



RESEARCH ARTICLE

NATURAL PRODUCT CHEMISTRY

**GC-MS ANALYSIS OF SOME BIOACTIVE CONSTITUENTS OF
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627012, Tamil Nadu, India.****ABSTRACT**

Mussaenda frondosa is one of the medicinally important plants belonging to the family Rubiaceae, commonly known as "Vellai ilai" in Tamil. Traditionally leaves are used in the treatment of jaundice, asthma, hyperacidity, ulcers, leprosy, diuretic, wound, swells, antimicrobial, diuretic activity, hypolipidemic effect, hepatoprotective activity, fever and cough. In the present study the ethanolic extract of *Mussaenda frondosa* has been subjected to GC-MS analysis. Twenty chemical constituents have been identified, The major chemical constituents are (-)-Quinic acid (32.87 %), 4-((1E)-3-Hydroxy-1-propenyl)-2-methoxyphenol (8.30%), Naphthalene, decahydro-2-methoxy-(7.20 %). 1, 2, 3-Benzenetriol (7.70%),

KEYWORDS

Mussaenda frondosa, phytochemicals, GC-MS analysis, Quinic acid,

INTRODUCTION

Mussaenda frondosa Linn. (Rubiaceae) commonly known as pink Mussaenda. It is found throughout India and has historically been used to treat a wide assortment of diseases. Plant is known by various names in different languages as “Bedina” in Hindi, “Sriparnah” in Sanskrit, and “Nagavalli” in Telugu.²⁻⁴ Traditionally *Mussaenda frondosa* Linn. is reported to possess number of medicinal properties. The whole plant is used as astringent, expectorant, in jaundice, hyperacidity, ulcers, leprosy, diuretic, wound healing, swelling, antimicrobial, protective⁵, asthma⁶. The plant is also found to possess hypolipidemic effect⁷, hepatoprotective activity⁸, fever and cough. Hence the objective of the present study is to identify the Phytochemical constituents with the aid of GC-MS technique.

EXPERIMENTAL

Collection of plant material

The whole plant of *Mussaenda frondosa* was collected in the month of October from Kulathupuzha, Western Ghats of South India, Kerala. The plant was identified by Prof.P.Jayaraman, Plant Anatomy Research Center, West Thambaram, Chennai, Tamil Nadu, India. A voucher specimen (MSU-132) has been kept in the Herbarium of the Department of Pharmaceutical Chemistry, Manonmaniam Sundaranar University, Tirunelveli -627 012, Tamil Nadu, India.

Preparation of powder and extract

The whole plant was shade-dried and pulverized to powder in a mechanical grinder. The powder (1kg) was successively extracted with various solvents such as petroleum ether

(40°-60°C), benzene, chloroform, ethanol and water. The extracts were concentrated under reduced pressure in a rotary evaporator (Buchi, USA). The ethanolic extracts of the plant was used for GC-MS analysis.

GC –MS analysis

Preparation of extract

2 µl of the ethanolic extract of *Mussaenda frondosa* was employed for GC/MS analysis⁹.

Instruments and chromatographic conditions

GC-MS analysis was carried out on a GC clarus 500 Perkin Elmer system comprising a AOC-20i autosampler and gas chromatograph interfaced to a mass spectrometer (GC-MS) instrument employing the following conditions: column Elite-1 fused silica capillary column (30 × 0.25 mm ID × 1EM df, composed of 100% Dimethyl poly siloxane), operating in electron impact mode at 70 eV; helium (99.999%) was used as carrier gas at a constant flow of 1ml/min and an injection volume of 0.5 EI was employed (split ratio of 10:1) injector temperature 250°C; ion-source temperature 280°C. The oven temperature was programmed from 110°C (isothermal for 2 min), with an increase of 10°C/min, to 200°C/min, then 5°C/min to 280°C/min, ending with a 9 min isothermal at 280°C. Mass spectra were taken at 70 eV; a scan interval of 0.5 s and fragments from 40 to 550 Da.

Identification of components

Interpretation on mass spectrum of GC-MS was done using the database of National Institute Standard and Technology



(NIST) having more than 62,000 patterns. The mass spectrum of the unknown component was compared with the spectrum of the known components stored in the NIST library. The name, molecular weight and structure of the components of the test materials were ascertained.

RESULTS AND DISCUSSION

GC-MS analysis

Mussaenda frondosa Linn ethanol extract

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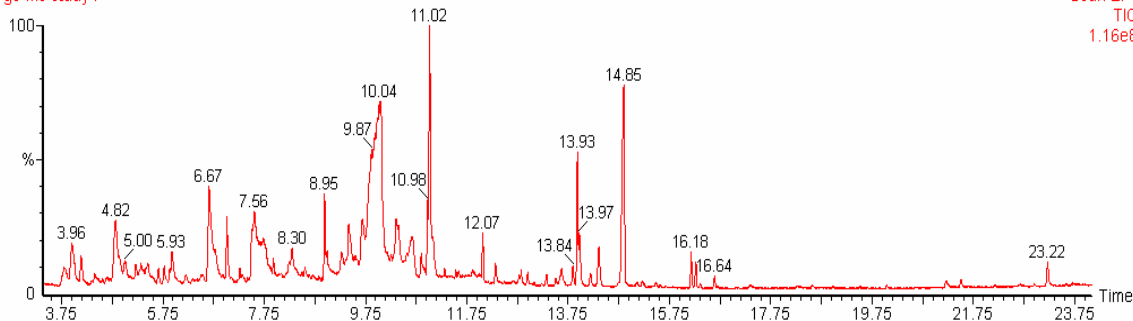


Figure.1

GC-MS Chromatogram of ethanolic extract of the whole plant of *Mussaenda frondosa*

Table 1

Phytocomponents identified in the ethanolic extracts of the whole plant of *Mussaenda frondosa* by GC-MS.

No.	RT	Name of the compound	Molecular Formula	MW	Peak Area (%)
1.	3.96	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-	C ₆ H ₈ O ₄	144	2.37
2.	4.41	1-Octanol, 2,7-dimethyl-	C ₁₀ H ₂₂ O	158	0.51
3.	4.82	2-Furancarboxaldehyde, 5-(hydroxymethyl)-	C ₆ H ₆ O ₃	126	4.97
4.	5.00	à-D-Glucopyranoside, O-à-D-glucopyranosyl-(1.fwdarw.3)-à-D-fructofuranosyl	C ₁₈ H ₃₂ O ₁₆	504	1.07
5.	5.93	2-Methoxy-4-vinylphenol	C ₉ H ₁₀ O ₂	150	1.47
6.	6.51	9-Acetoxy-nonanal	C ₁₁ H ₂₀ O ₃	200	0.49
7.	6.67	1,2,3-Benzenetriol	C ₆ H ₆ O ₃	126	7.70
8.	7.02	Benzaldehyde, 3-hydroxy-4-methoxy-[Isovanillin]	C ₈ H ₈ O ₃	152	1.83



9	7.27	Caryophyllene	C ₁₅ H ₂₄	204	0.40
10.	7.56	Naphthalene, decahydro-2-methoxy-	C ₁₁ H ₂₀ O	168	7.20
11	8.30	Lactose	C ₁₂ H ₂₂ O ₁₁	342	1.99
12.	9.69	3-O-Methyl-d-glucose	C ₇ H ₁₄ O ₆	194	2.68
13.	10.04	(1R,3R,4R,5R)-(-)-Quinic acid	C ₇ H ₁₂ O ₆	192	32.87
14	11.02	4-((1E)-3-Hydroxy-1-propenyl)-2-methoxyphenol	C ₁₀ H ₁₂ O ₃	180	8.30
15.	13.84	3,5-Dimethoxy-4-hydroxycinnamaldehyde	C ₁₁ H ₁₂ O ₄	208	0.49
16	13.93	Hexadecanoic acid, ethyl ester	C ₁₈ H ₃₆ O ₂	284	2.86
17.	16.18	Linoleic acid ethyl ester	C ₂₀ H ₃₆ O ₂	308	0.83
18.	16.27	Oleic Acid	C ₁₈ H ₃₄ O ₂	282	0.63
19	16.64	Octadecanoic acid, ethyl ester	C ₂₀ H ₄₀ O ₂	312	0.31
20	23.22	8-Phenyl-6-thio-theophylline	C ₁₃ H ₁₂ N ₄ OS	272	0.85

Table 2

Activity of phyto-components identified in the ethanolic extracts of the whole plant of *Mussaenda frondosa* by GC-MS.

RT	Name of the compound	Compound Nature	**Activity
3.96	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-	Flavonoid fraction	Antimicrobial, Anti inflammatory
4.14	Butanedioic acid, diethyl ester	Ester compound	No activity reported
4.82	2-Furancarboxaldehyde, 5-(hydroxymethyl)-	Aldehyde compound	Antimicrobial, Preservative
5.00	α -D-Glucopyranoside, O- α -D-glucopyranosyl-(1.fwdarw.3)- α -D-fructofuranosyl	Sugar moiety	Preservative
5.93	2-Methoxy-4-vinylphenol	Phenolic compound	Antimicrobial, Antioxidant, Anti inflammatory, Analgesic
6.51	9-Acetynonanal	Aldehyde compound	Antimicrobial
6.67	1,2,3-Benzenetriol	Pyrogallol	Antiseptic, Antioxidant, Antidermatitic, Fungicide Insecticide, Candidicide
7.02	Benzaldehyde, 3-hydroxy-4-methoxy-[Isovanillin]	Isovanillin	Antimicrobial
7.27	Caryophyllene	Sesquiterpene	Anti-tumor, Analgesic, Antibacterial, Antiinflammatory Sedative, Fungicide

7.56	Naphthalene, decahydro-2-methoxy-	Naphthalene compound	Insecticide
8.30	Lactose	Sugar compound	Preservative
9.69	3-O-Methyl-d-glucose	Sugar moiety	Preservative
10.04	(1R,3R,4R,5R)-(-)-Quinic acid	Quinic acid	Antimicrobial
11.02	4-((1E)-3-Hydroxy-1-propenyl)-2-methoxyphenol	Phenolic compound	Antimicrobial, Antioxidant Antiinflammatory, Analgesic
13.84	3,5-Dimethoxy-4-hydroxycinnamaldehyde	Cinnamaldehyde compound	Antimicrobial, Antiinflammatory Anticancer, Anesthetic, Antiulcer Antiviral, Hypoglycemic
13.93	Hexadecanoic acid, ethyl ester	Palmitic acid ester	Antioxidant, Hypocholesterolemic Nematicide, Pesticide, Flavor, Lubricant, Antiandrogenic, Hemolytic 5-Alpha reductase inhibitor
16.18	Linoleic acid ethyl ester	Linoleic acid ester	Antiinflammatory, Hypocholesterolemic, Cancer preventive Hepatoprotective Nematicide, Insectifuge Antihistaminic, Antieczemic Antiacne, 5-Alpha reductase inhibitor Antiandrogenic, Antiarthritic, Anticoronary, Insectifuge
16.27	Oleic Acid	Oleic acid	Antiinflammatory, Antiandrogenic Cancer preventive, Dermatitigenic Hypocholesterolemic, 5-Alpha reductase inhibitor, Anemiagenic Insectifuge, Flavor
23.22	8-Phenyl-6-thio-theophylline	Sulfur compound	Antimicrobial

***Source: Dr.Duke's phytochemical and ethnobotanical databases [Online database].*

Four major phytochemical constituent's mass spectra are presented in Figure 2-Figure 5. They were identified as (-)-Quinic acid (32.87 %), 4-((1E)-3-Hydroxy-1-propenyl)-2-methoxyphenol (8.30%), 1,2,3-Benzenetriol (7.70%) and Naphthalene, decahydro-2-methoxy-(7.20 %) respectively.

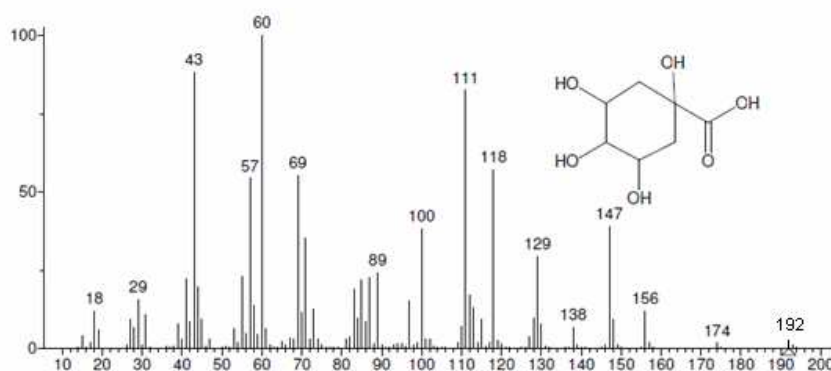


Figure.2
Mass spectrum of 1(R), 3(R), 4(R), 5(R)-(-) Quinic acid (RT: 10.04)

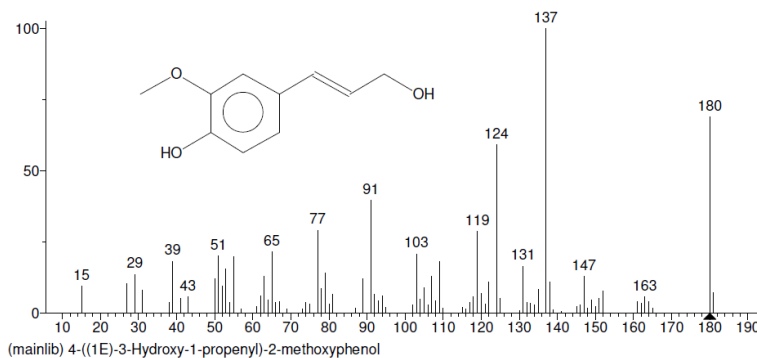


Figure.3
Mass spectrum of 4-((1E)-3-Hydroxy-1-propenyl)-2-methoxyphenol (RT: 11.02)

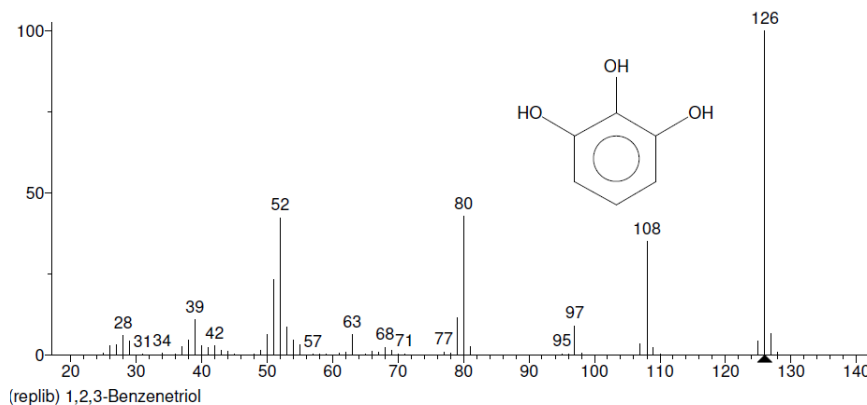


Figure.4
Mass spectrum of 1,2,3-Benzenetriol (RT: 6.67)

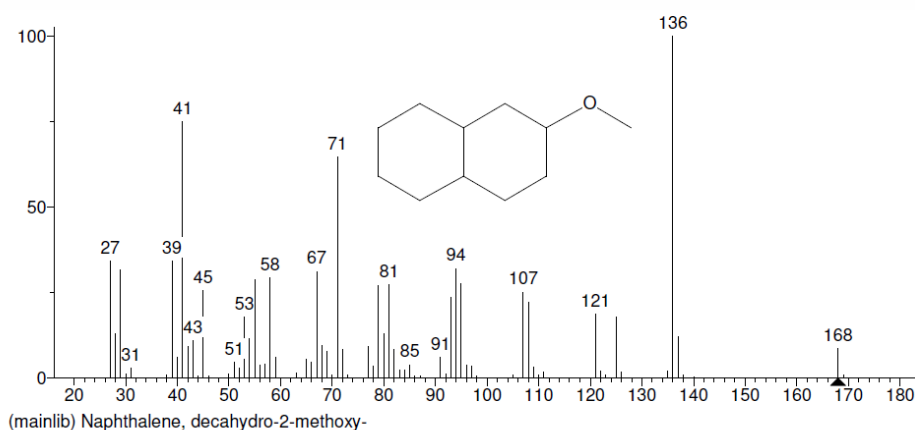


Figure.5
Mass spectrum of Naphthalene, decahydro-2-methoxy- (RT: 7.56)

CONCLUSION

In the present study twenty chemical constituents have been identified from ethanolic extract of the whole plant of *Mussaenda frondosa* by Gas Chromatogram-Mass spectrometry (GC-MS) analysis. The presence of various bioactive compounds justifies the use of the whole plant for various ailments by traditional practitioners. However isolation of individual phytochemical

constituents and subjecting it to biological activity will definitely give fruitful results.

It could be concluded that *Mussaenda frondosa* contains various bioactive compounds. So it is recommended as a plant of phytopharmaceutical importance. However, further studies will need to be undertaken to ascertain fully its bioactivity, toxicity profile, effect on the ecosystem and agricultural products.

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