87	Ethyl iso-allocholate	C26H44O5	436	5.20
17	23.91	Hexadecanoic acid	C36H56O6	584	2.25

18	23.95	7-Diphenyl-1,6 dioxopyridazino(4,5:2',3')pyrrolo(4',5'-d) pyridazine	C20H13N5O2	355	1.42
19	24.01	5H-Cyclopropa(3,4)benz(1,2-e)azulen-5-one,	C28H36O11	548	3.98
20	24.08	Octadecane, 3-ethyl-5-(2-ethylbutyl)-	C26H54	366	6.70

CONCLUSION

The correlation between the phytochemical compounds and their biological activities is now being the matter of innovative thought. Maytenus ematginata is a plant, traditionally used for the treatment of earthworms, toothache, cooling effects, purify blood, fever, asthama, ulcer, rheumatism and gastrointestinal disorders etc. But till date, there are few reports on chromatographic analysis of petroleum ether, chloroform and methanolic extract of the plant. Here we report the presence of some important compounds in the plant Maytenus ematginata isolated by GC-MS analysis. GC-MS study of plant extracts may give information on nature of active principles present in the medicinal plants. These phytoconstituents presumed to be responsible for eliciting the traditional activity of this plant Maytenus ematginata.

ACKNOWLEDGMENT

Authors are thankful to SAIF Panjab University Chandigarh, India for providing GC-MS facilities. Corresponding author also thankful to Mr. Mr. Azim Ansari for helping in structural characterization of component of extracts of plant.

REFERENCES

[1] Ahmedull M, Nayar MP. Red data book for Indian plants. Botanical Survey of India, 4, 1999.
[2] Duraipandiyan V, Ayyanar M, Ignacimuthu S. Antimicrobial activity of some ethnomedicinal plants used by Paliyar tribe from Tamil Nadu, India. BMC Complement. Altern. Med 2006; 6:35-41.
[3] Akinmoladun AC, Ibukun EO, Afor E, Obuotor EM, Farombi EO. Phytochemical constituent and antioxidant activity of extract from the leaves of Ocimum gratissimum: Scientific Research and Essays. 2007;2(5):163-66.
[4] Yadav RNS. Agarwala M. Phytochemical analysis of some medicinal plants: Journal of Phytology 2011;3(12):10-14.
[5] Mythili K, Umamaheswara Reddy C, Chamundeeswari D, Manna PK. GC-MS analysis of phytocomponents and in vitro inhibitory effects of Calanthe triplicate: Journal of Natural Products 2013;6:141-46.
[6] Anjali Ruikar, Rasika Torane, Amruta Tambe, Vedavati Puranik. Nirmala deshpande. GC-MS Study Of A Steam Volatile Matter From Mimusops elengi: Int. J. Chemtech. Res 2009;1(2)158-61.
[7] Akin-Osanaiye C. B., Gabriel A. F. and Alebiosu R. A. Characterization and antimicrobial screening of ethyl oleate isolated from Phyllanthus amarus (Schum and Thonn): Annals of Biological Research 2011;2 (2) : 298-05.
[8] Rasika C. Torane, Gayatri S. Kamble, Tushar V. Gadkari, Amruta S. Tambe and Nirmala R. Deshpande. GC-MS Study of Nutritious leaves of Ehretia laevis: Int.J.Chem tech Res 2011;3(3):1589-91
[9] Jie MSF, Choi CYCJ. Int. Fed. Clin. Chem. 1991;3,122.
[10] Betz JM, GayML, Mossoba MM, Adams S, Portz BS. Chiral gas chromatographic determination of ephedrine-type alkaloids in dietary supplements containing Má Huáng: J AOAC Int. 80;(2):303-15.
[11] M. Sermakkani, V. Thangapandian (2012). GC-MS analysis of Cassia italica leaf methanol extract: Asian Journal of Pharmaceutical and Clinical Research. 1997;5(2):90-4.
[12] Hussein G, Yashiva H, Nakamura-N Hattori. Inhibitory effects of Sudanese plant extract on HIV-1 replication and HIV-1 protease: Phytotherapy Res 1999;13:31-36.
[13] Vilegas W, Sanommiya M, Rastrelli L and PizzaC. Isolation and structure of two new flavonoid glycoside from the infusion of Maytenus aquifoliumleaves. Evaluation of the antiulcer activity of the infusion: J. Agric. Food Chem 1999; 47: 403-06.
[14] Spivey AC, M Weston, S Woodhead, Celastraceae sesquiterpenoids: biological activity and synthesis: Chem Soc Rev 2002;31:43-59.
[15] Pullaiah T. Encyclopedia of world medicinal plants. 1st ed. Paratyphi. Regency Publication, New Delhi. 2006: 1316-17.
[16] Mukharjee P. K., Quality Control of Herbal Drug, 1st ed., Business Horizon Publication, New Delhi,

2002,186-193, 405.

[17] Abdel-Aal EI, Haroon AM, Mofeed J. Successive solvent extraction and GC–MS analysis for the evaluation of the phytochemical constituents of the filamentous green alga Spirogyra longata: Egypt J Aquat Res 2015; 41: 233–46.

[18] Al-Owaisi M, Al-Hadiwi N, Khan SA. GC-MS analysis, determination of total phenolics, flavonoid content and free radical scavenging activities of various crude extracts of Moringa peregrina (Forssk.) Fiori leaves: Asian Pac J Trop Biomed 2014; 4: 964–70.