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PHYTOCHEMICAL PROFILING OF ROOT AND FRUIT OF *MAYTINUS EMARGINATA* (WILLD.) DING HOU THROUGH GC-MS

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ABSTRACT

Herbal drugs play an important role in health care programs especially in developing countries. Hence in the present study phytochemical constituents presents in the *Maytenus emarginata* root and fruit was identified by using Gas Chromatography – Mass Spectroscopy (GC-MS) technique. The roots and fruits were collected, dried in shade and converted to the powder form. This powder is then extracted through Soxhlet apparatus using acetone solvent for GC-MS analysis. The concentrated extract is then analysed by GC-MS technique and the various secondary metabolites were identified using NIST library search. The result shows the presence of different phytoconstituents which includes fatty acids, palmitic acid, steric acid, fatty alcohl, fluro compound, vitamin – E, triterpens. In acetone extract of root contain 32.88% β-amyrin (triterpen). In acetone extract of fruit contain 41.14% oleic acid (unsaturated fatty acid) and 18.95% squalene (triterpen). All these phytoconstituents shows properties such as antibacterial, antifungal, analgesic, antiinflametory, antidepresent, anticancer, antitumor, antioxidant, antifertility, antistroke, anticarcinogenic etc. *Maytenus emarginata* root and fruits contain the various phytoconstituent that can be useful in different fields like pharmaceuticals, perfume, drug development etc. and plant can be recommended as a plant of phytopharmaceutical importance.

KEYWORDS: Herbal drugs, Phytochemical profiling, *Maytenus emarginata*, GC-MS, secondary metabolites.

INTRODUCTION

Herbal drugs play an important role in health care programs especially in developing countries. Ancient Indian literature incorporates a remarkably broad definition of medicinal plants and considers all plant or parts of plants to be potential sources of medicinal substances. However, a key obstacle, which has hindered the acceptance of the alternative medicines in the developed countries, is the lack of documentation and stringent quality control. There is a need for documentation of research work carried out on traditional medicines.[4,21] With this backdrop, it becomes extremely important to make an effort towards standardization of the plant material to be used as medicine. The process of standardization can be achieved by stepwise pharmacognostic studies, include morphological, anatomical study and biochemical characterization by qualitatively as well as quantitatively. These studies help in identification and authentication of the plant material. Correct identification and quality assurance of the starting materials is an essential prerequisite to ensure reproducible quality of herbal medicine which will contribute to its safety and efficacy.[23] Many plants are cheaper and more accessible to most people especially in the developing countries than orthodox medicine, and there is lower incidence of adverse effects after use. These reasons might account for their worldwide attention and use.[17] The medicinal properties of some plants have been documented by some researchers. [2] Medicinal plants constitute the main source of new pharmaceuticals and healthcare products.[8] Extraction and characterization of several active phytocompounds from these green factories have given birth to some high activity profile drugs.[11] Indeed, the market and public demand has been so great that there is a great risk that many medicinal plants today, face either extinction or loss of genetic diversity.[12] Knowledge of the chemical constituents of plants is desirable because such information will be value for the synthesis of complex chemical substances .Such phytochemical screening of various plants is reported by many researchers.[13- 15] A grow ing body of evidence indicates that secondary plant metabolites play critical roles in human health and may be nutritionally important.[6] It is believed that crude extract from medicinal plants are more biologically active than isolated compounds due to their synergistic effects.[9] Phytochemical screening of plants has revealed the presence of numerous chemicals including alkaloids, flavonoids, tannins, steroids,glycosides and saponins. Secondary metabolites from plant serve as defense mechanisms against predation by many microorganisms, insects and herbivores.[3] Gas chromatography and mass spectroscopy technique is compatible in many ways. GC can separate the compounds of volatile and semi volatile nature with great efficiency but cannot identify them. On the other hand MS can

identify the compounds with the great efficiency but cannot separate them. This technology provides its application in identification as well as quantification of organic compound which are volatile and semi volatile in nature present in complex biological mixture. It can determine the molecular weights of compounds and elemental composition of unknown organic compounds.

It can also elucidate the structure of unknown organic compounds in mixture by matching their spectra with reference spectra. Combination of these powerful separation and detection techniques like gas chromatography and mass spectroscopy (GC-MS) provides the non-biased, large scale analysis of known and unknown metabolites present in the complex mixtures.

Maytenus emarginata (Willd) D. Hou. belonging to the family Celastraceae, is an evergreen tree that generally grows as small trees, bushes or lianas and has resinous stems and leaves. They tolerate various types of stresses of the desert, locally known as vickado, "Kankero" in Hindi, "Thorny staff tree" in English. Synonyms of this plant are *Celastrus emarginatus* Willd. *Gymnosporia emarginata* (Willd) Thw. *Gymnosporia montana* (Roth) Benth. Traditionally, species of *Maytenus* have been used for fever, asthma, rheumatism and gastrointestinal disorders worldwide. Some biomolecules from *Maytenus* species has been reported to be active against HIV-Protease[7] Carcinoma and leukemia[19] and MDR (Multi Drug Resistance).[20] Various parts of this plant contain immense medicinal properties such as shoots of the plant help for mouth ulcer.[18]

The bark is ground to a paste and applied with mustard oil to kill lice in the hair.[22] Pulverized leaves are given in milk to children as a vermifuge.[10] A decoction of the leaf twigs is used as a mouthwash to relieve toothache. Ash of leaves is used to heal up sores and wound gives a cooling effect.

The leaves are burnt and mixed with ghee to form an ointment used to heal sores.[16] The tender leaves are chewed raw in the treatment of jaundice. The fruit is used in medicines to purify blood.[1] As there are no reports on phytoconstituents of this plant, the present study aims at the Phytochemical Profiling of root and fruit of *Maytenus emarginata* (Willd) D. Hou.

MATERIALS AND METHOD

Collection of Plant Material

The root and fruit of *Maytenus emarginata* were collected from forest of Yavatmal district, Maharashtra, India. The collected plant were carefully examined for infected parts and were removed accordingly. Only fresh parts were taken for the analysis. These plant parts were dried in the shade till all its moisture gets evaporated. These dried root and fruit then pulverized to the powder form for further analysis.

Extraction

5 gram of flower powder was extracted using Soxhlet apparatus for 24 hours in acetone solvent separately. These extract then evaporated to dryness. At the time of analysis dried extract was dissolved in same solvent and these samples taken for GC – MS analysis.

GC – MS Analysis

The analysis was carried out using gas chromatography – high resolution mass spectrophotometer. Dried extract were dissolved in the 5 ml of acetone solvent. 0.4 ul of this solution is employed for GC – MS analysis. The GC-MS analysis was carried out using Trace GC Ultra (Thermo Scientific) with column (HP-5) of 30 meter length, 0.25 mm diameter and 0.25 film. Helium gas is used as carrier gas at constant flow rate of 1ml/ minute. Injector temperature was set at 250 ^{0}C. The oven temperature were programmed from 80^{0}C to 280 ^{0}C. 80^{0}C 1 minute hold up to 200 ^{0}C at 8 ^{0}C/ minutes, 7 minutes hold up to 280 ^{0}C at the rate of 10 ^{0}C/minutes. The sample was injected in split mode as 20:1. Identification of the compounds was done by comparing the spectral data of sample compound with the compound spectra present in spectral libraries (NIST).

RESULTS

The roots extracted in acetone shows the presence of fourteen phytoconstituents. Figure 1. represents the chromatogram of acetone extract of root and table 1 represents the phytochemical profiling in the acetone extract of root with their retention times, relative percentage, molecular weight and molecular formula of metabolites . The fruits extracted in acetone solvent shows the presence of ten compounds. Figure 2 explore the chromatogram of acetone extract of fruit and table 2 represent phytochemical profiling in the acetone extract of fruits with their retention times, relative percentage, molecular weight and molecular formula of metabolites. Figure 3 represents the structures of identified metabolites.

Table 1: Phytochemical profiling of acetone extract of *M. emarginata root*

Sr. No.	R.T.	Name of Compound	Rel. %	MW	MF
1	7.23	Cyclohexane, octyl-	2.58	196	$C_{14}H_{28}$
2	8.09	3- Acetonylcyclopentanone	3.44	140	$C_8H_{12}O_2$
3	10.47	1,1[1]-Bicyclohexyl , 2 (2-methyl propyl)-,trans-	4.18	222	$C_{16}H_{30}$
4	11.50	3-Trifluroacetoxytetradecane	2.21	310	$C_{16}H_{29}F_3O_2$
5	12.87	Carbonic acid , octadecyl phenyl ester	3.20	390	$C_{25}H_{42}O_3$
6	13.54	2- Hexadecanol	6.89	242	$C_{16}H_{34}O$
7	13.62	1- Hexadecanol , 2- methyl	1.48	256	$C_{17}H_{34}O$
8	16.42	Hexahydro-farnesol	1.46	228	$C_{15}H_{32}O$
9	20.00	Pyrrobutamide	9.85	311	$C_{20}H_{22}Cl\ N$
10	23.98	β-N- Normethadol	16.99	297	$C_{20}H_{27}NO$
11	25.55	Octadecanoic acid, cicosyl ester	7.38	564	$C_{38}H_{76}O_2$
12	26.97	β- Amyrin	32.88	426	$C_{30}H_{50}O$
13	28.10	1- Heptatricotanol	5.54	536	$C_{37}H_{76}O$
14	31.00	Squalene	1.84	410	$C_{30}H_{50}$

Table 2: Phytochemical profiling of acetone extract of *M. emarginata* fruit

Sr. No.	R.T.	Name of Compound	Rel. %	MF	MW
1	8.09	3- Acetonylcyclopentanone	0.99	140	$C_8H_{12}O_2$
2	10.45	3- Trifluroacetoxytetradecane	1.24	302	$C_{16}H_{29}F_3O_2$
3	13.54	1- Hexadecannol, 2- methyl	1.49	256	$C_{17}H_{36}O$
4	19.77	Phthalic acid, butyl tetradecyl ester	24.93	418	$C_{26}H_{42}O_4$
5	19.99	n-Hexadecanoic acid	3.24	256	$C_{16}H_{32}O_2$
6	22.82	Oleic acid	41.14	282	$C_{18}H_{34}O_2$
7	27.03	Vitamin – E	1.24	430	$C_{29}H_{50}O_2$
8	28.93	Olean-12-one-3,15,16,21,22,28-hexol	1.74	506	$C_{30}H_{50}O_6$
9	31.01	Squalene	18.95	410	$C_{30}H_{50}$
10	34.16	Linolenin, 1- mono-	4.98	352	$C_{21}H_{36}O_4$

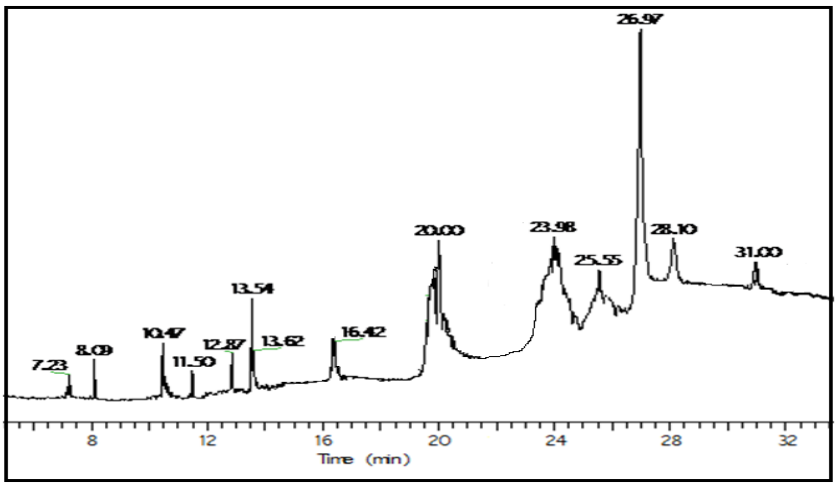

Figure 1: The total ion chromatogram of acetone extract of *M. emarginata* root showing peaks with retention times.

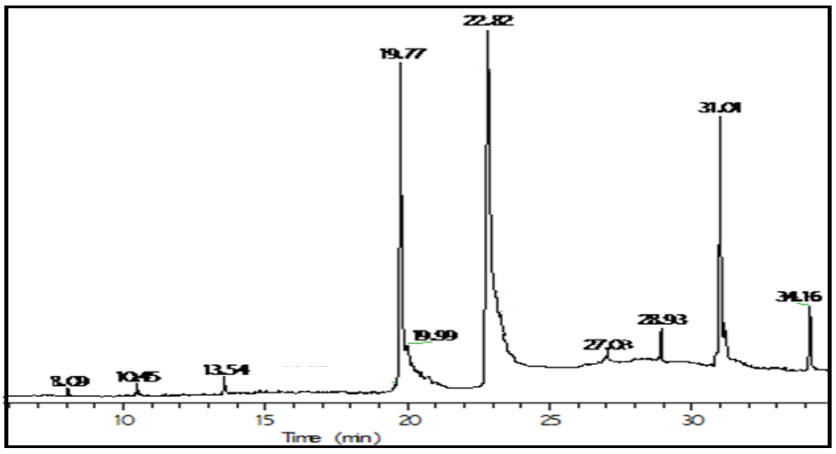

Figure 2: The total ion chromatogram of acetone extract of *M. emarginata* fruit showing peaks with retention times.

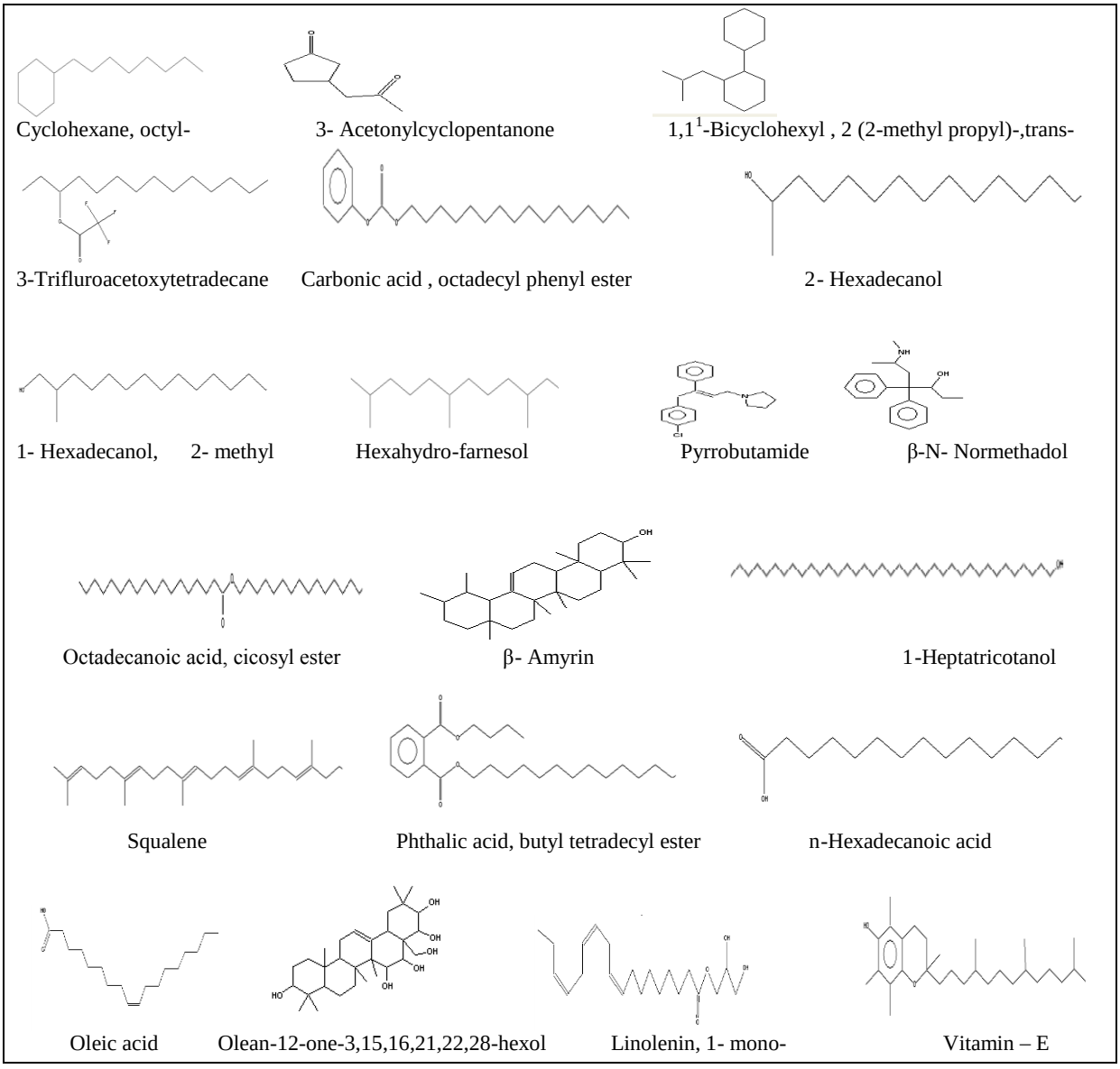

Figure 3: Structures of the compounds identified in acetone extract of root and fruit.

DISCUSSION

In the present investigation roots and fruits of *Maytenus emarginata* were extracted using acetone solvent followed by the GC – MS analysis which authenticates the fourteen and ten compounds in each respective sample. Acetone extract of roots observed the presence of Cyclohexane, octyl-, 3- Acetonylcyclopentanone , 1,1[1]-Bicyclohexyl , 2 (2-methyl propyl)- ,trans- , 3-Trifluroacetoxytetradecane , Carbonic acid , octadecyl phenyl ester , 2-Hexadecanol , 1- Hexadecanol , 2- methyl , Hexahydro-farnesol, Pyrrobutamide , β-N-Normethadol , Octadecanoic acid, cicosyl ester , β- Amyrin , 1- Heptatricotanol , Squalene. Acetone extract of fruit observed the presence of 3- Acetonylcyclopentanone, 3-Trifluroacetoxytetradecane , 1- Hexadecannol, 2- methyl, Phthalic acid, butyl tetradecyl ester, n-Hexadecanoic acid , Oleic acid , Vitamin – E, Olean-12-one-3,15,16,21,22,28-hexol, Squalene , Linolenin, 1- mono.

CONCLUSION

The result shows the presence of different phytoconstituents which includes fatty acids, palmitic acid, steric acid, fatty alcohl, fluro compound, vitamin – E , triterpens. In acetone extract of root contain 32.88 % β-amyrin (triterpen). In acetone extract of fruit contain 41.14% oleic acid (unsaturated fatty acid) and 18.95% squalene (triterpen) . All these phytoconstituents shows properties such as antibacterial, antifungal, analgesic , antiinflametory, antidepresent, anticancer, antitumor, antioxidant , antifertility, antistroke, anticarcinogenic etc. *Maytenus emarginata* root and fruits contain the various phytoconstituent that can be useful in different fields like pharmaceuticals, perfume, drug development etc. and plant can be recommended as a plant of phytopharmaceutical importance.

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