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Determination of Volatile Compounds from *Commiphora myrrha* (Nees) Engl. Resin Marketed in Central Sudan by GC/MS

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Abstract: The medicinal properties attributed to resins of this plant in Sudanese traditional medicine prompted us to study the chemical composition of the oil. The GC/MS chromatogram of the oil revealed the presence of 58.86% monoterpenes and 23.28% sesquiterpenes. Predominant monoterpenoids were; m-cymene (21.56%), linalool (7.21%) and p-mentha-1-en-8-ol (5.28%) while the predominant sesquiterpenoids were; alpha-guaiene (3.55%) and $C_{15}H_{24}$ (3.23%).

Keywords: *Commiphora myrrha*, Essential Oil Composition, Resins, Sudan

1. Introduction

Continuing our investigations on chemistry of essential oils from aromatic plants used in Sudanese Traditional Medicine [1] – [5], we have analyzed the essential oil of *Commiphoramyrrha*. The resin is used by the Sudanese local people to treat various ailments.It was masticated as antiseptic. A paint was prepared for skin diseases and pustule complaints. Resins obtained from various other species of *Commiphora* were used as substitute of *C. myrrha*. This complicates the characterization of myrrh, because most previous chemical studies reported on the resin were based on commercial material, and not on a product obtained from properly identified trees [6].

The aim of this paper is to present qualitative and quantitative analysis of the oil of this plants species marketed in the central Sudan.

2. Materials and Methods

2.1. Plant Material

The plant material (resin) used in this study was purchased in April, 2010 from Bahry Market, Khartoum State, Sudan. Based on the available specimen, the plant material was identified as *C. myrrha* by one of the author, Prof. H.H EL-Kamali.

2.2. Preparation and Isolation of Volatile Component

The resin sample of *C. myrrha* was subjected to hydrodistillation for 4 h using a Clevenger – type apparatus. The oil was dried over anhydrous sodium sulfate and stored at 5 C until analysis [7].

2.3. Gas Chromatographic–Mass Spectrometry (GC/MS)

GC-MS analyses were performed on a QP-2010 Shimadzu spectrometer instrument. Fused silica capillary column with stationary phase was used: (50% phenyl and dimethylpolysiloxane) and (50% dimethylpolysiloxane), 30 m, 0.25 mm diameter. The analytical conditions were as follows: carrier gas , helium ; injector temperature , 250 C; temperature program, 1 min at 70C rising to 220 C at a rate of 3 C/min. Individual components were identified by comparison of the retention times and mass spectra provided by Wiley Library in the data system and literature [8].

3. Results and Discussion

Light yellow volatile oil was obtained by hydrodistillation of dried resin of *C. myrrha* in 2.1 % yield. Table 1 shows the relative percentages, formula, class type, retention time, mass peaks, base peaks and main fragment ions of the constituents of the *C. myrrha* resin oil.

Table 1. *chemical composition of Commiphora myrrha resin.*

NO	Compound	%	Formula	Class Type	Retention Time (RT)	Mass peaks	Base peaks	Main fragment ions (m/z)
1	Delta-3-carene	0.07	$C_{10}H_{16}$	MH	6.700	300	93.05	53,67,79,93,105,121,163
2	alpha-terpinene	0.05	$C_{10}H_{16}$	MH	17.687	293	121.10	55,65,79,93,105,121,136,
3	Gamma-elemene	0.68	$C_{15}H_{24}$	SH	17.862	145	121.10	55,67,77,93,105,121,136,148,161
4	(-)-alpha-muurolene	0.03	$C_{15}H_{24}$	SH	18.357	315	105.05	55,67,91,105,119,129,149,161,176,189,204
5	Copaene	0.1	$C_{15}H_{24}$	SH	19.560	299	105.05	55,69,81,93,105,119,133,147,161,169,189,204
6	Unidentified	0.42	$C_{15}H_{24}$	SH	19.883	195	81.10	53,67,81,91,105,123,133,147,161
7	8,8-Dimethyl-9-methylene-1,5-cycloundecadiene	3.81	$C_{14}H_{22}$	-	20.174	109	93.05	55,67,81,93,107,121,133,147,161,175,189,204
8	1H-cycloprop[e]azulene,1a,2,3,4,4a,5,6,7b-octahydro-1,1,4,7-tetrameth	0.06	$C_{15}H_{24}$	SH	20.686	313	204.20	55,65,79,91,105,119,133,147,161,175,189,204
9	Beta-caryophellene	0.63	$C_{15}H_{24}$	SH	21.389	267	93.10	55,69,79,93,105,120,133,147,161,175,189,204
10	Germacrene B	0.60	$C_{15}H_{24}$	SH	21.850	227	121.10	55,67,97,93,107,121,133,147,161,175,189,204
11	Unidentified	0.03	$C_{29}H_{42}O$	-	22.034	311	119.05	55,69,79,93,107,119,131,147,161,175,189,204
12	Unidentified	0.07	$C_{15}H_{24}$	SH	22.431	300	161.05	55,67,81,91,105,119,133,147,161,177,204
13	Humulene	0.22	$C_{15}H_{24}$	SH	22.889	267	93.10	55,67,80,93,107,121,133,147,161,175,189,204
14	Caryophyllene	0.12	$C_{15}H_{24}$	SH	23.067	324	91.05	55,67,79,91,105,119,133,147,161,175,189,204
15	Nopol	0.03	$C_{11}H_{18}O$	-	23.503	338	105.05	55,67,79,93,105,119,133,147,161,176,189,204
16	Cyclosativene	0.14	$C_{15}H_{24}$	SH	23.736	286	161.15	55,67,79,93,105,119,133,146,161,176,189,204
17	E-germacrene D	1.17	$C_{15}H_{24}$	SH	23.970	132	161.10	55,67,81,91,105,119,133,147,161,176,189,204
18	Unidentified	0.65	$C_{15}H_{24}$	SH	24.290	286	93.05	55,67,79,93,105,121,147,161,175,189,204
19	Iso-furano-germacrene	21.02	$C_{15}H_{20}O$	OS	24.574	140	108.05	53,65,79,91,108,119,133,148
20	(+)-alpha-muurolene	0.07	$C_{15}H_{24}$	SH	24.740	284	105.05	55,65,81,91,105,119,133,147,161,175,189,204
21	1H-Benzocycloheptene, 2,4a,5,6,7,8,9,9a- octahydro-3,5,5-trimethyl-9-methylene	0.18	$C_{15}H_{24}$	SH	24.904	316	93.05	55,67,81,93,105,119,134,147,161,176,189,204
22	Bicyclo[5.2.0]nonane4-ethenyl-4,8,8-trimethyl-2-methylene	0.31	$C_{15}H_{24}$	SH	25.054	299	93.05	53,67,79,93,107,119,133,147,161,175,189,204
23	Alpha-cubebene	0.47	$C_{15}H_{24}$	SH	25.315	226	161.10	55,67,79,91,105,119,133,148,161,176,189,204
24	Alpha-elemene	0.28	$C_{15}H_{24}$	SH	25.545	268	161.10	55,67,81,91,105,119,134,147,161,176,189,204
25	Guaiene	0.11	$C_{15}H_{24}$	SH	26.262	307	105.05	55,67,81,91,105,119,133,147,161,176,189,204
26	Beta-patchoulene	0.12	$C_{15}H_{24}$	SH	26.441	315	161.10	55,67,81,91,107,122,133,142,161,175,189,204
27	Gamma-caryophyllene	0.08	$C_{15}H_{24}$	SH	26.781	327	93.05	55,59,81,93,107,119,135,148,161,175,189,204
28	Gamma-elemene	3.34	$C_{15}H_{24}$	SH	27.121	123	121.10	53,67,81,93,105,121,133,147,161,175,189,204
29	p-cresyl-n-butyrate	0.70	$C_{11}H_{14}O_2$	-	27.860	117	108.05	53,65,79,91,108,115,128,141,155,165,183,199,214
30	Cyclopropancarboxylic acid,2,2-dimethyl-3-(2-methyl-1-propen-1-yl)-,2-	0.07	$C_{21}H_{28}O_3$	-	28.507	279	123.10	53,81,93,105,123,134,153,159,169,183,197,212,229

NO	Compound	%	Formula	Class Type	Retention Time (RT)	Mass peaks	Base peaks	Main fragment ions (m/z)
	methyl-4-oxo-3-(1,3-pentadien-1-yl)-2-cyclopenten-1-yl ester							
31	Unidentified	0.05	$C_{14}H_{18}$	-	28.637	330	118.00	53,67,77,91,108,118,128,141,157,171,186,199,214
32	Unidentified	0.03	$C_{11}H_{14}O_2$	-	28.868	319	122.00	53,65,77,94,108,122,131,149,162,174,187,202,215,230
33	Cubenol	0.12	$C_{15}H_{26}O$	OS	29.432	315	119.10	55,67,81,95,105,119,133,147,161,179,187,204
34	Unidentified	48.68	$C_{16}H_{18}O_2$	-	29.856	146	108.05	51,65,79,91,108,118,128,143,159,181,185,199,214
35	Unidentified	13.59	$C_{14}H_{14}O_2$	-	30.152	141	109.05	53,65,79,91,109,115,128,141,155,171,183,199,214
36	Bicyclo[4.4.0]dec-1-ene,2-isopropyl-5-methyl-9-methylene	0.95	$C_{15}H_{24}$	SH	30.484	160	161.10	55,69,81,95,105,119,134,147,161,176,189,204
37	Unidentified	8.96	$C_{16}H_{24}$	-	32.383	156	108.05	53,65,79,93,108,115,131,145,159,173,187,201,216
38	Germacron	0.03	$C_{15}H_{22}O$	OS	31.287	297	107.10	53,67,79,93,107,121,135,149,161,175,200,217
39	Unidentified	1.23	$C_{15}H_{24}$	SH	31.530	189	93.10	55,67,81,93,107,121,133,147,161,175,189,204
40	Unidentified	0.42	$C_{17}H_{16}O_2S$	-	32.083	271	123.05	45,65,79,91,107,123,138,159,173,191,214,231,246
41	Thujen-2-one	3.98	$C_{10}H_{14}O$	OM	32.383	154	108.05	53,65,79,93,108,115,131,145,159,173,187,201,216
42	Unidentified	3.80	$C_{10}H_{14}O_3$	-	33.227	174	123.05	45,65,79,91,107,123,138,147,159,178,191,199,214,231,246
43	Eudesm-4-en-11-ol	0.18	$C_{15}H_{26}O$	OS	35.776	312	161.01	55,67,79,93,107,121,133,147,161,175,189,204
44	Unidentified	0.06	$C_{10}H_{14}$	MH	36.843	322	106.05	55,65,83,91,106,119,125,145,159,174,187,202,215,230
45	9,12,15-Octadecatrienal, dimethyl acetal	0.12	$C_{20}H_{36}O_2$	-	39.317	324	108.05	55,65,79,91,108,119,133,146,159,172,185,199,214,232,239,258,274
46	Unidentified	0.06	$C_{13}H_{18}O_2$	-	40.956	338	146.10	55,69,79,91,108,119,135,146,159,171,185,199,214
47	Unidentified	0.05	$C_{16}H_{20}$	-	42.302	337	197.00	53,67,77,91,108,115,128,142,155,169,185,197,212,228,254,272

MH = Monoterpene hydrocarbons; OM = Oxygenated Monoterpenes;
SH = Sesquiterpene Hydrocarbons; OS = Oxygenated Sesquiterpenes.

Thirty two components were identified by GC/MS in *C. myrrha* oil, accounting for more than 68% of the whole oil. The *C. myrrha* essential oil mainly consists of oxygenated sesquiterpenes (Ca. 21.35%), followed by sessquiterpene hydrocarbons (Ca. 10.01%), oxygenated monoterpenes (2.98%) and monoterpene hydrocarbons (0.18%).

The main components were the $C_{16}H_{18}O_2$ (42.68%), the oxygenated sesquiterpene, isofurano-germacrene (21.02%), $C_{14}H_{14}O_2$ (13.59%) and 8,8-Dimethyl-1,9-methylene – 1,5-cycloundecadiene (3.81%). Some other components were only characterized but not identified (Ca. 32%).

Extracts prepared from *C. molmol* resins were analyzed by GC/MS. Twenty two terpenoid compounds were identified in the hexane extract of the resin. Among them, 2-acetoxyfuranodiene (9.80%), furanoeudesma-1,3-diene 8.97%, isofuranogermacrene 6.71%, epicurzerenone 3.64%, 2-methoxyfuranodiene 2.97% and lindestrene 2.74% were the main compounds from the myrrha resin, Tamar Ltd). Furanoeudesma-1,3-diene 20.59%, isofuranogermacrene 17.94%, 2-acetoxyfuranodiene 8.80% , 2-methoxyfuranodiene 7.33% and lindestrene 6.24% from myrrha resin , Pamir Ltd. [9]. The major constituents of the essential oil identified from the resin of *C. myrrha* by Mohammed et al., [10] were alpha- elemene, 7-isopropyl-1,4-dimethyl-2-azulenol, curzerne, germacra-1(10)7,11-trien-15-oic acid and 8,12-epoxy-6-hydroxy-C-lactone. Volatile concentrates from the oleo-gum resin of *C. myrrha* was isolated by supercritical extraction with carbon dioxide. It is main components, identified and quantified by GC/MS were furanoeudesma-1,3-diene, lindestrene, curzerene and germacrone [11]. Chemical analysis of essential oil from resin of Myrrha shows that the resin is rich in sesquiterpenes and sesquiterpene lactones compounds that possess anti-inflammatory and antitumor activity [12].

4. Conclusion

Analysis of *C. myrrha* resin oil in this study is an attempt to gain a better understanding of the secondary metabolite profile of this important valuable plant species.

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