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GC-MS Screening of Some Bioactive Compounds from Methanolic Extract of Medicinally Relevant Wild Edible Plant Parts

Mahadkar Shivprasad*[1], Jadhav Varsha[2]
[1]Assistant Professor, Department of Botany Dr. Shantilal Dhanji Devse Arts College, Commerce and Science College, Wada Palghar, Maharashtra, India
[2]Associate Professor, Department of Botany Shivaji University Kolhapur, Maharashtra, India

ABSTRACT

In present study the bioactive compounds from methanolic extract of Oroxylum indicum (L.) Vent, Zanthoxylum rhetsa (Roxb.) DC, Ensete Superbum (Roxb.) Cheesuran, Woodfordia fruticosa (L.) Kurz and Smilax zeylanica L. were evaluated by using GC-MS method. The GC-MS analysis of the methanolic extract revealed that presence of many similar major compound like Hexadecanoic acid- methyl ester, 9-Octadecynoic acid- methyl ester, n-Hexadecanoic acid, 9,12-Octadecadienoic acid- methyl ester and Pentadecanoic acid. Majority of the compounds were belonging to acid group. Common compound in all these plants was hexadecanoic acid.

Keywords : Bioactive Compounds, GCMS analysis, Wild Edible Plants.

I. INTRODUCTION

Wild edible plants having duel significance. They have edible as well as medicinal value. Wild edible plants considered as one of the main sources of biologically active compounds. Wild edible plants are capable for synthesizing low molecular weight organic compounds called secondary metabolites having unique and complex structures. GC-MS method used for the analysis these active principles in plants which is used in cosmetic, drugs, pharmaceutical or food industries.

Bioactive compounds consist of low-molecular weight compounds that are regarded as not essential for sustaining life, but as crucial for the survival of the producing organism. More than 50,000 structures have been identified in plants through various screening methods. The actual numbers of bioactive compounds in the plant kingdom would exceed 100,000 structures (Mathekaga and Meyer1998, Koperuncholan et. al. 2010, Koperuncholan and Ahmed 2011).

II. MATERIALS AND METHODS

Plant material

The five different plants viz. Ensete superbum (Roxb.) Cheesman, Oroxylum indicum (L.) Vent., Smilax zeylanica L., Woodfordia fruticosa (L.) Kurz. and Zanthoxylum rhetsa (Roxb.) DC. were collected from the Kolhapur district of Maharashtra, India.

Preparation of extract

The Sample of five different plant parts like fruits of Oroxylum indicum and Zanthoxylum rhetsa, flowers of Ensete superbum and Woodfordia fruticosa while leaves of Smilax zeylanica were used for preparation of extract. These plant parts were dried and Pulverized to powder in a mechanical grinder. Required quantity of the plant sample was weighted, transferred to flask, treated with the Methanol until the powder was fully immersed, incubated over night and filtered through a Whatmann No.41 filter paper. Filtrate is then concentrated till dry residue was remained. After weighing the residue, respective amount of methanol was added to make the final solution. Centrifugation was also done if needed in case of non clearance solution. These solutions were further used for GC-MS for analysis.

GC-MS/MS analysis of bioactive compounds from wild plants

The methanolic extract obtained from five wild edible plants were subjected to Gas Chromatography and Mass Spectroscopy for the determination of bioactive volatile compounds. Some of the important features are summarized below.

GC-MS analysis of the samples were carried out using Shimadzu Make QP-2010 with non polar 60 M RTX 5MS Column. Helium was used as the carrier gas and the temperature programming was set with initial oven temperature at 400C and held for 3 min and the final temperature of the oven was 4800C with rate at 100C [min.sup.-1]. A2 µL sample was injected with split less mode. Mass spectra was recorded over 35-650 amu range with electron impact ionization energy 70eV. The total running time for a sample is 45 min. The chemical components from the methanolic extracts of plants were identified by comparing the retention times of chromatographic peaks using Quadra pole detector with NIST Library to relative retention indices. Quantitative determinations were made by relating respective peak areas to TIC areas from the GC-MS.

III. RESULTS AND DISCUSSION

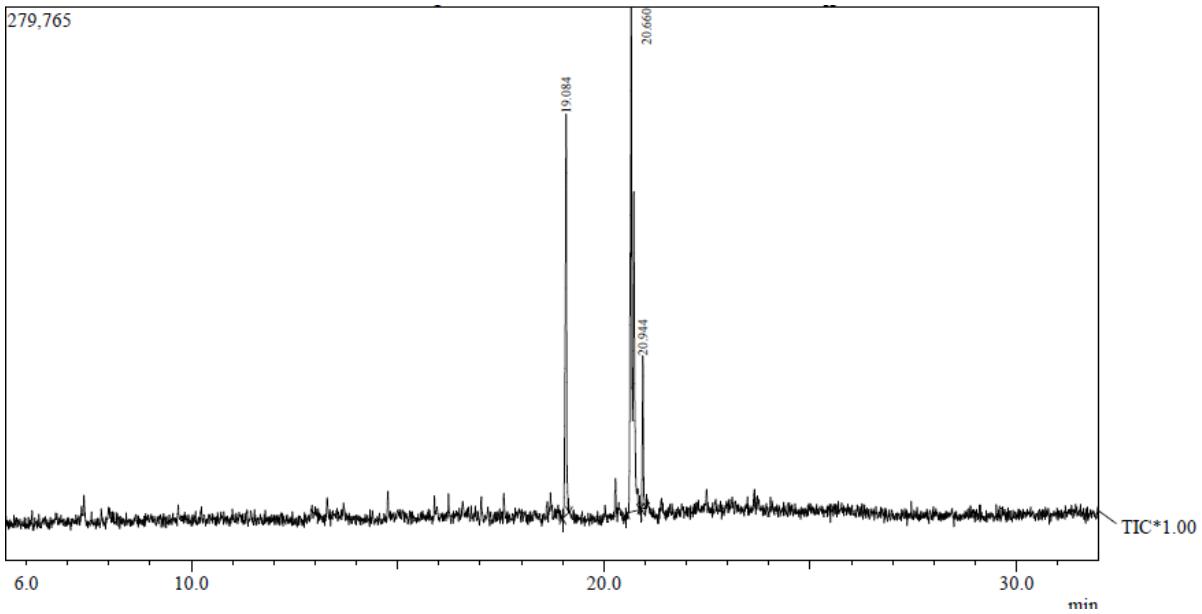

Figure 1. GC-MS chromatogram of methanolic extract of Fruits of Zanthoxylum rhetsa (Roxb.) DC

Lalitharani et al. (2010) carried out GC-MS analysis of ethanolic extract of Zanthoxylum rhetsa (Roxb.) DC. spines. They carried out investigation of ethanolic extract of spines of Z. rhetsa. Through GCMS analysis and detected total 15 compounds (Butane, 1,1 diethoxy-; Pentane, 1,1-diethoxy-; Hexanoic acid, ethyl ester; Propane, 1,1,3-triethoxy-; Hexadecanoic acid, ethyl ester; 3-Buten-2-one, 4-(2,6,6- trimethyl-1-cyclohexen-1-yl); Dodecanoic acid; Azulene, 1,4-dimethyl-7-(1-methylethyl)-; Tetradecanoic acid; 1,2- Benzenedicarboxylic acid,butyl octyl ester; n-Hexadecanoic acid; 9,12-Octadecadienoic acid(Z,Z)-; Oleic Acid; Octadecanoic acid, 2-hydroxy-1,3-propanediyl ester; 1, 2- Benzenedicarboxylic acid, diisooctyl ester). In present GCMS analysis methanolic extract offruits of Z. rhetsa showed 3 chemical compounds namely- n-Hexadecanoic acid; 9,12-Octadecadienoic acid, methyl ester, (E,E)- and Octadecanoic acid, 2-(2-hydroxyethoxy)ethyl
ester. Some of the compounds found in both work were same.

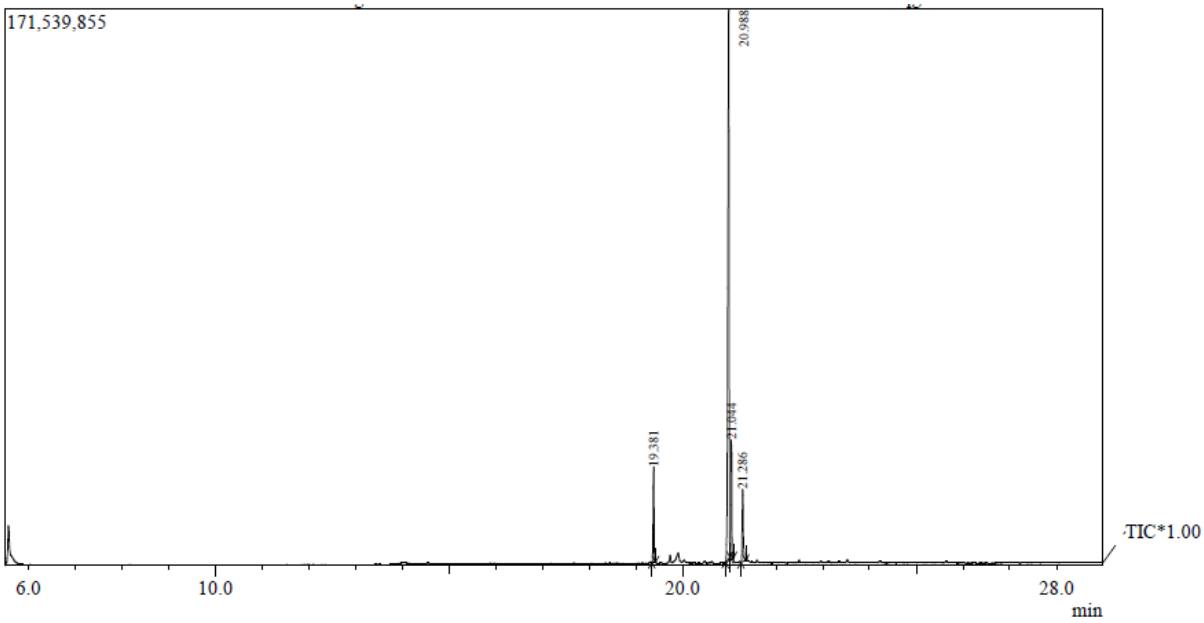

Figure 2. GC-MS chromatogram of methanolic extract of Fruits of Oroxylum indicum (L.) Vent.

D'Mello et al. (2012) have done investigation and quantification of phytoconstituents from O. indicum bark by GC-Mass and HPLC techniques. They determined composition of phytoconstituents terpenoids by GC and GC-Mass technique. GC-Mass result of petroleum ether extract showed presence of eucalyptol, terpineol, anethole, myrcene, terpinene, Rphellandrene, p-cymene, γ-terpenine, ocimene, δ-2-carene, p-copaene, p-cymene-8-ol, caryophyllene, limonene, decenol, α Pinene, valencene and dichloromethane extract showed presence of α copaene, β elemene, α, β caryophyllene, germacrene-D, α-cadinene, nhexacosane. In present study GCMS analysis of methanolic extract of fruits of O. indicum showed presence of Hexadecanoic acid; methyl ester; 9-Octadecynoic acid, methyl ester; 9- Octadecenoic acid, methyl ester, (E)-; Octadecanoic acid, methyl ester, respectively. Earlier authors analysed different compound in O. indicum bark and candidate identified same compound from fruit.

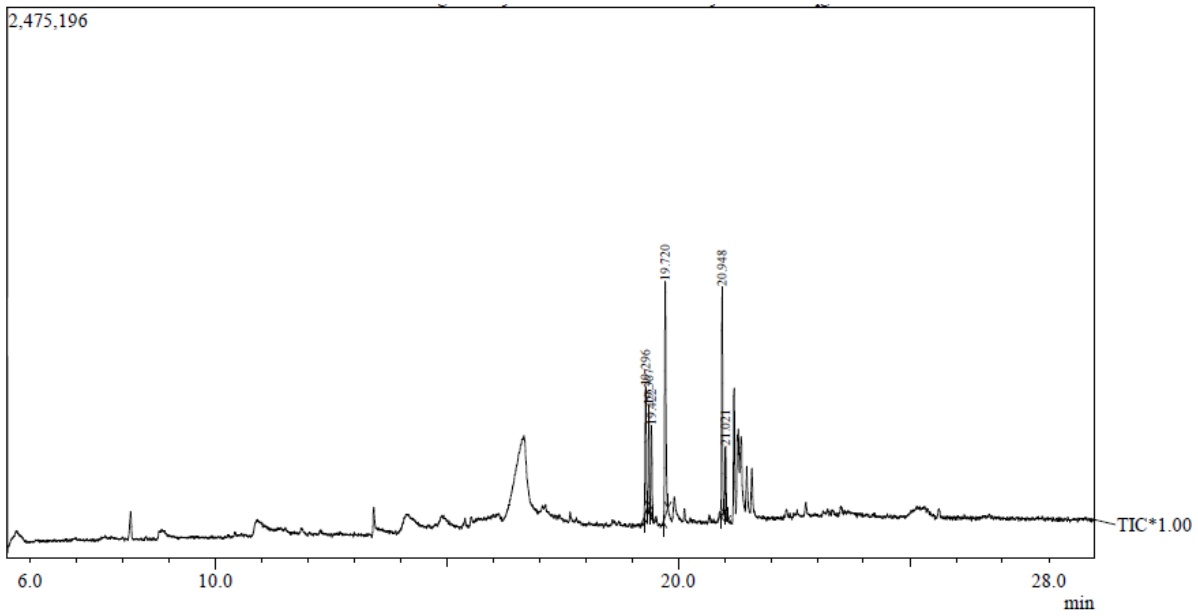

Figure 3. GC-MS chromatogram of methanolic extract of leaves of Smilax zeylanica L.

Zubair et al. (2013) carried out GC/MS profiling, in vitro antioxidant, antimicrobial and haemolytic activities of Smilax macrophylla leaves. They determined antimicrobial activity, antioxidant activity (total phenolic content, total flavonoids content, DPPH free radical scavenging activity) and n-hexane factors through GCMS. Through GCMS analysis they identified total 38 chemical compounds namely- 3-Methyl-1-pentene; 3-Methyl pentane; 2-Nitrobutane; 3,4-Dimethylpentane; 2,2-Dimethylpentane; 2,4-Dimethylpentane; 2,3- Trimethylbutane; 2,3-Dimethylpentane; 2,4-Dimethylhexane; 2,3,3-Trimethylbutane; 3,4- Dimethylhexane; 1,2,4-Trimethylcyclopentane; 2,3,4-Tetramethylpentane; 2,4,6- Trimethylheptane; 3-Ethyl-2,5-dimethylhexane; 2,6-Dimethyloctane; n-Decane; 5-Ethyl-4- methyl-3-heptanone; 5-Ethyl-4-methyl-3-heptanone; 3-Methyltridecane; 11, 14, 17- Eicosatrienoic acid, methyl ester; Heneicosane; Trans-Phytol; 9,12-Octadecadienoic acid (Z,Z); (6Z)-6-Octadecadienoic acid; Alpha-Tocopherol-beta-D-mannoside; Gamma-Sitosterol; n-Hexatriacontane; 1-(+)-Ascorbic acid 2,6-dihexadecanoate. In present work GCMS analysis of methanolic extract of leaves of S. zeylanica showed presence of chemical compounds namely- Hexadecanoic acid, methyl ester; n-Hexadecanoic acid; 9,12- Octadecadienoic acid, methyl ester; 11-Octadecenoic acid, methyl ester, (Z)-.

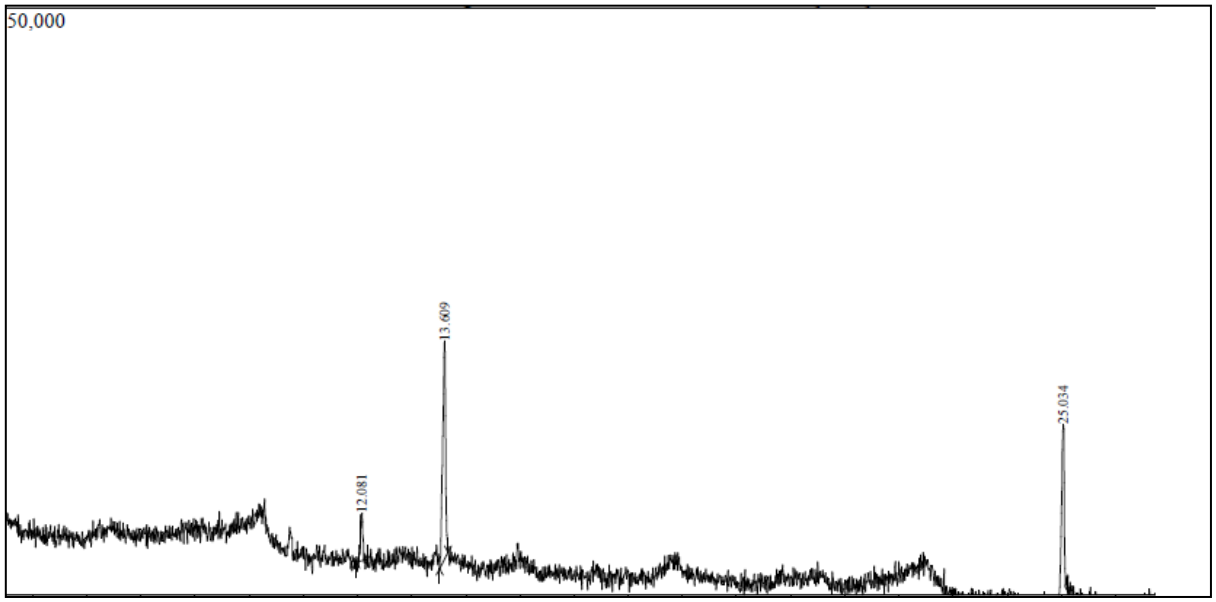

Figure 4. GC-MS chromatogram of methanolic extract of Flowers of Ensete superbum (Roxb.) Cheesman,

Graven et al. (1996) determined structure and molecular composition of the seed coat of the Musaceae. They selected mature seeds of Musa acuminata, M. balbisiana, M.mannii, M. paradisiaca, M. rosacea, M. textilis, M. velutina, Ensete ventricosum, E. glaucum, Musella lasiocarpa and determined macromolecular composition using various microscopic and chromatographic techniques. GCMS analysis of Musa velutina seed coat showed presence of propanedialdehyde; 2,3-butanedione; 2-butanone; 2-methylfuran; 3-methylfuran; acetic acid; 2-butanol cis/trans; hydroxypropane; 2,5-dimethylfuran; but-3-enal-2-one; 3- hydroxypropanal; pyruvic acid; (2H)-furan-3-one; 3-furaldehyde; 4,2-pentadienal; 2- furaldehyde; 1-(acetyloxy) propane-2-one; (5H)-furan-2-one; 2,3-dihydro-5-methylfuran-2- one; 5-methyl-2-furaldehyde; phenol; 2-hydroxy-3-methyl-2-cyclopentene-1-one; 4-methylphenol; 2-methyl-phenol (o-cresol); guaiacol; 2-ethylphenol; 4-methylguaiacol; 1,2 dihydroxybenzene; 4-vinylphenol; guaiacylethane (=4-ethylguaiacol); methyl-1,2- dihydroxybenzene; 4-vinylguaiacol; syringol; guaiacolaldehyde; 4-methylsyringol; 4-(trans- 2-propenyl)guaiacol; 4-butene guaiacol; 4-acetyl guaiacol; methyl 2-isopropylbenzoate; levoglucosan; methyl a-methyl cinnamate; 4-vinylsyringol; methyl b-methyl cinnamate; 2- butanone, 4-(4 hydroxy-3 methoxy phenyl, zingirone; syringylaldehyde; 4-(prop-cis-2-enylsyringol; 4-(prop-trans-2-enyl-) syringol; 4-acetyl syringol; 4-(prop-2-enol) guaiacol; 3-methoxy-4,4-hydroxy stilbene. In present work GCMS analysis of methanolic extract of flowers of Ensete Superbum showed presence of 4H-Pyran-4-one, 2,3-dihydro-3,5- dihydroxy-6-methyl-; 2-Furancarboxaldehyde, 5-(hydroxymethyl)-; Pentadecanoic acid.

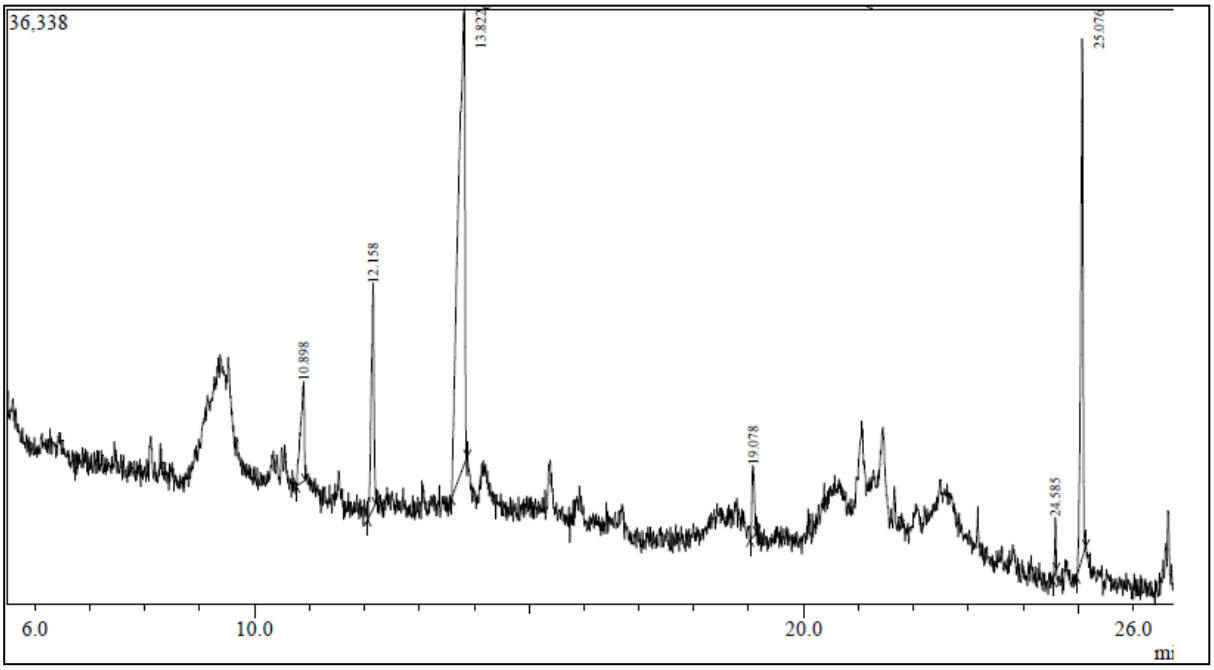

Figure 5. GC-MS chromatogram of methanolic extract of Flowers of Woodfordia fruticosa (L.) Kurz

Grover and Patni (2013) carried out phytochemical characterization using various solvent extracts and GC-MS analysis of methanolic extract of Woodfordia fruticosa (L.) Kurz. leaves. They selected leaves and flowers of W. fruticosa and extracted by using different solvents like ethyl acetate, methanol, benzene, ethanol, chloroform. GCMS analysis of methanolic extract of leaves of W. fruticosa showed Dihydroactinidiolide; Caryophyllene Oxide/Caryophyllene Epoxide; 8,11,14-Eicosatrienoic acid / Homo-gamma-linolenic acid; 10,12-Pentacosadiynoic acid; 6,9,12,15-Docosatetraenoic acid, methyl ester; 1-Cyclohexene- 1-methanol, .alpha.,2,6,6-tetramethyl-; Diisobutyl phthalate; Hexadecanoic acid,15-methyl-, methyl ester; 7,9-Di-tert-butyl-1-oxaspiro(4,5)deca-6,9-diene-2,8-dione; Benzenepropanoic acid / Hydrocinnamic acid/ 3,5-bis(1,1-dimethylethyl)-4-hydroxy-; Dibutyl phthalate/ Butyl phthalate/ Benzene-1,2-dicarboxylic acid di-n-butylester; Eicosanoic acid, ethyl ester/Arachidicacid; Cyclopropaneoctanoic acid, 2-hexyl-, methyl ester; Phytol; 2-Propanol, 1-(2-butoxyethoxy)-; Ethyl Oleate; 9-Octadecenoic acid (Z)-; 2H-1-Benzopyran-2-one; Di-noctyl phthalate; 1,2-Benzenedicarboxylic acid; Benzene,1-[[4-(4- butylcyclohexyl)phenyl]ethynyl]-2,4-dimethyl-; 1-([4-(4-Butylcyclohexyl)phenyl]ethynyl)- 2,4-dimethylbenzene; gamma.-Elemene; (E,E)-7,11,15-Trimethyl-3-methylene-hexadeca- 1,6,10,14-tetraene/β-Springene. In present study GCMS analysis of methanolic extract of flowers of W. fruticosa showed presence of chemical compounds namely- 1,3,5-Triazine-2,4,6-triamine; 4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-; 2- Furancarboxaldehyde, 5-(hydroxymethyl)-; Malonic acid, bis(2-trimethylsilylethyl ester; Pentadecanoic acid, 14-methyl-, methyl ester; Pentadecanoic acid. This study indicates the importance of wild plants and the utility of their bioactive compounds.

Table 1. Analysed bioactive compound from wild edible plants shown in

Sr.No.	Name of the plant	Retention Time	% Area of peak	Compound Analyzed	Molecular formula	Mol. Wt. (In grams)	Functional Group
1.	Zanthoxylum rhetsa (Roxb.) DC. **Family-** Rutaceae **Vernacular name-** Tirphal, Chirphal. **Edible part-** Fruit.	19.084	28.64	n-Hexadecanoic acid	C16H32O_2	256	Acid
		20.660	63.83	9,12-Octadecadienoic acid, methyl ester, (E,E)-	$C_{19}H_{34}O_2$	294	Acid
		20.944	7.53	Octadecanoic acid, 2-(2-hydroxyethoxy)ethyl ester	$C_{22}H_{44}O_4$	372	Acid
2.	Oroxylum indicum (L.) Vent. **Family-** Bignoniaceae. **Vernacular name-** Tetu. **Edible part-** Fruit.	19.381	8.59	Hexadecanoic acid, methyl ester	$C_{17}H_{34}O_2$	270	Acid
		20.988	72.51	9-Octadecynoic acid, methyl ester	$C_{19}H_{34}O_2$	294	Acid
		21.044	10.50	9-Octadecenoic acid, methyl ester, (E)-	$C_{19}H_{36}O_2$	296	Acid
		21.286	8.40	Octadecanoic acid, methyl ester	$C_{19}H_{38}O_2$	298	Acid
3.	Smilax zeylanica L. **Family-** Smilacaceae. **Vernacular name-** Chopchini, Ghotvel. **Edible part-** Leaves.	19.367	10.57	Hexadecanoic acid, methyl ester	$C_{17}H_{34}O_2$	270	Acid
		19.422	10.30	n-Hexadecanoic acid	$C_{16}H_{32}O_2$	256	Acid
		20.948	24.01	9,12-Octadecadienoic acid, methyl ester	$C_{19}H_{34}O_2$	294	Acid
		21.021	7.09	11-Octadecenoic acid, methyl ester, (Z)-	$C_{19}H_{36}O_2$	296	Acid
4.	Ensete Superbum (Roxb.) Cheesuran. **Family-** Musaceae. **Vernacular name-** Ran-keli, Chaveli-keli. **Edible part-** Flower.	12.081	7.86	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-	$C_6H_8O_4$	144	Hydroxy or Corbonyl
		13.609	49.92	2-Furancarboxaldehyde, 5-(hydroxymethyl)-	$C_6H_6O_3$	126	Hydroxy or Corbonyl
		25.034	42.22	Pentadecanoic acid	$C_{15}H_{30}O_2$	242	Acid
5.	Woodfordia fruticosa (L.) Kurz. **Family-** Lytharaceae. **Vernacular name-** Dhayati. **Edible part-** Flower.	10.898	6.88	1,3,5-Triazine-2,4,6-triamine	$C_3H_6N_6$	126	Amine
		12.158	11.18	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-	$C_6H_8O_4$	144	Hydroxy or Corbonyl
		13.822	56.15	2-Furancarboxaldehyde, 5-(hydroxymethyl)-	$C_6H_6O_3$	126	Hydroxy or Corbonyl
		19.078	3.05	Malonic acid, bis(2-trimethylsilylethyl ester	$C_{13}H_{28}O_4Si_2$	304	Acid
		24.585	1.18	Pentadecanoic acid, 14-methyl-, methyl ester	$C_{17}H_{34}O_2$	270	Acid
		25.076	21.57	Pentadecanoic acid	$C_{15}H_{30}O_2$	242	Acid

IV. CONCLUSION

All the studied wild edible plant parts, many compounds were detected, which were rich in bioactive volatile compounds. Among these volatile compounds some are represents functional group of hydroxy, acetyl, carbonyl, acid, hydrocarbon, siloxane, acetate and amine. The major compounds noticed were Hexadecanoic acid, methyl ester; n-Hexadecanoic acid; 9,12-Octadecadienoic acid, methyl ester; Octadecanoic acid; Octadecanoic acid, 2-(2-hydroxyethoxy)ethyl ester; 2-Furancarboxaldehyde, 5-(hydroxymethyl)-; 4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-; Pentadecanoic acid.

Hence, the presence of some of the important bioactive volatile compounds will certainly prove the use of extract of selected wild edible plant parts for the preparation of soaps, shampoos, shaving cream cosmetics, oil paints, varnishes, detergent, grease, household products (dispersing and thickening agent), rubber molding lubricant (anti-tack agent). Because of the presence of such volatile compounds in selected parts of wild edible plant, these may be highly demanded in the pharmaceutical and food industries.

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