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Research Article

GC-MS analysis of ethanolic extract of *Momordica charantia* fruit

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Abstract

Researchers are particularly interested in medicinal plants because most pharmaceutical businesses use them to make pharmaceutical compounds. Traditionally, especially in India, a large number of compounds utilized as food colors, tastes, perfumes, and medicinal biochemicals are obtained from plants. Most herbal treatments and their derivative products were often made from crude plant extracts, which are a complex mixture of various phytochemical constituents (plant secondary metabolites). The chemical properties of these components differ greatly between species. The GC-MS method employed for the study of the extracted materials is an interesting instrument for figuring out the concentration of specific active principles in herbs used in the food, pharmaceutical, cosmetic, or pharmaceutical industries. The aim of this work was to discover bioactive compounds from the ethanolic fruit extract of *Momordica charantia* using gas chromatography and mass spectrometry (GC-MS). The GCMS-QP2010 Ultra Version was used to perform GCMS analysis of the ethanolic extract in accordance with standard procedure. The findings demonstrated the presence of various 32 phytochemicals, including heptacosanoic acid, Eicosanoic acid,Eicosanoic acid, Undecanoic acid, docanoic acid, decanal, 1-(Pyrrolidin-3-yl) pyrazole, Tricotanoic acid in the ethanolic extract of *M. charantia*. Because of the ethanolic extract contains secondary metabolites, the *M. charantia* may have anti-inflammatory, Antifungal, neurological disorders, anti-tumor, anti-microbial, antioxidant, and antidiabetic properties. These results support the traditional use of *M. charantia* for a number of ailments. Further research is needed to determine the extract's active ingredient and elucidate its exact method of action in a range of ailments.

Keywords: 1-(Pyrrolidin-3-yl) pyrazole, *M. charantia*, Heptacosanoic acid, Eicosanoic acid, Decanal

INTRODUCTION

Momordica charantia Linn. Bitter melon, often called bitter gourd or karela, is a member of the Cucurbitaceae family. It grows in tropical regions of Asia, East Africa, and the Caribbean [1]. The fruit has surface warts and is oblong or spindle in shape [2]. Dysmenorrhea, piles, rheumatism, pneumonia, gout, jaundice, eczema, and psoriasis are among the conditions it is used to treat [3,4,5]. The plant is used to treat several illnesses, including diabetes, anthelmintics, laxatives, and digestive disorders. Extraction is the primary technique used to extract and separate bioactive phytochemicals from plant sources prior to component analysis [6]. Because of this, medicinal plants are now a significant source of pharmaceuticals and account for around 25% of prescriptions. The World Health Organization believes that traditional medicine will continue to play a major part in the healthcare system because over 80% of people in third-world countries rely on it. The likelihood of medicinal plants going extinct is higher. Therefore, identifying the active principles in medicinal plants is necessary for the scientific validation of traditional medicinal plants or the identification of lead compounds for use as therapeutic medicines [7]. The concentration of specific active principles in herbs used in food, medicine, cosmetics, environmental, and forensic applications can be ascertained using the GC-MS technique used for the analysis of the produced extracts. It integrates two analytical methods into one for the analysis of chemical compound mixtures. Mass spectroscopy examines each component independently, whereas gas chromatography separates the constituents of a mixture. According to chemical analyses, phenolics, flavonoids, alkaloids, terpenoids, saponin, tannin, and volatile components are its primary elements [8].

MATERIALS AND METHODS

Collection and identification of plant material

Fresh fruits of *Momordica charantia* L fruits were harvested from local area of Prayagraj, U.P., India. The Botanical Survey of India (BSI), Prayagraj, recognized and verified the plant material with Authentication No. 2023-24/100.

Sample preparation

A soxhlet extracter was used to extract 100 g of dried plant powder in 500 ml of ethanol until a clear, colorless solvent was obtained. The extracted substance was stored in an airtight container and dried by evaporation for subsequent use. *Momordica charantia* fruit extract was analyzed by gas chromatography-mass spectroscopy (GC-MS) using the Thermo GCMS-QP2010 Ultra, which features a DB 35 – MS Capillary Standard non-polar column with dimensions of 30 mm×0.25 mm ID×0.25 µm films. The carrier gas, helium, is used at a slow pace of 1.0 ml/min. After five minutes at 70 °C, the oven's temperature was gradually increased to 310 °C after ten minutes. At 280 °C, the injector was operating. Component identification was based on comparing the retention indices of NIST libraries. The components were identified and the results were tallied after a comparison with those in the computer library (NIST) attached to the GC-MS apparatus [9].

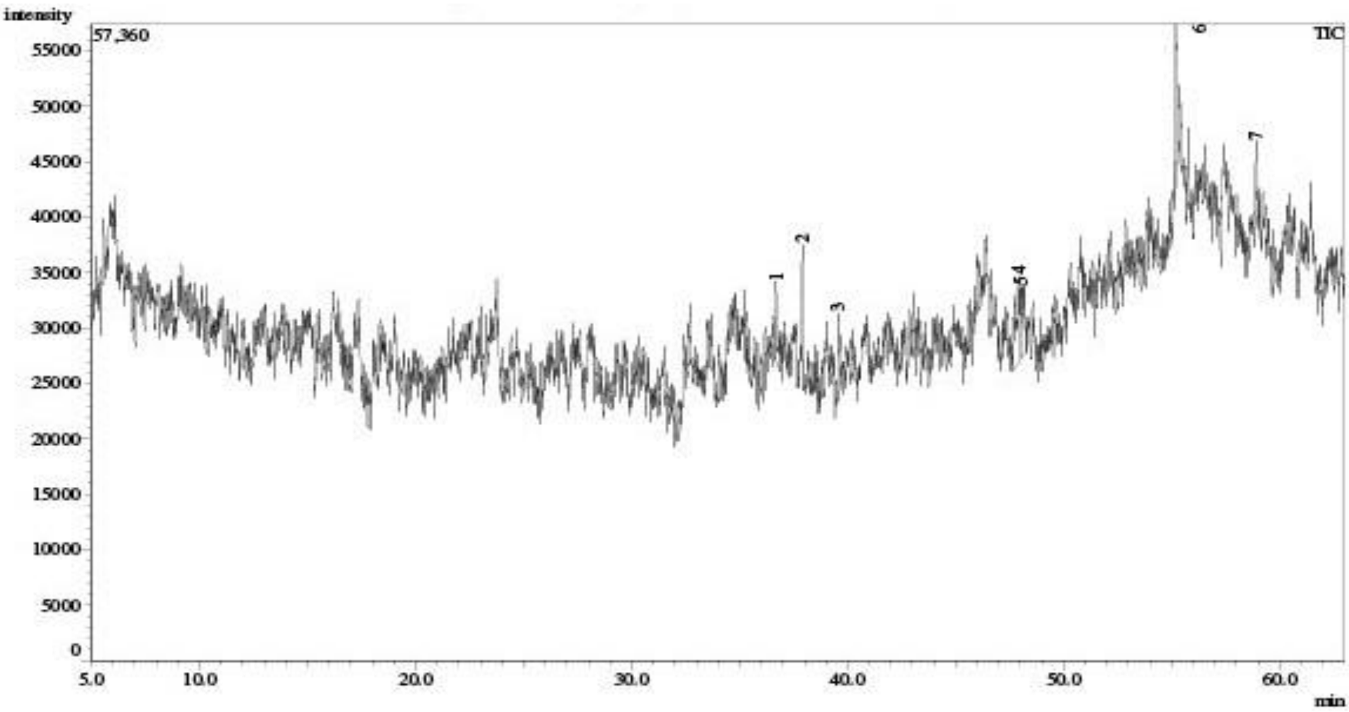
RESULTS AND DISCUSSION

The analysis and extraction of plant material play an essential role in the development, modernization and quality control of herbal compositions. Understanding plant toxicity and protecting humans and animals from natural poisons are two more benefits of studying medicinal plants. Therefore, using gas chromatography and mass spectroscopy, the current study was conducted to identify the bioactive chemicals contained in the ethanolic extract of *Momordica charantia*. Table 1 and Fig. 1, 2 provide the active principles together with their retention time (RT), molecular formula, molecular weight (MW), and concentration (peak area%). The ethanolic extract of *Momordica charantia* contains 32 phytochemical components. Figure 2 displayed the GC-Mass spectra of the discovered chemicals from *Momordica charantia*. Among the found bioactive phytocompounds, heptacanoic acid, Docosanoic acid, Tridecanoic acid, ethyl tridecanoate, undecanoic acid, Levomenthol, decanal, 1-Hexanol,5-methyl-2-(1-methylethyl)-, 1-(pyrrolidin-3-yl) pyrazole, Bicyclo[2.2.1] heptan-2-one,4,7,7-trimethyl-, isomyocorene and 1-Cyclohexene-1-methanol have anticancer, anti-inflammatory, antifungal, antibacterial activity [1]; antifungal [[11]; anticonvulsant, antioxidant, Antimicrobials [12]; antimicrobial; topical antifungal [13]; topical analgesic and respiratory infection [1]; antifungal, skin protection; anti-microbial [15]; alpha-glucosidase inhibitors, neurodegenerative disorders, immunological disorders [16]; hypoglycemic, antiseptic , analgesic [17]; antioxidant, antimicrobial activity [18]; antitumor, antiepileptic, antimicrobial, antifungal activites [19, 20]respectively. Due to the presence of above stated chemicals in the fruit ethanolic extract of *Momordica charantia* may be used in different therapeutic applications.

Table 1 GC-MS spectral analysis of ethanoilc fruit extract of *Momordica charantia*

Peak	RT (Min)	Name of Compound	Molecular Formula	Mol. Wt.	Peak area %	A/H
1.	36.675	Heptacosanoic acid, methyl ester	$C_{28}H_{56}0_2$	424	13.08	6.52
2.		Eicosanoic acid, methyl ester	$C_{21}H_{42}0_2$	326		
3.		Docosanoic acid, methyl ester	$C_{23}H_{46}0_2$	354		
4.		Tridecasanoic acid, methyl ester	$C_{14}H_{28}0_2$	228		
5.		Triacontanoic acid, methyl ester	$C_{31}H_{62}0_2$	466		
6.	37.892	Ethyl tridecanoate	$C_{15}H_{30}0_2$	242	9.69	3.26
7.		Docosanoic acid, ethyl ester	$C_{24}H_{48}0_2$	368		
8.		Undecanoic acid, ethyl ester	$C_{13}H_{26}0_2$	214		
9.		Octadecanoic acid, ethyl ester	$C_{20}H_{40}0_2$	312		
10.		Eicosanoic acid, ethyl ester	$C_{22}H_{44}0_2$	340		
11.	39.600	Octadecanoic acid, 2-(dimethylamino) ethyl ester	$C_{22}H_{45}NO_2$	355	12.60	6.24
12.		S-[2-[N,N Dimethylamino] ethyl] N,N dimethylcarbamoyl thiocarbohydroximate	$C_8H_{17}N_3O_2S$	219		
13.		4-Methylpentyl S-2-(dimethylamino) ethyl propylphosphonothiolate	$C_{13}H_{30}NO_2PS$	295		
14.		Dimethylaminoethyl palmitate	$C_{20}H_{41}NO_2$	327		
15.		[2-(Benzo[4,5]thiazolo[2,3-c][1,2,4]triazol-3-ylsulfanyl)ethyl](dimethyl)amine	$C_{12}H_{14}N_4S_2$	278		
16.	47.908	Decanal	$C_{10}H_{20}O$	156	20.38	9.35

17.		1-Hexanol,5-methyl-2-(1-methylethyl)-	$C_{10}H_{22}O$	158		
18.	48.075	1,4-Hexadiene,3,3,5-trimethyl-	C_9H_{16}	124	14.29	8.31
19.		Bicyclo[2.2.1]heptan-2-one,4,7,7-trimethyl-	$C_{10}H_{16}O$	152		
20.		1-(Pyrrolidin-3-yl) pyrazole	$C_7H_{11}N_3$	137		
21.		2-Octene, 2-methyl-6-methylene-	$C_{10}H_{18}$	138		
22.		Cycloprapane,1,1-dimethyl-2-(2-methyl-2-propenyl)-	C_9H_{16}	124		
23.	55.192	1,3,7-Octatriene,2,7-dimethyl-	$C_{10}H_{16}$	136	21.86	5.33
24.		Butane, 1-chloro-4-(methylenecyclopropyl)-	$C_8H_{13}Cl$	144		
25.		Furosolidagonone	$C_{20}H_{28}O_2$	300		
26.		2,3-Diazabicyclo[2.2.1]hept-2-ene,4-methyl-1-(pent-4-en-1-yl)	$C_{11}H_{18}N_2$	178		
27.		Isomyocorene	$C_{10}H_{16}$	136		
28.	58.908	7,7-Dimethyl-bicyclo[2.2.1]teptan-2-ol	$C_9H_{16}O$	140	8.10	4.10
29.		(5-Methylcyclopent-1-enyl)methanol	$C_7H_{12}O$	112		
30.		1-Cyclohexene-1-methanol	$C_7H_{12}O$	112		
31.		Cyclopropane, 1,1-dibromo-2-hexyl-	$C_9H_{16}Br_2$	282		
32.		Levomenthol	$C_{10}H_{20}O$	156		



Peak Report TIC

Peak#	R.Time	I.Time	F.Time	Area	Area%	Height	Height%	A/H	Mark	Name
1	36.674	36.617	36.875	46743	13.08	7172	11.83	6.52		Heptacosanoic acid, methyl ester
2	37.903	37.858	37.983	34605	9.69	10609	17.50	3.26		Ethyl tridecanoate
3	39.597	39.517	39.692	45025	12.60	7218	11.91	6.24		Octadecanoic acid, 2-(dimethylamino
4	47.907	47.642	47.925	72792	20.38	7786	12.84	9.35		Decanal
5	48.075	48.050	48.275	51062	14.29	6142	10.13	8.31	V	1,4-Hexadiene, 3,3,5-trimethyl-
6	55.195	55.142	55.283	78090	21.86	14649	24.16	5.33	V	1,3,7-Octatriene, 2,7-dimethyl-
7	58.908	58.858	58.992	28923	8.10	7047	11.62	4.10		7,7-Dimethyl-bicyclo[2.2.1]heptan-2-
				357240	100.00	60623	100.00			

Figure 1 GC-MS chromatogram for fruit ethanolic extract of *Momordica charantia*

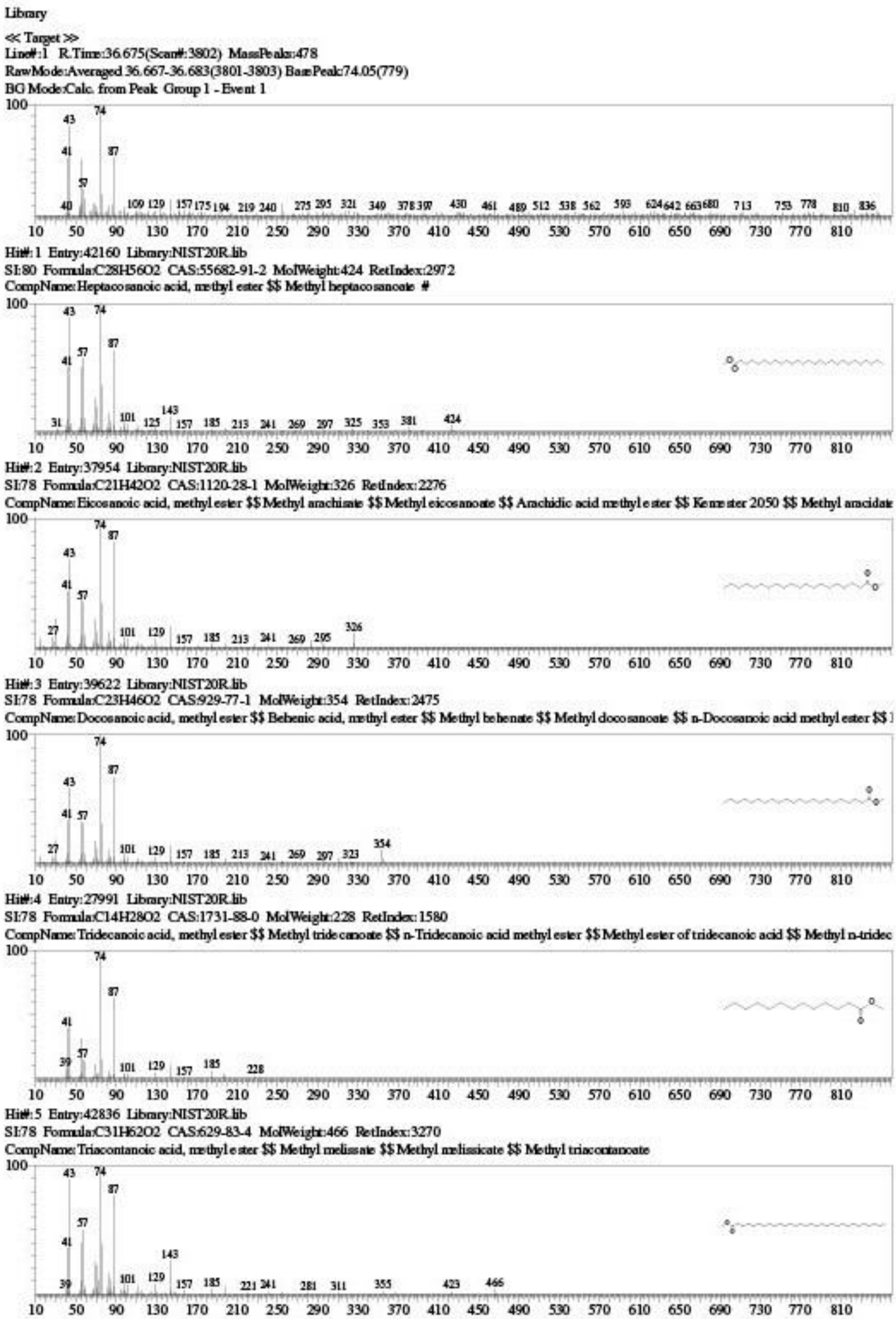


Figure 2: GC-Mass spectra for compounds 1-5

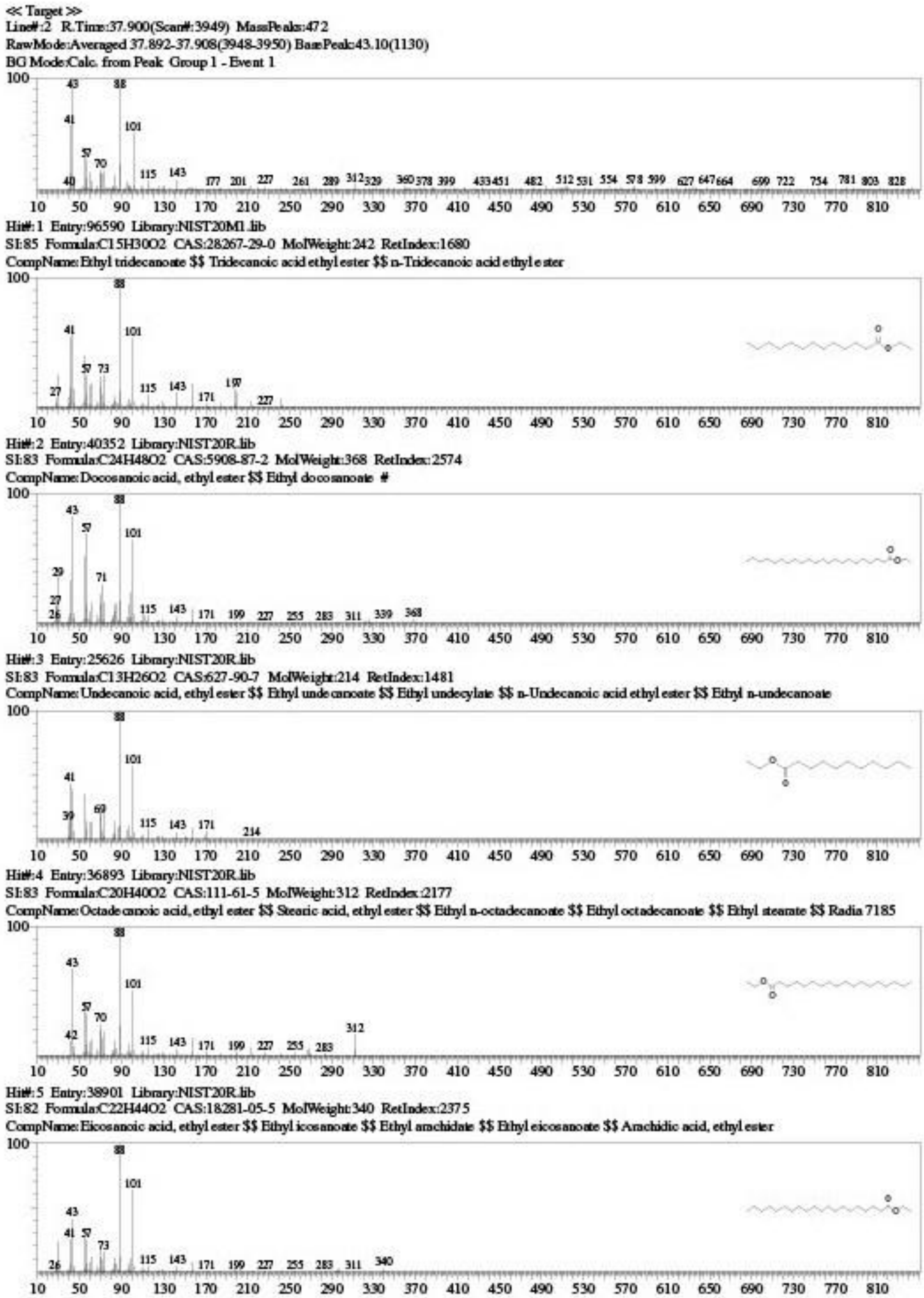


Figure 2 (Continue) : GC-Mass spectra for compounds 6-10

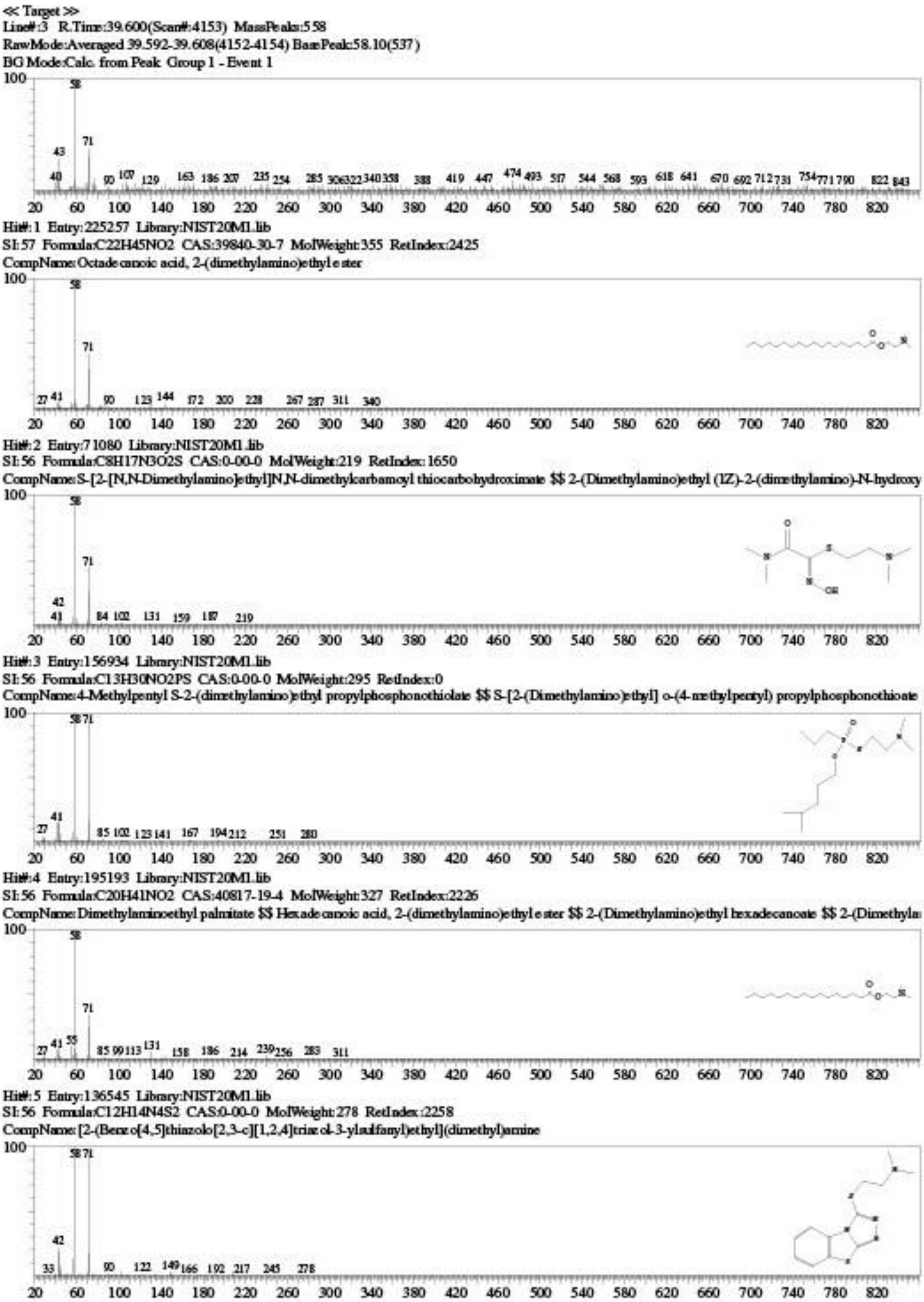


Figure 2: GC-Mass spectra for compounds 11-15 (Continue..)

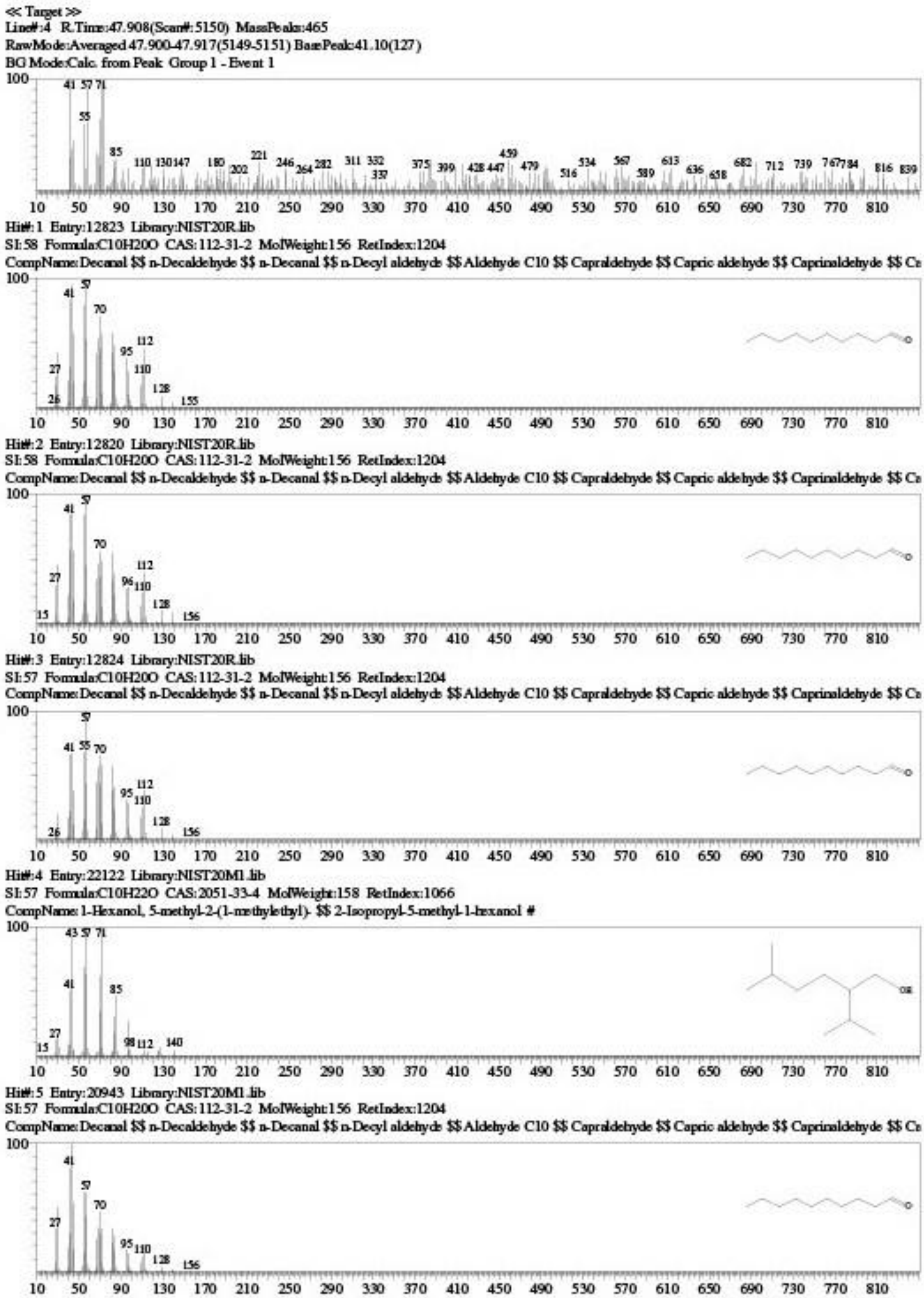


Figure 2 (Continue) : GC-Mass spectra for compounds 16-17

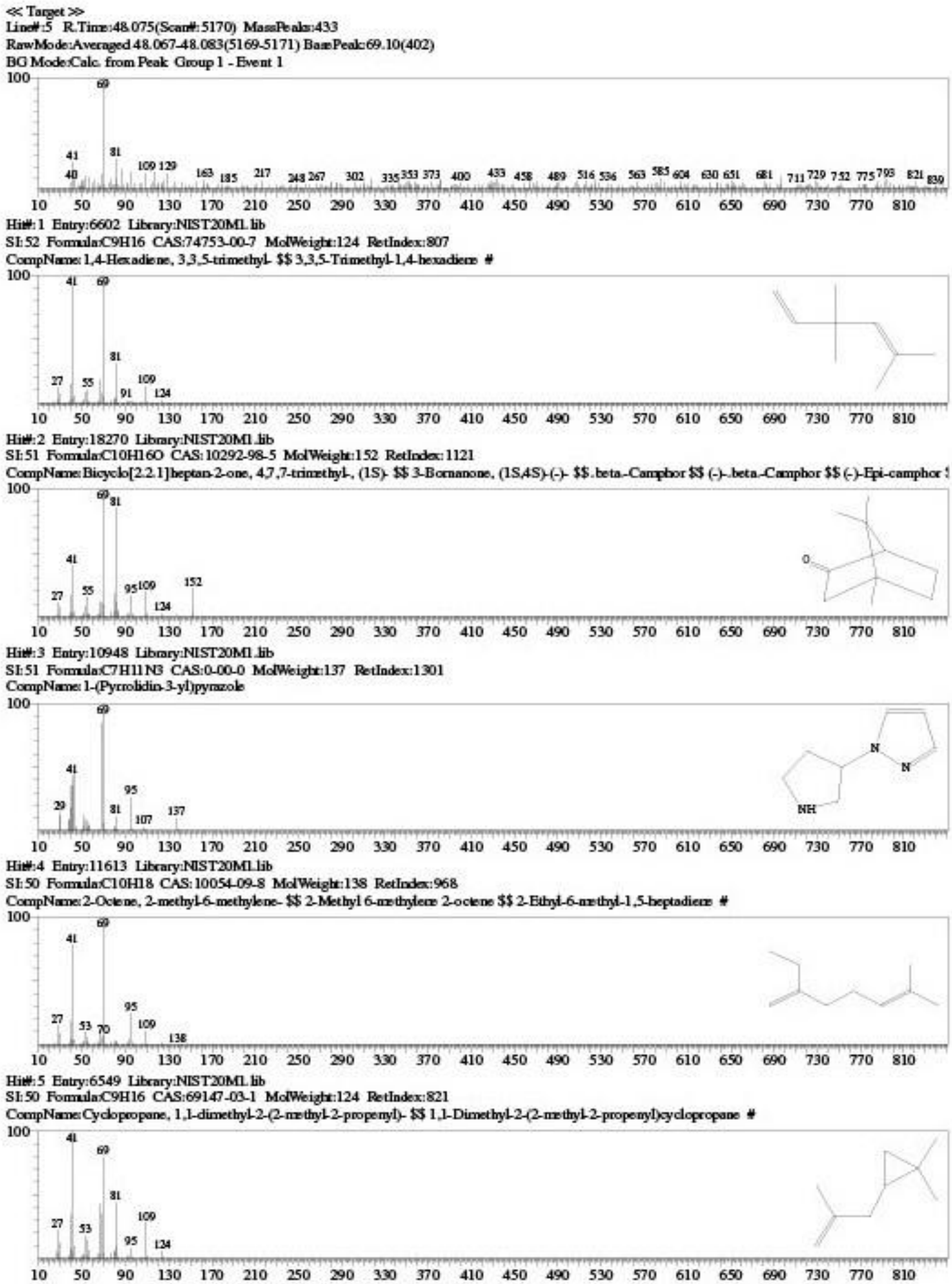


Figure 2 (Continue) : GC-Mass spectra for compounds 18-22

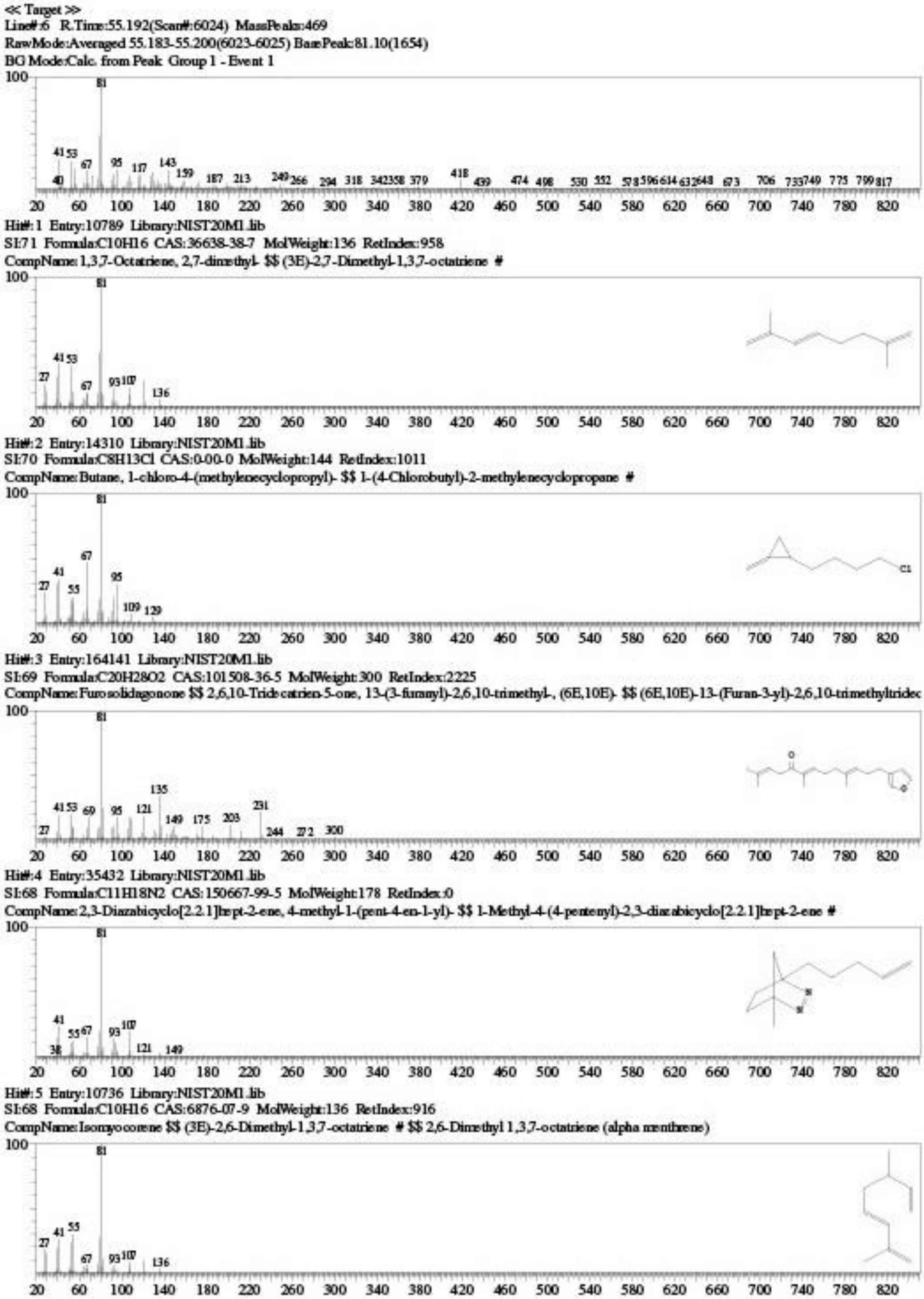


Figure 2 (Continue) : GC-Mass spectra for compounds 23-27

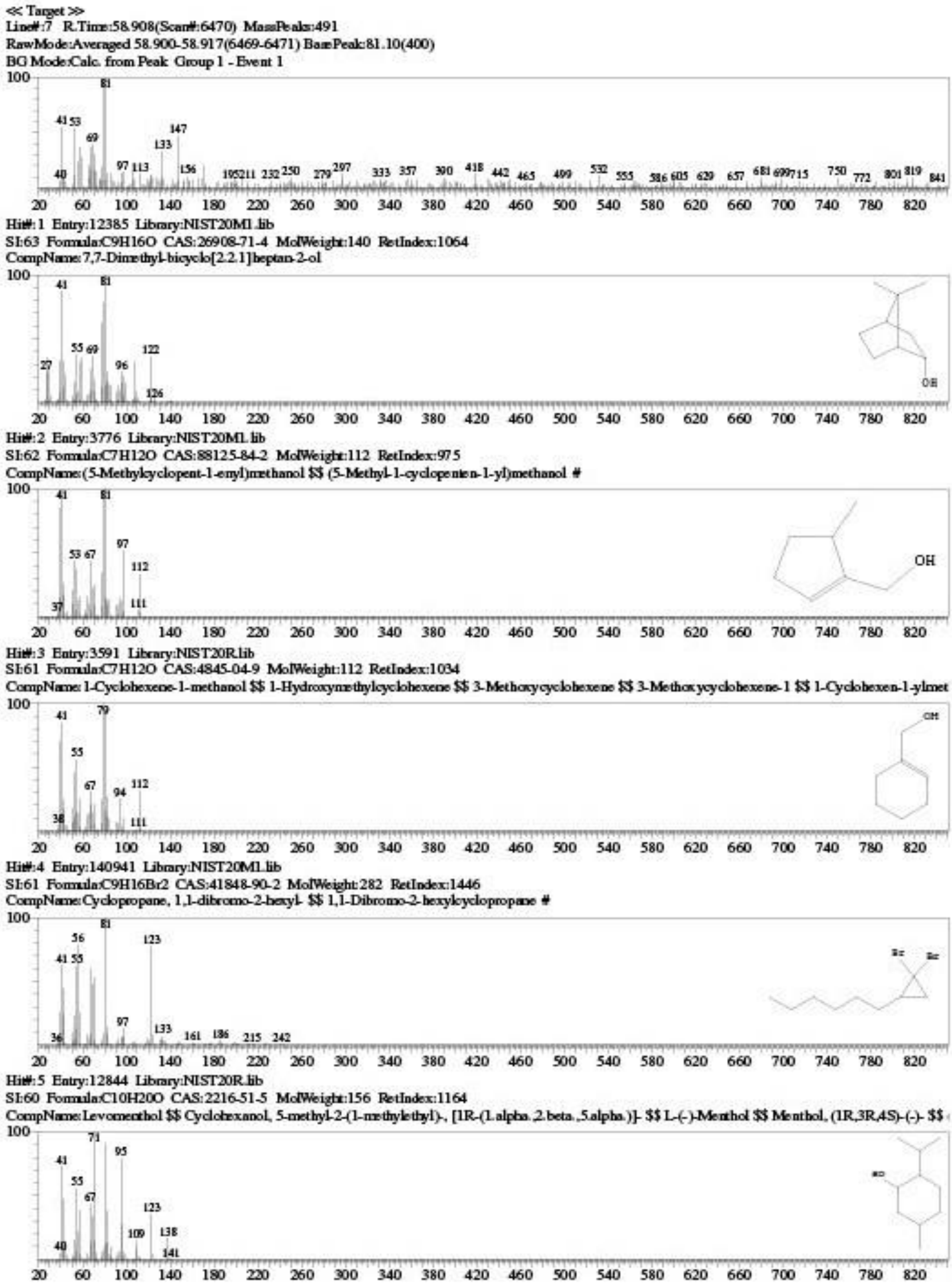


Figure 2 (Continue) : Mass spectra for compound 28-32

The source of novel medications is medicinal plants. Many of the current medicines are produced indirectly from the medicinal herbs. They have provided several substances to fight against various diseases and illness.

CONCLUSION

Due to their potential as sources of novel compounds with therapeutic value and as discovery of lead compounds for drug development, medicinal plants, the foundation of conventional medicine, have been the subject of significant pharmacological research in recent decades. Therefore, 32 compounds were found when the bioactive molecules in *Momordica charantia* were identified by GC-MS analysis. Heptacanoic acid, Docosanoic acid, Tridecanoic acid, ethyl tridecanoate, undecanoic acid, Levomenthol, decanal, 1-Hexanol,5-methyl-2-(1-methylethyl)-, 1-(pyrrolidin-3-yl) pyrazole, Bicyclo [2.2.1] heptan-2-one,4,7,7-trimethyl-, isomyocorene and 1-Cyclohexene-1-methanol among the phytochemicals that have been found to have antioxidant, antibacterial, anticancer, antidiabetic, and anti-inflammatory properties. This study concludes that the existence of these phytochemicals and bioactive substances in *Momordica charantia* may make it a new potential source of pharmaceuticals.

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References

1. Bharathi LK, & John KJ, "Momordica genus in Asia - An Overview" Springer Nature, 2013.
2. Grover JK, Yadav SP, "Pharmacological actions and potential uses of Momordica charantia: a review" J Ethnopharmacol, 2004; Jul; 93(1):123-32. DOI: https://doi.org/10.1016/j.jep.2004.03.035
3. Raman A, Lau C, "Anti-diabetic properties and phytochemistry of Momordica charantia L. (Cucurbitaceae)" Phytomedicine, 1996; Mar; 2(4):349-62. DOI: https://doi.org/10.1016/S0944-7113(96)80080-8
4. Bailey CJ, Day C, Leather dale BA, "Traditional treatments for diabetes from Asia & the West Indies" Pract. Diabetes, 1986; 3:190-192.DOI: **https://doi.org/10.1002/pdi.1960030406**
5. Dans AM, Villarruz MV, Jimeno CA, Javelosa MA, Chua J, Bautista R, Velez GG, "The effect of Momordica charantia capsule preparation on glycemic control in type 2 diabetes mellitus needs further studies" J Clin Epidemiol, 2007; Jun; 60(6):554-9. DOI: https://doi.org/10.1016/j.jclinepi.2006.07.009
6. Altemimi A, Lakhssassi N, Baharlouei A, Watson DG, Lightfoot DA, "Phytochemicals: Extraction, Isolation, and Identification of Bioactive Compounds from Plant Extracts" Plants (Basel), 2017; Sep 22:6(4):42. https://doi.org/10.3390/plants6040042
7. Taylor J, Rabe T, McGaw L. et al., "Towards the scientific validation of traditional medicinal plants" Plant Growth Regulation, 2001; 34: 23–37. https://doi.org/10.1023/A:1013310809275
8. Zubair M, Tousif MI, Riaz N, Saleem M, Nazir M, Tauseef S, Abd_Allah EF, "In vitro antioxidant and in silico enzyme inhibition studies of Carissa carandas Linn. Potential ingredient for nutraceutical development" International Journal of Food Properties, 2024; 27(1):1–26. https://doi.org/10.1080/10942912.2024.2409122
9. Horyomba Siaka Ouandaogo, Souleymane Diallo, Eddy Odari, and Johnson Kinyua, "Phytochemical Screening and GC-MS Analysis of Methanolic and Aqueous Extracts of *Ocimum kilimandscharicum* Leaves" ACS Omega, 2023**;** *8* (50), 47560-47572. DOI:https://doi.org/10.1021/acsomega.3c05554
10. Kim HY, Moon JY, & Cho SK, "Heptadecanoic Acid, an Odd-Chain Fatty Acid, Induces Apoptosis and Enhances Gemcitabine Chemosensitivity in Pancreatic Cancer Cells" Journal of medicinal food, 2023; *26*(3), 201–210. https://doi.org/10.1089/jmf.2022.K.0061
11. Tan KN, Carrasco-Pozo C, McDonald TS, Puchowicz M, & Borges K, "Tridecanoin is anticonvulsant, antioxidant, and improves mitochondrial function" Journal of cerebral blood flow and metabolism, 2017; *37*(6), 2035–2048. https://doi.org/10.1177/0271678X16659498
12. Misra D, Ghosh NN, Mandal M, Mandal V, Baildya N, Mandal S, & Mandal V, "Anti-enteric efficacy and mode of action of tridecanoic acid methyl ester isolated from Monochoria hastata (L.) Solms leaf" Brazilian journal of microbiology, 2022; *53*(2), 715–726. https://doi.org/10.1007/s42770-022-00696-3
13. Rossi A, Martins MP, Bitencourt TA, Peres NTA, Rocha CHL, Rocha FMG, Neves-da-Rocha J, Lopes MER, Sanches PR, Bortolossi JC, & Martinez-Rossi NM, "Reassessing the Use of Undecanoic Acid as a Therapeutic Strategy for Treating Fungal Infections" Mycopathologia, 2021; *186*(3), 327–340. https://doi.org/10.1007/s11046-021-00550-4
14. Zhang J, Hu Y, & Wang Z, "Menthol and Its Derivatives: Exploring the Medical Application Potential" Engineering in life sciences, 2025; *25*(9), e70039. https://doi.org/10.1002/elsc.70039
15. National Center for Biotechnology Information, PubChem Compound Summary for CID 8175, Decanal. Retrieved April 1, 2026 from https://pubchem.ncbi.nlm.nih.gov/compound/Decanal.
16. McGinty D, Scognamiglio J,Letizia CS, Api AM, "Fragrance material review on 3,5,5-trimethyl-1-hexanol" Food and Chemical Toxicology, 2010; 48(Supplement 4):S47-S50 https://doi.org/10.1016/j.fct.2010.05.026
17. Karrouchi K, Radi S, Ramli Y, Taoufik J, Mabkhot YN, Al-Aizari FA, & Ansar M, "Synthesis and Pharmacological Activities of Pyrazole Derivatives: A Review" Molecules, 2018; *23*(1), 134. https://doi.org/10.3390/molecules23010134
18. Attia Mohamed I, Aboul-Enein Mohamed N, El-Azzouny Aida A, Maklad, Yousreya A, Ghabbour Hazem A, "Anticonvulsant Potential of Certain New (2E)-2-[1-Aryl-3-(1H-imidazol-1-yl)propylidene]-N-(aryl/H)hydrazinecarboxamides" The Scientific World Journal, 2014;357403:9. **https://doi.org/10.1155/2014/357403**
19. Locklen Grimsey, Sandy F Van Vuuren, Mitchell Henry Wright, Ian Edwin Cock, "Selected South African Combretum spp. extracts inhibit methicillin-resistant Staphylococcus aureus and ESBL strains of Escherichia coli and Klebsiella pneumonia" South African Journal of Botany, 2024;Volume 165, 49-58,ISSN 0254-6299, https://doi.org/10.1016/j.sajb.2023.12.018
20. Nasr FA, Noman OM, Alqahtani AS, Qamar W, Ahamad, SR, Al-Mishari AA, Alyhya N, & Farooq M, "Phytochemical constituents and anticancer activities of *Tarchonanthus camphoratus* essential oils grown in Saudi Arabia" Saudi pharmaceutical journal : SPJ : the official publication of the Saudi Pharmaceutical Society, 2020; *28*(11), 1474–1480. https://doi.org/10.1016/j.jsps.2020.09.013