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Evaluation of Phytochemical Constituents from the Leaves of *Memecylon umbellatum Burm*.f

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ABSTRACT

A valuable Indian ethnomedicinal plant, Memecylon umbellatum was investigated for GC-MS (Gas Chromatography-Mass Spectrometry) analysis to determine the chemical constituents present in various extracts of the leaves. Powdered leaf plant materials were subjected to successive extraction with organic solvents such as petroleum ether, chloroform and ethanol by Soxhlet extraction method. Totally, 20 different compounds from chloroform extract, 11 different compounds from petroleum ether extract and 10 various compounds from ethanol extract were identified. All the compounds identified were medicinally valuable for the treatment of various human ailments. In addition, all the phytochemical compounds were needed further investigations on toxicological aspects for the development of new lead of therapeutic interest.

Key words: *Memcylon umbellatum*, Medicinal plant, phyto-chemical constituents, GC-MS analysis.

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INTRODUCTION

World Health Organization (WHO) [1] estimated that 80% of world population relies on medicinal plants for their primary health care needs. Out of the 3,50,000 plant species known so far, about 35,000 (some estimate up to 70,000) are used worldwide for medicinal purposes and less than about 0.5% of these have been investigated for their phyto-chemical and pharmacological potential [2]. This green inheritance thus represents an enormous reservoir of putative lead compounds to be discovered for various diseases. Plants are important sources of medicines and at least 25% of the prescription drugs issued in the United States of America and Canada contain bioactive compounds that are derived from or modeled after plant natural products [3]. Medicinal plants are best source to obtain a variety of drugs and therefore such plants should be investigated to understand better about their properties, safety and efficacy [4]. The active principles of many drugs found in plants are secondary metabolites. Medicinal plants are major sources of obtaining antimicrobial drugs [5].

The genus Memecylon L., (family: Melastomataceae) comprises of about 300 species in the world, of which 30 species has been reported from India [6, 7] and 16 species from Tamilnadu state [8]. The species Memecylon umbellatum Burm.f is an ethnomedicinal plant used traditionally for treating various diseases. Ethnomedicinally, leaves are used to treat eye troubles, gonorrhea, leucorrhea and wounds [9, 10], treatment of bone fracture, herpes [11], diabetes [12-14], skin diseases [15], snake bite [16]. Chemical constituents such as umbelactone (4-hydroxymethyl-3-methyl-but-2-ane-4, 7-olide), amyrin, sitosterol, tartaric acid, malic acid, oleanolic acid, urseolic acid [17], tannins [18] were reported. Biological activity such as anti-diabetic [12, 19], anti-viral [9, 10] and wound healing activity [20] were reported. After scrutiny of published literature, so far meager work has been done regarding the phyto-chemical evaluation on this selected plant. Hence, in the present study GC-MS analysis was carried out with petroleum ether, chloroform and ethanol extracts of the leaves of Memecylon umbellatum Burm.f. to investigate the chemical constituents present in it.

MATERIALS AND METHODS

Collection of plant material and preparation of the extracts

The leaves of Memecylon umbellatum Burm.f were collected from Jamnamaruthur, Javadu Hills, Tiruvannamalai District, Tamilnadu. The collected plant material was botanically identified and confirmed by Rapinat Herbarium, St. Joseph's College, Tiruchirappalli, Tamilnadu. The herbarium specimens were preserved and submitted to Department of Botany and Microbiology, A.V.V.M. Sri Pushpam College (Autonomous), Thanjavur District, Tamilnadu for further reference (Voucher no. ACT57). The leaves were chopped into small pieces, shade-dried and coarsely powdered by using a pulverizor. The coarse powders were then subjected to successive extraction with various organic solvents of increasing polarity such as petroleum ether, chloroform and ethanol by Soxhlet method [21]. The extracts were then collected and distilled off on a water bath at atmospheric pressure and the last trace of the solvents was

removed in vacuo and stored at 4˚C. All the extracts were then used for GC-MS analysis to determine the chemical constituents present in it.

Gas Chromatography-Mass spectrometry (GC-MS) analysis

GC-MS analysis was performed with GC Clarus 500 Perkin Elmer equipment. Compounds were separated on Elite-1 capillary column (100% Dimethylpolysiloxane). Oven temperature was programmed as follows: isothermal temperature at 50ºC for 2 min., then increased to 200ºC at the rate of 10ºC/min., then increased up to 280ºC at the rate of 5ºC/min. held for 9 min. Ionization of the sample components was performed in the EI mode (70 eV). The helium was used as gas carrier (1ml/min.), and 2 µl of sample was injected. The detector was Mass detector turbo mass gold-Perkin Elmer. The total running time for GC was 36 min. and software Turbomass 5.2 was used in this GC-MS study [22].

Identification of compounds

All the compounds were identified from petroleum ether, chloroform ethanol extracts based on direct comparison of the retention times and their mass spectra with the spectra of known compounds stored in the spectral database, NIST (Version year 2005).

RESULTS AND DISCUSSION

The chemical constituents identified by the GC-MS analysis on various extracts of the leaves of Memecylon umbellatum Burm.f. were enumerated along with molecular formula, retention time, molecular weight, peak area. In the chloroform extract of the leaves, totally 20 compounds were identified, of which 17 compounds were belonged to aliphatic groups and 3 compounds were belonged to aromatic groups. In aliphatic groups, alkane type possessed 5 compounds, fatty acid possessed 7 compounds and fatty alcohol had 2 compounds. While in aromatic groups, alkylated phenol, Fatty alcohol and triterpene possessed each one compound. In aliphatic group, the fatty acid compound 2,6,1014,18,22-tetracosahexaene, 2,6,10,15,19,23-hexamethyl-(all-E)- was found to be present as major constituent with the peak area 29.27 and retention time was 28.84 followed by oleic acid with peak area 24.19 and retention time was 18.80 and n-hexadecanoic acid with the peak area 21.40 and retention time was 16.15 respectively. Similarly, in aromatic group the alkylated phenol compound namely phenol, 2, 4-bis (1, 1-dimethylethyl) - was found as major constituent with the peak area 0.69 and retention time was 10.31 (Table 1).

In the petroleum ether extract of the leaves, totally 11 compounds were identified, of which 9 compounds were belonged to aliphatic group and 2 compounds were belonged to aromatic groups. In aliphatic group, alkene, fatty alcohol, diterpene alcohol and triterpene type possessed one compound each while fatty acid possess 5 compounds. In aromatic group, alkylated phenol and dicarboxylic acid possess one compound each. Among these compounds, the dicarboxylic acid compound namely 1,2-benzenedicarboxylic acid, diisooctyl ester was

found the major constituents in this extract with highest peak area of 71.24 % and the retention time recorded was 24.65, followed by aliphatic triterpene compound squalene with the peak area 10.64 and retention time was 28.86 (Table 2).

In the ethanol extract of the leaves, totally 10 compounds were identified of which, 6 compounds were belonged to aliphatic groups and 4 compounds were belonged to aromatic groups. In aliphatic groups, 3 compounds were fatty acid whereas, alkane, diterpene alcohol and fatty alcohol was possessed each single compound. In aromatic group, phytosterol and triterpenoid had 2 compounds each. In aliphatic group, the fatty acid compound nonacosane was found as major constituent with the peak area 14.30 and retention time was 27.69, followed by the alkane compound heptacosane with peak area 0.70 and retention time was 20.35 and oleic acid with peak area 0.26% and retention time 18.82. In aromatic group, the triterpenoid compound lupeol was found as the major constituent with the peak area 76.17% and retention time was 32.81, followed by α-Amyrin with the peak area 3.80% and retention time was 30.35 respectively (Table 3).

Secondary metabolites in plant products are responsible for several biological activities in man and animals [5]. The compounds identified by GC-MS in all the extracts are medicinally valuable and possess various pharmaceutical applications. Some compounds are medicinally potent even in minimal doses and thus the phytosterol compound, β-sitosterol possess anti-cancerous activity even in small doses. Clinical studies on the compound β-sitosterol showed significant anti-inflammatory and cardioprotective effect [23], on urinary symptoms and benign prostatic hyperplasia [24] in human. The compound lupeol could possess potential antiporotzoal, anti-inflammatory, anti-tumour, cardioprotective, hepatoprotective, antimicrobial activity. Duke phyto-chemical database showed wide range of pharmacological activities for the isolated plant compounds such as anti-inflammatory, anti-leukotriene-d4, carcinogenic, prostaglandigenic, secretogogue, spermicide for ricinoleic acid, 5-alpha-reductase-inhibitor, allergenic, alpha-reductase-inhibitor, anemiagenic, anti-alopecic, anti-androgenic, anti-inflammatory, anti-leukotriene-d4, cancer-preventive, choleretic, dermatitigenic, hypocholesterolemic, insectifuge for oleic acid, allergenic, analgesic, anaphrodisiac, anti-inflammatory, anti-oxidant, anti-pyretic, anti-radicular, anti-rheumatalgic, anti-septic, anti-tartar, cancer-preventive, carminative, counter-irritant, dentifrice, fungicide, herpetifuge, insectifuge, pesticide for methyl salicylate. In our previous report, we have been reported the basic phytochemical constituents of Memecylon umbellatum and its antimicrobial potentiality several pathogenic gram-positive and gram-negative bacteria [25]. Thus, the present and previous studies have been identified and reported the biological activities of the plant.

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Table1: Identification of chemical constituents from chloroform extract of the leaves of M. umbellatum by GC-MS analysis

S. No.	Name of the compounds	Molecular formula	Molecular weight	Retention time	Peak area %
(i) Aliphatic					
a. Alkane					
1	Hexadecanoic acid, ethyl ester	$C_{18}H_{36}O_2$	284	16.41	1.94
2	Undecane	$C_{11}H_{24}$	156	4.91	0.14
3	7-Tetradecane, (Z)-	$C_{14}H_{28}$	196	8.75	0.28
4	Hexadecane	$C_{16}H_{34}$	226	8.86	0.13
5	1-Hexadecanol	$C_{16}H_{34}O$	242	11.18	0.49
b. Alkylated phenol					
6	Tetradecanoic acid	$C_{14}H_{28}O_2$	228	13.43	0.50
c. Cycloalkane					
7	Dodecane	$C_{12}H_{26}$	170	6.24	0.09
d. Fatty acid					
8	Octadecanoic acid	$C_{18}H_{36}O_2$	284	19.11	7.53
9	n-Hexadecanoic acid	$C_{16}H_{32}O_2$	256	16.15	21.40
10	9, 12-Octadecadienoic acid (Z,Z)-	$C_{18}H_{32}O_2$	280	18.71	3.60
11	Oleic acid	$C_{18}H_{34}O_2$	282	18.80	24.19
12	4,8,12,16-Tetramethyl-heptadecan-4-olide	$C_{21}H_{40}O_2$	324	21.90	0.60
13	Eicosanoic acid	$C_{20}H_{40}O_2$	312	22.12	1.07
14	2,6,1014,18,22-tetracosahexaene, 2,6,10,15,19, 23-hexamethyl- (all-E)-	$C_{30}H_{50}$	410	28.84	29.27
e. Fatty alcohol					
15	3,7,15-Tetramethyl-2-hexadecen-1-ol	$C20H_{40}O$	296	14.37	0.89
16	Phytol	$C_{20}H_{40}O$	296	18.36	6.16
f. Terpene					
17	1-Nonadecene	$C_{19}H_{38}$	266	13.69	0.65
(ii) Aromatic					
a. Alkylated phenol					
18	Phenol, 2,4-bis(1,1-dimethylethyl)-	$C_{14}H_{22}O_4$	206	10.31	0.69
b. Fatty alcohol					
19	Cyclooctane, methyl-	C_9H_{18}	126	6.12	0.15
c. Triterpene					
20	2(4H)-Benzofuranone, 5,6,7,7a-tetrahydro- 4,4,7a-trimethyl-, (r)- (synonyms: Dihydroactinidiolide)	$C_{11}H_{16}O_2$	180	10.77	0.21

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Table2: Identification of chemical constituents from petroleum ether extract of the leaves of M. umbellatum by GC-MS analysis

S. No.	Name of the compounds	Molecular formula	Molecular weight	Retention time	Peak Area %
(i) Aliphatic groups					
a. Alkene					
1	1-Butene, 2,3,3-trimethyl-	C_7H_{14}	98	3.37	2.89
b. Fatty alcohol					
2	3,7,11,15-Tetramethyl-2-hexadecen-1-ol	$C_{20}H_{40}O$	296	14.42	0.58
c. Fatty acid					
3	Hexadecanoic acid, 15-methyl-methyl ester	$C_{18}H_{36}O_2$	284	15.52	0.34
4	n-hexadecanoic acid	$C_{16}H_{32}O_2$	256	16.19	5.54
5	Hexadecanoic acid, ethyl ester	$C_{18}H_{36}O_2$	284	16.47	0.90
6	Oleic acid	$C_{18}H_{34}O_2$	282	18.83	4.17
7	Octadecanoic acid	$C_{18}H_{36}O_2$	284	19.17	1.38
d. Diterpene alcohol					
8	Phytol	$C_{20}H_{40}O$	296	18.42	1.86
e. Triterpene					
9	Squalene	$C_{30}H_{50}$	410	28.86	10.64
ii) Aromatic groups					
a. Alkylated phenol					
10	Phenol, 2,4-bis(1,1-dimethylethyl)-	$C_{14}H_{22}O$	206	13.88	0.47
b. Dicarboxylic acid					
11	1,2-benzenedicarboxylic acid, diisooctyl ester	$C_{24}H_{38}O_4$	390	24.65	71.24

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Table3: Identification of chemical constituents from ethanol extract of the leaves of M. umbellatum by GC-MS analysis

S. No.	Name of the compounds	Molecular formula	Molecular weight	Retention time	Peak area %
(i) Aliphatic					
Alkane					
1	Heptacosane	$C_{27}H_{56}O$	380	20.35	0.70
Diterpene alcohol					
2	Phytol	$C_{20}H_{40}O$	296	18.37	0.09
Fatty acid					
3	n-Hexadecanoic acid	$C_{16}H_{32}O_2$	256	16.19	0.25
4	Oleic acid	$C_{18}H_{34}O_2$	282	18.82	0.26
5	Nonacosane	$C_{29}H_{60}O$	408	27.69	14.30
Fatty alcohol					
6	3,7,11,15-Tetramethyl-2-hexadecen1-ol	$C_{20}H_{40}O$	296	14.38	0.37
(ii) Aromatic					
Phytosterol					
7	Stigamsterol	$C_{29}H_{48}O$	412	26.59	0.82
8	β-Sitosterol	$C_{29}H_{50}O$	414	29.01	3.26
Triterpenoid					
9	α-Amyrin	$C_{30}H_{50}O$	426	30.35	3.80
10	Lupeol	$C_{30}H_{50}O$	426	32.81	76.17

CONCLUSION

The present study it has been concluded that, the plant Memcylon umbellatum is a potential source of biologically active compounds with pharmaceutical value. Further, the compounds identified were needed further study on the toxicological aspects including clinical trials to develop safe drug for the treatment of various human ailments.

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