Research Article

GC-MS Analysis of Bioactive Components of *Myxopyrum serratulum* A.W. Hill (Oleaceae)

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Accepted on: 10-03-2016; **Finalized on:** 30-04-2016.

ABSTRACT

Myxopyrum serratulum belongs to the family Oleaceae. The present investigation was carried out to determine the possible bioactive components of leaf of *M. serratulum* using GC-MS analysis. Twenty four compounds were identified from the leaf of *M. serratulum*. The prevailing compounds in the ethanol extract of leaf of *M. serratulum* were 2-Propenoic acid, 3-(4-methoxy phenyl)- (47.02), 1-(2-Hydroxy-ethyl)-2-methyl-1H-benzoimidazole-5-carboxylic acid methyl ester (16.38), n-Hexadecanoic acid (5.21), Isoquinoline, 1,2,3,4-tetrahydro-1-ally1-6,7-dimethoxy-3,3-dimethyl- (5.15), Phytol (3.45), 3,7,11,15-Tetramethyl-2-hexadecen-1-ol (3.34), Ethyl α-d-glucopyranoside (3.02), Pyrazolidine-3,5-dione, 4-phenyl- (2.88), Hexadecanoic acid, ethyl ester (2.83), 1H-Indol-4-ol (2.55), 9,12-Octadecadienoic acid (z,z)- (1.72), 4-((1E)-3-Hydroxy-1-propenyl)-2-methoxyphenol (1.32), Oleic acid (1.12). The compounds identified through the GC-MS analysis were used in various applications as antimicrobial, anti-inflammatory and cancer preventive.

Keywords: *Myxopyrum serratulum*, GC-MS, Phytol, n-Hexadecanoic acid.

INTRODUCTION

Screening active compounds from plants has lead to the invention of new medicinal drugs which have efficient protection and treatment roles against various diseases including cancer and alzheimer's disease.[1,2] Plants remain a vital source of drugs and now a days much emphasis has been given to nutraceuticals. *Myxopyrum serratulum* (Oleaceae) commonly known as "Chaturamulla" is a large woody climbing shrub. The leaves are astringent, acrid, sweet, thermogenic, anodyne, febrifuge and tonic. They are useful in vitiated conditions of kapha and vata, cough, asthma, rheumatism, cephalalgia, nostalagia, consumption, fever, otopathy, neuropathy and cuts and wounds.[3] Taking into consideration of the medicinal importance of this plant, the ethanol extract of leaves of *M. serratulum* were analysed for the first time using GC-MS. This work will help to identify the compounds of therapeutic value. A majority of the rich diversity of southern region of western ghats Tamilnadu medicinal plants are yet to be scientifically evaluated for such properties. With this background, the present study was aimed to identify the phytoconstituents present in *M. serratulum* using GC-MS analysis. GC-MS is the best technique to identify the bioactive constituents of long chain hydrocarbons, alcohols, acids esters, alkaloids, steroids, amino acid and nitro compounds.[4]

MATERIALS AND METHODS

Collection of plant sample

The leaves of *Myxopyrum serratulum* A.W. Hill were collected from Pechiparai, Kanyakumari District, Tamil Nadu. With the help of local flora, the specimens were identified and preserved in the Ethnopharmacology Unit, Research Department of Botany, V.O. Chidambaram College, Tuticorin, Tamil Nadu.

Preparation of plant extract

The leaves of *Myxopyrum serratulum* were cleaned, shade dried and pulverized to powder in a mechanical grinder. Required quantity of powder was weighed and transferred to stoppered flask, and treated with ethanol until the powder is fully immersed. The flask was shaken every hour for the firsts 6 hours and then it was kept aside and again shaken after 24 hours. This process was repeated for 3 days and then the extract was filtered. The extract was collected and evaporated to dryness by using vacuum distillation unit. The final residue thus obtained was then subjected to GC-MS analysis.

GC-MS Analysis

GC-MS analysis of ethanol extract was performed with GC clarus 500 Perkin Elmer system and Gas chromatograph interfaced to a Mass spectrometer (GC-MS) equipped with a Elite – 1 fused silica capillary column (30 mm x 0.25 mm 1D x 1 um df, composed of 100% Dimethyl poly siloxane). For GC-MS detection, and electron ionization system with ionizing energy of 70 eV was used. Helium gas (99.999%) was used as the carrier gas at constant flow rate 1 ml/min and an injection volume of 2 ul was employed (Split ratio of 10:1); Injector temperature 2500C; ion-source temperature 2800C. The oven temperature was programmed from 1100 C (isothermal for 2 min) with an increase of 100C/min, to 2000C, then 50C/min to 2800C, ending with a 9 min isothermal at 2800C. Mass spectra were taken at 70 eV, a scan interval of 0.5 seconds and fragments from 45 to 450 Da. Total GC running time was 36 minutes. The relative % amount of each component was calculated by comparing its average

peak area to the total areas, software adopted to handle mass spectra and chromatograms was a turbomass.

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

The results pertaining to GC-MS analysis led to the identification of number of compounds from the GC fraction of the ethanol extract of *Myxopyrum serratulum* leaf. These compounds were identified through mass spectrometry attached with GC. The compounds present in the ethanol extract of *Myxopyrum serratulum* leaf identified by GC-MS analysis are shown in Figure 1. The active principles with their retention time (RT), molecular formula, molecular weight, (MW), and concentration (%), in the ethanol extract of *M. serratulum* leaf are presented in table 1. The prevailing compounds in ethanol extract were 2-Propenoic acid, 3-(4-methoxy phenyl)- (47.02), 1-(2-Hydroxy-ethyl)-2-methyl-1H-benzoimidazole-5-carboxylic acid methyl ester (16.38), n-Hexadecanoic acid (5.21), Isoquinoline, 1,2,3,4-tetrahydro-1-ally1-6,7-dimethoxy-3,3-dimethyl- (5.15), Phytol (3.45), 3,7,11,15-Tetramethyl-2-hexadecen-1-ol (3.34), Ethyl α-d-glucopyranoside (3.02), Pyrazolidine-3,5-dione, 4-phenyl- (2.88), Hexadecanoic acid, ethyl ester (2.83), 1H-Indol-4-ol (2.55), 9,12-Octadecadienoic acid (z,z)- (1.72), 4-((1E)-3-Hydroxy-1-propenyl)-2-methoxyphenol (1.32), Oleic acid (1.12) respectively. Figure 2,3,4,5,6,7 and 8 show the mass spectrum and structures of (3-Nitrophenyl) methanol, isopropyl ether, Pyrazolidine-3,5-dione, 4-phenyl-, 1-(2-Hydroxy-ethyl)-2-methyl-1H-benzoimidazole-5-carboxylic acid methyl ester, Phytol, Linoleic acid ethyl ester, Stigmast-4-en-3-one, Table 2 lists the major phytocomponents and their biological activities obtained through the GC-MS study of *Myxopyrum serratulum* leaf.

Among the identified phytochemicals, 9,12-octadecadienoic acid (z, z) have the property of anti inflammatory and antiarthritic as reported by the earlier workers.[5,6,7] n-Hexadecanoic have the property of antioxidant and antibacterial activty.[8] n-Hexadecanoic acid has shown cytotoxicity to human leukemic cells, MOLT-4 and also showed *in vivo* antitumor activity in mice.[9,10] Biological screening tests showed that 2-propenoic acid, 3-(4-methoxypheneyl)- have significant activity against different bacteria and fungi.[11] 4-((1E)-3-Hydroxy-1-propenyl)-2-methoxyphenol, was used as antimicrobial agents.[12] Pyrazolidine-3, 5-dione derivative has been developed as anti inflammatory and antibacterial agents.[13] Oleic acid may hinder the progression of adreno leuko dystrophy (ALD), a fatal disease that affects the brain and adrenal glands.[14] Oleic acid also keeps cell membranes soft and fluid allowing helpful antiinflammatory substances like omega-3 fatty acid to penetrate the cell membrane move easily and preventing the negative effects of bad cholestrol.[15] Phytol is detected in *Myxopyrum serratulum* leaf which was also found to be effective in different stages of arthritis. It was found to five good as well as preventive and therapeutic results against arthritis. The results show that reactive oxygen species promoting substances such as phytol constitute of promessing novel class of pharmaceuticals for the treatment of rheumatoid arthritis and possibly chronic inflammatory disease.[16]

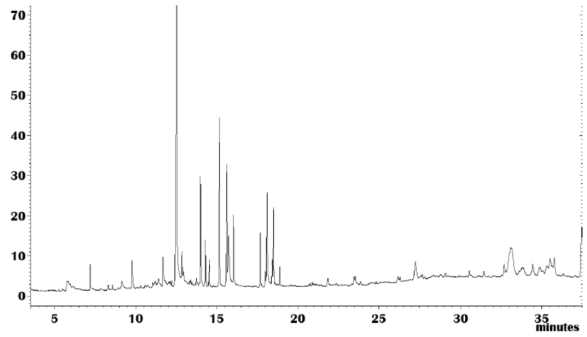

Figure 1: GC-MS chromatogram of the ethanol extract of *M. serratulum* leaf

Mass Spectrum of *Myxopyrum serratulum* leaf

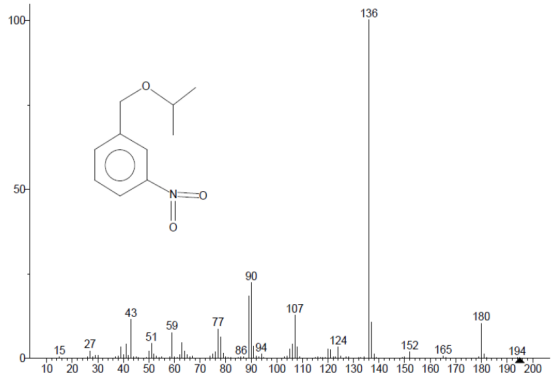

Figure 2: (3-Nitrophenyl) methanol, isopropyl ether

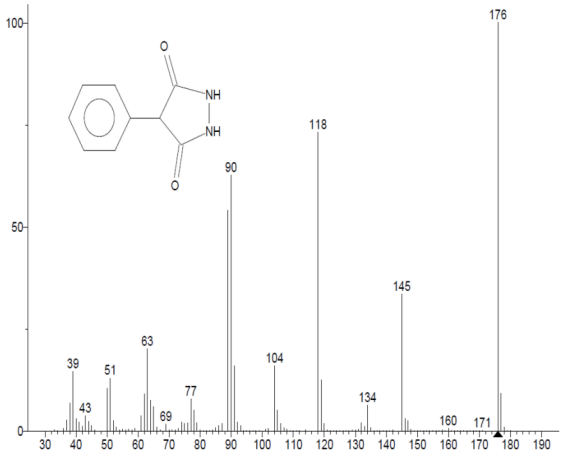

Figure 3: Pyrazolidine-3,5-dione, 4-phenyl-

Table 1: Components detected in *M. serratulum* leaf

No.	RT	Name of the compound	Molecular Formulae	Molecular Weight	Peak Area %
1.	5.80	5-Hydroxymethylfurfural	C6H6O3	126	0.72
2.	7.18	1H-Indol-4-ol	C8H7NO	133	2.55
3.	8.32	2-Furanmethanol, 5-ethenyltetrahydro-α,α,5-trimethyl-, cis-	C10H18O2	170	0.13
4.	9.15	(3-Nitrophenyl) methanol, isopropyl ether	C10H13NO3	195	0.29
5.	9.81	Pyrazolidine-3,5-dione, 4-phenyl-	C9H8N2O2	176	2.88
6.	11.69	Ethyl α-d-glucopyranoside	C8H16O6	208	3.02
7.	12.51	2-Propenoic acid, 3-(4-methoxyphenyl)-	C10H10O3	178	47.02
8.	12.84	4-((1E)-3-Hydroxy-1-propenyl)-2-methoxyphenol	C10H12O3	180	1.32
9.	13.99	3,7,11,15-Tetramethyl-2-hexadecen-1-ol	C20H40O	296	3.34
10.	14.55	Phytol, acetate	C22H42O2	338	0.91
11.	15.16	1-(2-Hydroxy-ethyl)-2-methyl-1H-benzoimidazole-5-carboxylic acid methyl ester	C12H14N2O3	234	16.38
12.	15.60	n-Hexadecanoic acid	C16H32O2	256	5.21
13.	15.73	Isoquinoline, 1,2,3,4-tetrahydro-1-allyl-6,7-dimethoxy-3,3-dimethyl-	C16H23NO2	261	5.15
14.	16.03	Hexadecanoic acid, ethyl ester	C18H36O2	284	2.83
15.	17.68	Phytol	C20H40O	296	3.45
16.	18.09	9,12-Octadecadienoic acid (Z,Z)-	C18H32O2	280	1.72
17.	18.41	Linoleic acid ethyl ester	C20H36O2	308	0.41
18.	18.50	Oleic Acid	C18H34O2	282	1.12
19.	18.89	Octadecanoic acid, ethyl ester	C20H40O2	312	0.82
20.	21.86	Eicosanoic acid	C20H40O2	312	0.04
21.	27.23	Stigmast-4-en-3-one	C29H48O	412	0.57
22.	32.94	dl-α-Tocopherol	C29H50O2	430	0.08
23.	34.45	2,2,4-Trimethyl-3-(3,8,12,16-tetramethyl-heptadeca-3,7,11,15-tetraenyl)-cyclohexanol	C30H52O	428	0.00
24.	35.51	9,10-Secocholesta-5,7,10(19)-triene-3,25,26-triol, (3β,5Z,7E)-	C27H44O3	416	0.03

Table 2: Activity of phytocomponents identified in the ethanol extract of *M. serratulum* leaf

No.	Name of the compound	Compound Nature	**Activity
1.	5-Hydroxymethylfurfural	Aldehyde	Antimicrobial; Anti-inflammatory
2.	1H-Indol-4-ol	Alkaloid	Antimicrobial; Anti-inflammatory
3.	2-Furanmethanol, 5-ethenyltetrahydro-α,α,5-trimethyl-, cis-	Furan compound	No activity reported
4.	(3-Nitrophenyl) methanol, isopropyl ether	Nitrogen compound	Antimicrobial
5.	Pyrazolidine-3,5-dione, 4-phenyl-	Alkaloid	Antimicrobial; Anti-inflammatory
6.	Ethyl α-d-glucopyranoside	Sugar moiety	Preservative
7.	2-Propenoic acid, 3-(4-methoxyphenyl)-	Aromatic compound	Antimicrobial
8.	4-((1E)-3-Hydroxy-1-propenyl)-2-methoxyphenol	Phenolic compound	Antimicrobial; Anti-inflammatory, Antioxidant; Analgesic
9.	3,7,11,15-Tetramethyl-2-hexadecen-1-ol	Terpene alcohol	Antimicrobial; Anti-inflammatory
1(	Phytol, acetate	Diterpene compound	Antimicrobial; Anti-inflammatory, Anticancer; Diuretic
1:	1-(2-Hydroxy-ethyl)-2-methyl-1H-benzoimidazole-5-carboxylic acid methyl ester	Nitrogen compound	Antimicrobial

1	n-Hexadecanoic acid		Antioxidant; Hypocholesterolemic, Nematicide; Pesticide, Lubricant; Antiandrogenic, Flavor; Hemolytic
1	Isoquinoline, 1,2,3,4-tetrahydro-1-allyl-6,7-dimethoxy-3,3-dimethyl-	Alkaloid	Antimicrobial; Anti-inflammatory
1	Hexadecanoic acid, ethyl ester		Antioxidant; Hypocholesterolemic Nematicide; Pesticide, Lubricant; Antiandrogenic Flavor; Hemolytic
1	Phytol	Diterpene	Antimicrobial; Anti-inflammatory, Anticancer; Diuretic
1	9,12-Octadecadienoic acid (Z,Z)-	Linoleic acid	Antiinflammatory, Hypocholesterolemic Cancer preventive, Hepatoprotective, Nematicide Insectifuge, Antihistaminic Antieczemic, Antiacne, 5-Alpha reductase inhibitor Antiandrogenic, Antiarthritic, Anticoronary, Insectifuge
1	Linoleic acid ethyl ester	Linoleic acid ethyl ester	Antiinflammatory, Hypocholesterolemic Cancer preventive, Hepatoprotective, Nematicide Insectifuge, Antihistaminic, Antieczemic, Antiacne, 5-Alpha reductase inhibitor Antiandrogenic, Antiarthritic, Anticoronary, Insectifuge
1	Oleic Acid	Oleic acid	Cancer preventive, Flavor, Hypocholesterolemic 5-Alpha reductase inhibitor, Antiandrogenic Perfumery, Insectifuge, Anti-inflammatory Anemiagenic, Dermatitigenic, Choleretic
1	Octadecanoic acid, ethyl ester	Stearic acid ester	No activity reported
2	Eicosanoic acid	Saturated fatty acid	No activity reported
2	Stigmast-4-en-3-one	Steroid	Antimicrobial, Anti-inflammatory, Anticancer Antiasthma, Hepatoprotective, Diuretic
2	dl-α-Tocopherol	Vitamin E	Antiageing, Analgesic, Antidiabatic, Antiinflammatory, Antioxidant, Antidermatitic, Antileukemic, Antitumor, Anticancer, Hepatoprotective, Hypocholesterolemic Antiulcerogenic, Vasodilator, Antispasmodic, Antibronchitic, Anticoronary
2	2,2,4-Trimethyl-3-(3,8,12,16-tetramethyl-heptadeca-3,7,11,15-tetraenyl)-cyclohexanol	Cyclic compound	No activity reported
2	9,10-Secocholesta-5,7,10(19)-triene-3,25,26-triol, (3β,5Z,7E)-	Steroids	Antimicrobial, Anti-inflammatory, Anticancer, Antiasthma, Hepatoprotective Diuretic

**Source: Dr. Duke's Phytochemical and Ethnobotanical Databases

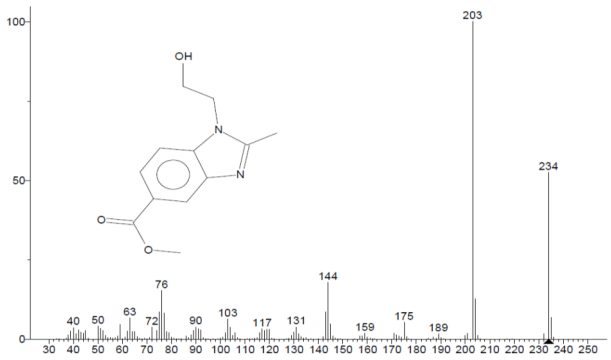

Figure 4: 1-(2-Hydroxy-ethyl)-2-methyl-1H-benzoimidazole-5-carboxylic acid methyl ester

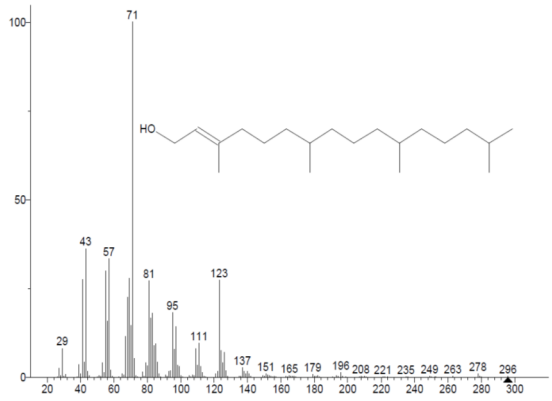

Figure 5: Phytol

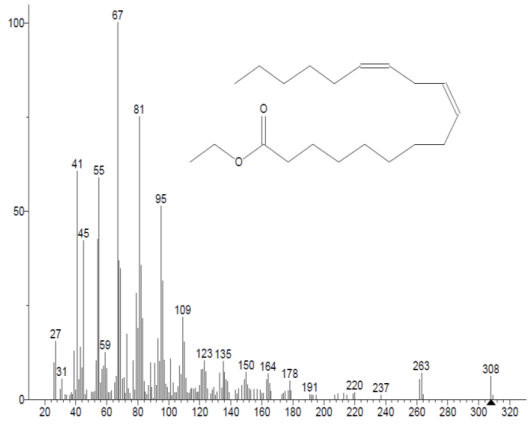

Figure 6: Linoleic acid ethyl ester

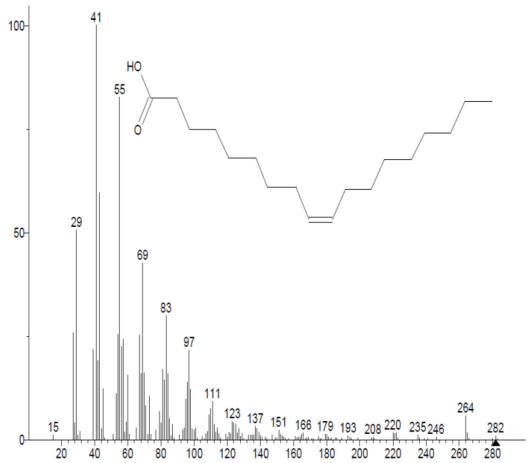

Figure 7: Oleic acid

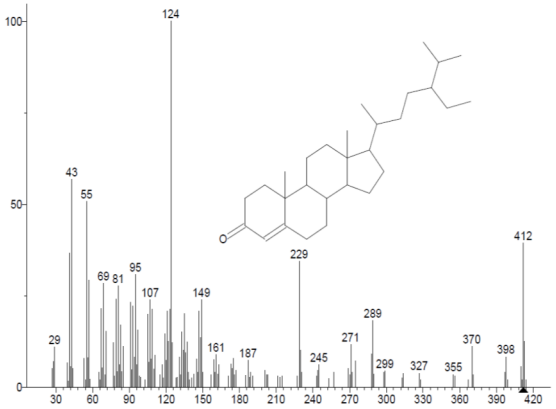

Figure 8: Stigmast-4-en-3-one

CONCLUSION

The presence of various bioactive compounds justifies the use of this plant for various ailments by traditional practitioners. However, isolation of individual phytochemical constituents and subjecting its biological activity will definitely give fruitful results. It could be concluded that *Myxopyrum serratulum* leaf contains various bioactive compounds. So it is recommended as a plant of phytopharmacetical importance. However, further studies are needed to undertake its bioactivity and toxicity profile.

Acknowledgement

We would like to thank Mr. S. Kumaravel, Senior Scientist, Indian Institute of Crop Processing Technology (Ministry of food Processing Industries, Government of India) Tanjavore, Tamilnadu for providing all the facilities and support used to carry out the work.

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Source of Support: Nil, **Conflict of Interest:** None.