Int. j. adv. multidisc. res. stud. 2023; 3(3):999-1002

Received: 05-05-2023
Accepted: 15-06-2023

International Journal of Advanced Multidisciplinary Research and Studies

ISSN: 2583-049X

Chemical Composition of Essential Oils of Fresh Jordanian *Euphorbia Hierosolymitana* Boiss

[1] Areej M Al-Ghoul, [2] Musa H Abu Zarga, [3] Mahmoud A Al-Qudah

[1, 3] Department of Chemistry, Faculty of Science, Yarmouk University, Jordan

[2] Department of Chemistry, Faculty of Science, Jordan University, Jordan

Corresponding Author: **Areej M Al-Ghoul**

Abstract

Essential oils, in turn, have attracted the attention of researchers in recent years for their multiple biological activities, which target several diseases. In this paper, the flowering aerial parts of fresh *E. hierosolymitana* Boiss were collected from its natural habitat in the Jerash area, Jordan, in July 2017. The essential oil was obtained from the collected plant by using the hydrodistillation Clevenger method. The essential oil was analyzed by (GC-MS). GC/MS analysis of the hydro-distilled oil. 112 components were identified. The identified compounds belonged to seven classes, which can be classified as; monoterpene hydrocarbons (MH), oxygen-containing monoterpenes (OM), sesquiterpene hydrocarbons (SH), and oxygen-containing sesquiterpenes (OS), diterpene hydrocarbons (DT), oxygenated hydrocarbons (OD), ester (E). The major components of the oil were found to be caryophyllene oxide (12.84%), α-chenopodiol (3.91%), benzene acetaldehyde (3.80%), heptanal (3.41%) and β-ylangene (3.12%).

Keywords: Euphorbiceae, *Euphorbia Hierosolymitana*, Essential Oil, Distillation, Volatile Compounds

1. Introduction

Many plants grow in Jordan, such as *Euphorbia hierosolymitana* Boiss, which belongs to the family Euphorbiaceae [1]. Milky or colored latex is found in most species of this family. Latex in certain species could have irritant, poisonous, or carcinogenic properties [2]. *Euphorbia hierosolymitana* Boiss grows in several areas in Jordan, such as Kerak, Shubak, Jerash, Tafila, Ajloun, Salt, and Irbid. The common name of *Euphorbia hierosolymitana* Boiss in Jordan is *Halabloub* [3]. *Euphorbia hierosolymitana Boiss* is characteristic of a milky latex that "bleeds" from the stems or leaves when they are broken. This latex contains certain substances which cause diarrhea. The plant grows to the height of a small round shrub, and during the year it undergoes several changes of color. In summer the plant appears dry and grey due to the shedding of the leaves during the dry season. In early winter color becomes green, while in spring, during the flowering season, the color becomes yellow [4].

Essential oils have been used for thousands of years in several cultures for medicinal and health purposes. Essential oils are rich in aromatic compounds [5, 6]. In addition, Essential oils are a mixture of volatile constituents produced by the secondary metabolism of aromatic and other varieties of plants [7]. They can be obtained by several methods. Such as expression, fermentation, effleurage, or extraction but among all the methods, steam distillation and hydro distillation are commonly used [8, 9]. Essential oil possesses many biological activities [10]. For that essential oils have been used traditionally as medicinal agents [11, 12].

Since no previous investigation has been reported on the volatile components of this plant, the present study aimed to extract volatile compounds from *Euphorbia hierosolymitana* using the techniques of hydrodistillation using the Clevenger-type apparatus. The volatile compounds present in the distillates were analyzed by (GC-MS).

2. Experimental

2.1 Collection and Authentication of Plant

The flowering aerial parts of fresh *E. hierosolymitana* Boiss were collected from its natural habitat in the Jerash area, Jordan in July (2017) and it was identified by Prof. Jamil Lahham from Al-Yarmouk University. A voucher was deposited to the Yarmouk University Herbarium.

2.2 Oil Isolation

The oils were isolated from *E. hierosolymitana* Boiss. After the freshly collected plant was minced, it was immediately hydrodistilled for three hours using Clevenger-type apparatus to yield colorless to pale yellow oil as previously described [13]. The oil was dried over anhydrous sodium sulfate and immediately stored in GC-grade n-hexane at 4 °C until it was analyzed by gas chromatography/mass spectrometry (GC/MS).

2.3 Identification of Components

Chemical analysis of the essential oils was carried out using gas chromatograph-mass spectrometry (Agilent, Palo Alto, USA; 6890N gas chromatograph). The chromatographic conditions were as follows: column oven program, 60 °C (1 min, isothermal) to 246 °C (3 min, isothermal) at 3 °C/min, the injector and detector temperatures were 250 °C and 300 °C, respectively. Helium was the carrier gas (flow rate 0.90 ml/min) and the ionization voltage was maintained at 70 eV.A HP-5 MS capillary column (30 m × 0.25 mm i.d., 0.25 µm film thicknesses) was used. Retention Indices (RIs) were calculated by injection of a series of n-alkanes (C_8-C_{20}) in the same column under the same conditions specified above for gas chromatography analysis.

Identification of the oil components was based on computer search using the library of the mass spectral data and by comparison of the calculated retention index with the available authentic standards and literature data.

3. Results and Discussions

The components of the essential oil were identified. The distilled essential oils from *E. hierosolymitana* Boiss (Figure 1) shows the total ion chromatogram of the essential oils from the plant.

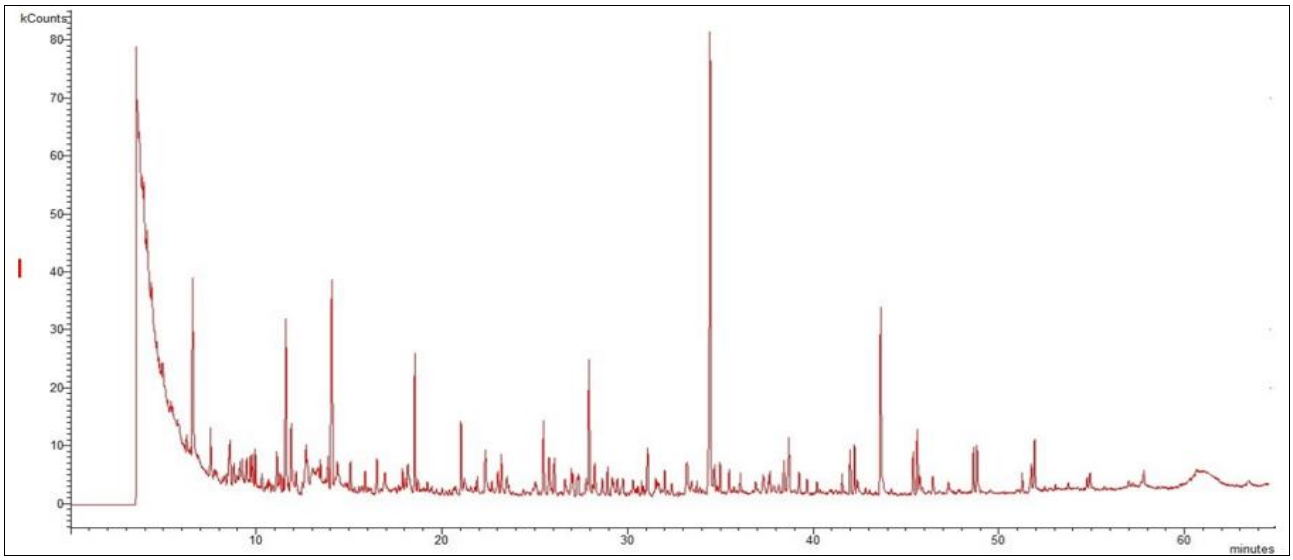

Fig 1: A representation of the obtained GC chromatogram with detection by the flame of oil from *E. hierosolymitana* Boiss

The main components of the essential oil, their percentages, and retention indices are presented in Table 1. GC/MS analysis of the hydrodistilled oil allowed the identification of 112 components that accounted for the total content. The identified components belonged to seven classes of compounds, which can be found in Table 2; monoterpene hydrocarbons (MH), oxygen-containing monoterpenes (OM), sesquiterpene hydrocarbons (SH), and oxygen-containing sesquiterpenes (OS), diterpene hydrocarbons (DT), oxygenated hydrocarbons (OD), ester (E). The major components of the oil were found to be caryophyllene oxide (12.84%), α-chenopodiol (3.91%), benzene acetaldehyde (3.80%), heptanal (3.41%) and β-ylangene (3.12%). The main compounds of the oil were chemically classified as follows, eight monoterpene hydrocarbons (4.95 %) including α-pinene (1.04 %), verbenene (0.50%), β-pinene (0.56 %), cis-pinene (0.82 %) as major components. Twenty-nine Oxygenated monoterpenes were identified (17.68 %) including 2,2-dimethyl-2,4-ocradienal (5.55 %), linalool (0.54 %), cis-chrysathenol (0.73 %), γ-terpineol (0.63 %), pipertenone oxide (1.74 %) and trans-myrtand (1.57 %) as major components. There were fifteen sesquiterpene hydrocarbons (9.63 %) including β-ylangene (3.12 %), α-copaene (1.0 %), β-longipinene (0.57 %), longifolene (0.47 %), β-gurjunene (0.80 %) and epi-cedrane (0.61 %) as the most abundant components. Twenty-two oxygenated sesquiterpene compounds (24.98 %) were identified, among which caryophyllene oxide (12.84%), α-chenopodiol (3.90 %), drmenone (0.91 %), eudesm-(11)-en-4-01 (0.71 %) and valeranone (0.67 %) were detected.

Table 1: The main components of the essential oil, their percentages, and retention indices

#	t_r	$KI_{exp.}$	$KI_{the.}$	Name of the compound	%A
1	3.848	812	811	Butyl acetate	1.00
2	4.101	828	828	Methyl pentanoate	0.99
3	6.574	900	902	Heptanal	3.41
4	7.561	939	932	*α*-Pinene	1.04
5	7.749	936	944	5-Methyl-3-heptanone	0.06
6	8.591	962	960	Benzaldehyde	1.86
7	8.812	968	969	Verbenene	0.50
8	8.966	973	979	*trans*-p-menthane	0.37

9	9.137	979	978	*β*-Pinene	0.56
10	9.249	982	986	6-Methyl-5-hepten-2-one	0.64
11	9.34	985	990	Endo-2-Norborneol	0.13
12	9.469	987	989	*cis*-Penane	0.82
13	9.608	993	995	3-Menthene	0.13
14	9.703	996	996	Mesitylene	0.67
15	9.830	1000	1000	n-Decane	0.62
16	9.954	1003	1008	cis -Dehydroxy linalooloxide	0.73
17	10.309	1012	1015	1,4-Cineole	0.36
18	10.668	1020	1029	p-Cymene	0.15
19	10.761	1023	1026	1,2,4-Trimethyl benzene	0.16
20	11.102	1031	1037	2-Acetyl-5-methylfurane	0.19
21	11.288	1036	1038	Santolina alcohol	0.61
22	11.442	1040	1044	Ethyl hex-(2E)-enolate	0.29
23	11.601	1044	1044	Benzene acetaldehyde	3.80
24	11.727	1047	1047	E-*β*-Ocimene	0.19
25	11.881	1050	1056	o-Cresol	2.08
26	12.147	1057	1057	Bergamal	0.57
27	12.488	1065	1065	Acetophenone	0.29
28	12.678	1070	1068	o-Tolualdehyde	1.61
29	12.773	1073	1073	trans-Linalool oxide	0.58
30	13.020	1079	1082	Fenchone	0.44
31	13.474	1090	1090	Nonanone	0.36
32	13.879	1100	1097	Linalool	0.54
33	14.053	1104	1104	2,2- Dimethyl -3,4- Ocatadienal	5.55
34	14.366	1111	1117	Endo- Fenchol	0.54
35	15.080	1127	1123	*trans*- Pinene hydrate	0.60
36	15.548	1138	1140	Nopinone	0.13
37	15.872	1145	1145	Camphor	0.41
38	16.027	1149	1154	neo -3- Thujanol	0.07
39	16.496	1160	1164	*cis*- Chrysathenol	0.73
40	16.949	1170	1165	*cis*- Dihydro –*α*- Terpineol	0.49
41	17.876	1191	1192	2- Decanone	0.43
42	18.017	1194	1194	*cis*- Dihdro carvone	0.19
43	18.176	1198	1198	*γ*-Terpineol	0.63
44	18.267	1200	1200	Dodecane	0.38
45	18.518	1206	1205	2E,4E- Nonadienal	2.74
46	18.720	1210	1208	iso –Dihydro carveol	0.34
47	19.220	1222	1229	Citronellol	0.18
48	20.634	1254	1253	Butyrophenone	0.06
49	21.028	1263	1262	*trans* – Myrtanol	1.57
50	21.218	1267	1271	2 – (1E) –propenyl phenol	0.52
51	21.904	1282	1291	*neo*- iso -3- Thujyl acetate	0.35
52	22.343	1292	1298	Thymol	1.06
53	22.689	1300	1300	n- Tridecanone	0.27
54	23.013	1308	1319	Iso – menthyl acetate	0.53
55	23.202	1313	1319	2,3,4- Trimethyl benzaldehyde	1.03
56	23.482	1320	1319	2E,4E- Decadienal	0.44
57	23.605	1323	1320	*cis* -2,3- Piananediol	0.22
58	25.474	1370	1370	Piperitenone oxide	1.74
59	25.738	1376	1371	*α*-Copaene	1.00
60	25.927	1381	1382	*β*-Maaliene	0.14
61	26.052	1384	1384	Modheph -2- ene	0.97
62	26.645	1399	1395	Ethyl geranate	0.53
63	26.801	1403	1396	Ethyl decanoate	0.07
64	26.985	1401	1401	*β*- Longipinene	0.57
65	27.068	1403	1398	Z- Trimenal	0.48
66	27.298	1408	1408	Longifolene	0.47
67	27.346	1409	1409	Dodacanal	0.44
68	27.767	1419	1419	E- Caryophyllene	0.38
69	27.928	1423	1423	*β*- Ylangene	3.12
70	28.117	1428	1428	*β*- Copaene	0.21
71	28.240	1431	1431	*β*- Gurjunene	0.80
72	28.641	1441	1441	Bakerol	0.47
73	28.920	1448	1455	epi- Cedrane	0.61
74	29.160	1454	1455	Z- Methy isoeigenol	0.42
75	29.244	1456	1456	*α*- neo –Clovene	0.37
76	29.464	1461	1461	Cyclamen aldehyde	0.48
77	29.758	1469	1468	Thujopsadiene	0.24

78	30.291	1482	1483	*γ*- Curcumene	0.32
79	30.566	1488	1490	*β*- Selinene	0.14
80	30.761	1493	1493	iso- menthyl Lactate	0.28
81	30.867	1496	1496	2- Tridecanone	021
82	31.090	1501	1502	Decyl propanoate	1.37
83	31.522	1512	1512	Cameroonan -7- α- ol	0.35
84	31.611	1515	1514	*trans*- cyclo iso Longifol -5- ol	0.31
85	31.703	1517	1516	10- epiItalicene ether	0.20
86	31.999	1524	1518	Menthylisovalerate	0.48
87	32.387	1534	1529	*trans*- Calamenene	0.29
88	33.179	1555	1559	*trans*- Cadinene ether	1.23
89	33.461	1562	1564	Longicamphenylone	0.39
90	33.713	1568	1572	Caryophyllenyl alcohol	0.35
91	34.043	1577	1576	Pentyl salicylate	0.06
92	34.449	1587	1580	Caryophyllene oxide	12.84
93	34.704	1594	1597	*cis*-Arteannuic alcohol	0.73
94	34.998	1601	1601	Hexadecan	0.64
95	35.489	1615	1613	Tetradecanal	0.54
96	36.102	1631	1633	*α*- Acorenol	0.39
97	37.313	1664	1669	ar-Turmerone	0.59
98	37.578	1671	1675	Valeranone	0.67
99	38.158	1681	1685	5- neo- Cardranol	0.20
100	38.415	1694	1700	Eudesm -7(11) –en -4- ol	0.71
101	38.696	1702	1705	n- Heptadecane	1.56
102	39.224	1716	1718	2Z,6Z – Fernesol	0.49
103	39.647	1728	1727	Guaiol acetate	0.29
104	40.207	1744	1749	Oplopanone	0.62
105	41.993	1795	1793	Drmenone	0.91
106	42.229	1801	1800	Octadecane	1.35
107	43.627	1843	1855	*α*- Chenopodiol	3.91
108	45.382	1896	1896	Rimuene	0.90
109	45.615	1903	1900	Nonadecane	1.35
110	45.723	1913	1906	1,5- diene iso Pimara -9(11)	0.39
111	46.455	1936	1940	11- Acetoxy eujesman -4- α- ol	0.54
112	47.275	1961	1948	Isophytol	0.20

Table 2: The classes of compounds in the essential oil of *e. hierosolymitana* Boiss

Monoterpene hydrocarbons	4.94
Oxygenated Monoterpenes	21.48
Sesquiterpene hydrocarbons	9.63
Oxygenated sesquiterpenes	27.15
Diterpene hydrocarbon	1.29
Oxygenated diterpene	0.20
Ester	3.78
Others	5.16

4. References

1. Al-Eisawi DMH. Flora of Jordan Checklist, revised Edition 1. The University of Jordan Press, Amman, Jordan, 2013.
2. Bruyns P, Mapaya R, Hedderson T. A new subgenaric classification for Euphorbia (Euphorbiaceae) in southern Africa based on ITS and pspA-trnH sequence data. Taxon. 2006; 55:397-420.
3. Alghoul A, Abu Zarqa M, Alqudah M. Chemical constituents of Euphorbia hierosolymitana Boiss. Jordan Journal of Chemistry, 2020.
4. Al-Ghoul A. Isolation and Identification of the Chemical Constituents of Euphorbia Hierosolymitana and Bassia Eirophora and Their Antioxidant Activity. Unpublished PhD dissertation. The University of Jordan. Amman, 2019.
5. Mahato N, Sharma K, Koteswararao R, Sinha M, Baral E. Citrus essential oils: Extraction, authentication and application in food preservation. Crit Rev Food Sci Nutr. 2019; 59:611-625.
6. Tongnuanchan P, Benjakul S. Essential oils: Extraction, bioactivities, and their uses for food preservation. Journal of Food Science. 2014; 79:R1231-R1249.
7. Bassole I, Juliani H. Essential oils in combination and their antimicrobial properties. Molecules.2012; 17:3989-4006.
8. Burt S. Essential oils: Their antibacterial properties and potential applications in foods-a review. International Journal of Food Microbiology. 2004; 94:223-253.
9. Tajkarimi M, Ibrahim S, Cliver D. Antimicrobial herb and spice compounds in food. Food control. 2010; 21:1199-1218.
10. Alessandro P, Paola A, Gianluigi B, Roberto V. Some Biological Activities of Essential Oils. Med Aromat Plants. 2013; 2(5):1-4.
11. Angnes S. Isolation, chemical characterization and evaluation of insecticide property of essential oil Piper amplumKunt, in Masters IDissertaçao (chemistry) R.U.o. Blumenau, Editor. Blumenau-SC, 2005, p88.
12. Almeida F, Ramos M, Amorim E, Albuquerque U. A comparison of knowledge about medicinal plants for three rural communities in the semi-arid region of northeast of Brazil. Journal of Ethnopharmacology. 2010; 127:674-684.
13. A-qudah M, Al-ghoul A, Trawenh I, Al-Jaber H, Al shboul T, *et al*. Antioxidant Activity and Chemical Composition of Essential Oils from Jordanian Ononis Natrix L and Ononis Sicula Guss. Journal of Biologically Active Products from Nature. 2014; 4:52-61.