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Biochemical analysis of leaves for the species Fagonia burguieri DC. , Zygophyllum coccineum L. Zygophyllum fabago L. (Zygophyllaceae) in Bahr al-Najaf depression in Iraq based on GC-Mass technology

[1]Raghad Khalil Alarkwazi,[2] Ruqayah Manoon Hasan,[3] Huda Jasim M.Altameme

[1]Factuly of Education for girls, University of Kufa,Najaf, Iraq
[2][3]Department of Biology, College of Science for Women, University of Babylon, Babylon,Iraq.
[1]drraghadala5@gmail.com,[2] Wsci.huda.j@uobabylon.edu.iq,
[3]ruqayah.alnomani@uokufa.edu.iq

ABSTRACT

The species Fagonia burguieri, Zygophyllum coccineum, Zygophyllum fabago belong to the family Zygophyllaceae of the order Zygophyllales, includes about six genera in Iraq. The chemical compounds of the leaves of these species, as 59 compounds were observed, the lowest number of chemical compounds 14 were recorded in the leaves of Fagonia burguieri, while the highest number 24 were recorded in the leaves of Zygophyllum coccineum and also 21 chemical compounds were recorded in Zygophyllum fabago. By comparing the chemical content, it was noticed that all the studied types were similar by containing the compounds: Oleic Acid, Cyclohexasiloxane, dodecamethyl- , cis-Vac acid, 3-Isopropoxy-1,1,1,7,7,7-hexamethyl-3,5,5-tris(trimethylsiloxy)tetrasiloxane, 13-Octadecenal, (Z)- , 9-Octadecenoic acid (Z)-, methyl ester, Mercaptoacetic acid, bis(trimethylsilyl)- and Morphinan. The results showed that the studied species can be separated using chemical analysis information.

Keywords: Bahr al-Najaf depression, Fagonia burguieri, Z. coccineum, Zygophyllum fabago, Zygophyllaceae, GC-Mass.

INTRODUCTION

Baher Al-Najaf depression is one of the fertile and interesting environments, and it is located in the Najaf governorate in central Iraq and extends linearly from the north of Najaf to the southwest of the city of Al-Hirah, previously it was submerged by the waters of the Euphrates river, and connected to the Gulf by the marshes, and because of its large area, which is estimated at 60 miles in length and 30 miles in width, it was called the sea of Najaf, but its water dried up after the water of the Euphrates was cut off from it [1]. A lot of researches and scientific studies have indicated that it plays an important role in the prosperity of the city of Najaf because most of its lands are agricultural [2]. [3] indicated that it is considered a wetland, consisting of a lake or swamp-like area with limited cultivated orchards, surrounded by vast desert or semi-

desert. The most abundant plant species in the area are annuals and perennials, and that the majority of annuals are widespread in the area. The majority of annual plants spread in the region belong to the Poaceae family, in addition to other plant families [4].

The family Zygophyllaceae belongs to the order Zygophyllales [5]. They are Perennial herbs with woody bases or shrubs, and rarely annual they contain about six genera in Iraq [6]. [7] stated that the family includes 25 genera and 250 species in the world. [8] reported that the family includes approximately 22 genera and 230-240 species.Its inhabitants reside in the desert or salty regions of temperate and tropical regions around the world [9] . [10] explained that individuals are importance in folk medicine due to their chemical content of phenols and flavonoids.

Fagonia burguieri DC. this species grows in the form of perennial spiny weeds or sub-shrubs, and it is a flowering plant that exists mainly in the form of low shrubs or perennial herbs, rarely as annual plants, and is distributed in sandy plains, coastal limestone hills and desert valleys [11]. It contains saponins, alkaloids, terpenoids, sterols, flavonoids, proteins, amino acids, coumarins and trace elements[12], as well as flavonols and glycosides [13]. Medically it is commonly used as a home remedy, and its aqueous and alcoholic extracts are used as medicines to treat conditions such as diabetes, asthma and stomach pain, as an anti-tumor, antioxidant and analgesic, and as a preventive antipyretic against smallpox factors, it has also been used to treat cancer, urinary tract secretions, dental pain, and kidney diseases [14]. Other effects include anti-allergic, analgesic, and anticoagulant, as well as anti-inflammatory and wound healing accelerator [15]. and treatment for hepatitis, abscesses, pimples, digestive problems, and cold [16].

Zygophyllum coccineum L. is a small perennial herb that is distinguished by its succulent leaves and white flowers. It grows in saline and sandy soils near the sea, its growth and distribution depend on the chemical composition of the soil [17]. The growth of species Z. coccineum was observed in abundance during heavy rains in 2012 and 2013 in the desert of Najaf [18]. [19] state that the plant is rich in saponins, as phytochemical examinations revealed that the main secondary metabolites in the plant are a class of Quinovic acid compounds belonging to Ursane, Triterpene, Saponins, including Zygophylloside, along with the flavonoid glycoside, sterols, and mollusks, the most abundant medicinal compound in it is Zygophyllin (28% in the leaves, 18% in the stems, and 26% in the fruits) and quinovic acid (36% in the leaves, 0.31% in the fruits and 0.47% in the stems). The species has medicinal value as an antidiabetic and antioxidant agent, and an environmental value as a biological compound of heavy metals from soil and water [20].

Zygophyllum fabago L. locally known as Khannaiq addijaj [21], is a perennial herbaceous plant also known as the Syrian bean caper distributed in Pakistan, Iran, Afghanistan, Iraq and Turkey [22], and some studies have shown various activities of it including antifungal and antibacterial activities [9]. Previous phytochemical studies on plant bark and aerial parts have shown that 27-nortriterpenoid glycosides, sulphated triterpenoid saponins fabagoin and zygophylosides E, G, (O-R) and separate disulfate triterpenoid derivatives [23]. The plant is considered one of the important herbs that have known properties, as the plant extract is used entirely by herbalists to treat some infectious diseases and haemorrhoids [24], and the aerial parts of it are also

used internally as an anti-rheumatic, anthelmintic, laxative, anti-asthma, and treatment coughing, expectorant and anti-inflammatory, and externally for skin diseases and wounds and as anti-inflammatory and analgesic for pain [25]. It is also used topically to relieve painful inflammatory symptoms caused by insect bites, such as bees, as well as scorpions [23]. So This study aims to diagnose the chemical constituents of these three species with GC-Mass technology.

Materials and methods

Collecting and preparing plants extraction

5.0g of dried leaves powder were taked and mix with 4ml of methanol and 2ml of acetone at a concentration of 99.99%, put it in a test tube and close tightly with continued stirring and leave it at room temperature for 24 hours. then filtered by filter paper and the filtrate was then ready for examination with a Gas Chromatography Mass Spectrometry (GC-MS) device [29].

GC-MS analysis

This test was performed at the GC-MS Unit / Ministry of Industry / Iraq. Type of device Gas Chromatography: Agilent (7820A) USA GC- Ms Spectrometer. The conditions of analysis as follow:

Analysis column: (30 meters length x 250 m diameter x 0.25 m inner diameter)

The Gas carrier was helium 99.999% with a constant flow of 1 mL / min.

The volume of injected fluid is 1 µl.

11.933 psi pressure

The temperature of the GC inlet line is 250 ° C

Ion source temperature is 310 ° C

Injector temperature 250 ° C, scanning range 50-500 M / Z

Type of injection: Spitless

The oven temperature is programmed from 80 ° C to 180 ° C, for 8 ° C / min, from 180 ° C to 280 ° C for 8 ° C / min, and from 280 ° C to 300 ° C for 4 ° C / The total time for running GC is 30 minutes.

Results and discussion

The GC-MS analysis showed the presence of 59 phytochemical compounds in all the studied species, which have many biological activities, including anti-inflammatory compounds such as Hexadecane, 9-Dodecenoic acid, Oleic Acid, 2,3-dihydroxypropyl ester and Octadec-9. -Eenoicacid and anti-cancer properties of 9-Octadecenoic acid (Z). In addition to the activity of high cholesterol in the blood in the compounds Dodecanoic acid and Tetradecanoic acid [26]. Changes appeared in the number of chemical compounds, contained in the species F.burguieri recorded 14 chemical

compounds (Table1), while the results of the study showed the presence of 24 compounds in the species Z. coccineum (Table2), and 21 chemical compounds in the species Z. fabago (Table3),. The results showed that the studied species were similar by containing the compounds: Oleic Acid, Cyclohexasiloxane, dodecamethyl- , cis-Vac acid, 3-Isopropoxy-1,1,1,7,7,7-hexamethyl-3,5,5-tris(trimethylsiloxy)tetrasiloxane, 13-Octadecenal, (Z)- , 9-Octadecenoic acid (Z)-, methyl ester, Mercaptoacetic acid, bis(trimethylsilyl)- and Morphinan.

The device recorded the appearance of symmetry in some chemical compounds in a curve area and different retention times for the same species, where the three species shared the compound 3-Isopropoxy-1,1,1,7,7,7-hexamethyl-3,5,5-tris (trimethylsiloxy). Tetrasiloxane. The species F. burguieri and Z. fabago are identical to the chemical compounds Cyclohexasiloxane, dodecamethyl, Oleic Acid, Hexasiloxane, tetradecamethyl. The two types Z. coccineum and Z. fabago were similar to the compounds Hexasiloxane, 1,1,3,3,5,5,7,7,9,9, 11,11-dodecamethyl, and the two types Z. coccineum and F. burguieri only shared the compound 1. 1,1,5,7,7,7-Heptamethyl-3,3-bis (trimethylsiloxy) tetrasiloxane.

In the species, F. burguieri the highest Area peak percent from total area was 12.90 at a time of 13.964 for the compound Octadecane (Table1), agrees with the study of [27],while the highest Area of peak in Z.coccineum was recorded for the compound Phytol about 11.81 at the time of appearance of 18,371 (Table2) consistent with the study of [28], and the alcoholic extract content of Z. fabago leaves contained the highest Area of peakof thiophene, tetrahydro-2-methyl, reaching 10.27 in the period of appearance of 16,385 (Table3), consistent with [23].

By comparing the number of peaks in each chemical diagram, it was observed that species Z.coccineum having (13) peaks (Figure2), the study is incompatible with [28] because The peaks number is (12), while the lowest number (12) was in F. burguieri (Figure1), and the highest peaks in Z. fabago with (17) peaks (Figure3), is incompatible with [23] because peaks number is (15). This is different from previous studies, where the number of peaks in each species differed.

The results of the study showed the chemical quality in each compound for each species, where the highest amount was recorded in the Z. fabago, reaching 17 at the top, 92 for the compound Hexadecanoic acid, while the lowest amount for the species F. burguieri was 6 at the top 80 for the compound Octadecane [23].

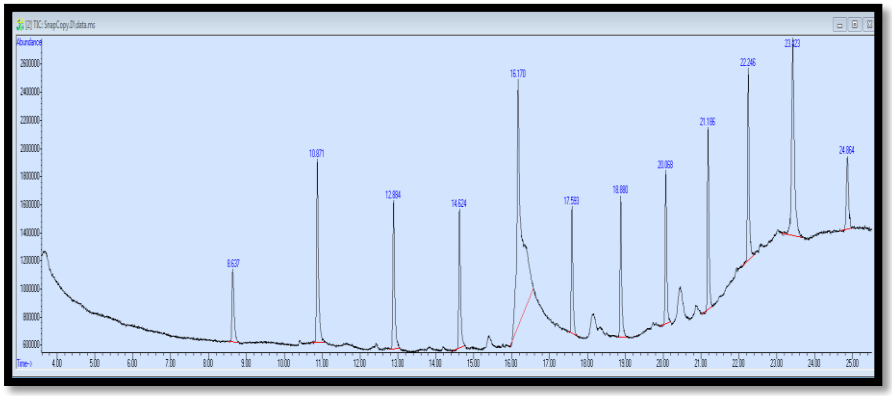
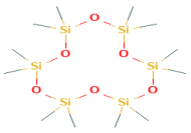
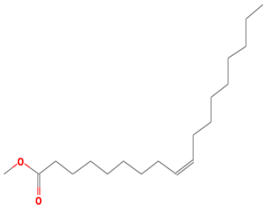
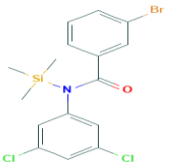
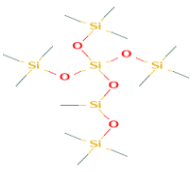
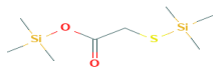
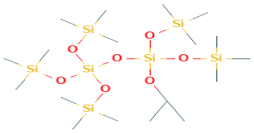
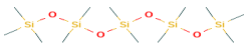
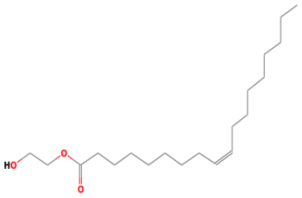
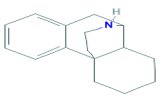
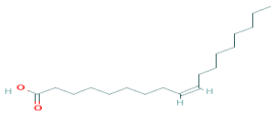


Figure (1) : Outline of chemical compounds in Methanolic extract of F.burguieri leaves

Table 1: Chemical compounds in Methanolic extract of *F.burguieri* leaves

No of peaks	Name of compound	Retention time	Area %	Molecular weightg /mol	Molecular formula	Structural formula
1	Cyclohexasiloxane, dodecamethyl	8.638	3.48	444.92	$C_{12}H_{36}O_6Si_6$	
2	cis-Vaccenic acid	12.883	6.60	282.5	$C_{18}H_{34}O_2$	
3	9-Octadecenoic acid (Z)-, methyl ester	10.870	8.31	296.48	$C_{19}H_{36}O_2$	
4	Octadecane	13.964	12.90	254.5	$C_{18}H_{38}$	
5	3-Bromo-N-(3,5-dichlorophenyl)benzamide tms	14.623	5.78	417.2	$C_{16}H_{16}BrCl_2NOSi$	
6	1,1,1,5,7,7,7-Heptamethyl-3,3-bis(trimethylsiloxy)tetrasiloxane	20.067	5.81	443.96	$C_{13}H_{39}O_5Si_6$	

7	Mercaptoacetic acid, bis(trimethylsilyl)-	17.591	5.02	236.48	$C_8H_{20}O_2SSi_2$	
8	3-Isopropoxy-1,1,1,7,7,7-hexamethyl-3,5,5-tris(trimethylsiloxy)tetrasiloxane	18.878	5.52	577.2	$C_{18}H_{52}O_7Si_7$	
9	Dodecanoic acid	16.172	12.40	194.18	$C_{12}H_{24}O_2$	
10	-(Octadecenal, (Z-13	22.244	7.74	266.5	$C_{18}H_{34}O$	
11	Pentasiloxane, dodecamethyl	23.422	13.11	384.84	$C_{12}H_{36}O_4Si_5$	
12	9-Octadecenoic acid (Z)-, 2-hydroxyethyl ester	24.957	11.09	326. 39	$C_{20}H_{38}O_3$	
13	Morphinan	12.667	6.54	227.34	$C_{16}H_{21}N$	

14	Oleic Acid	24.862	3.85	282.5	$C_{18}H_{34}O_2$	

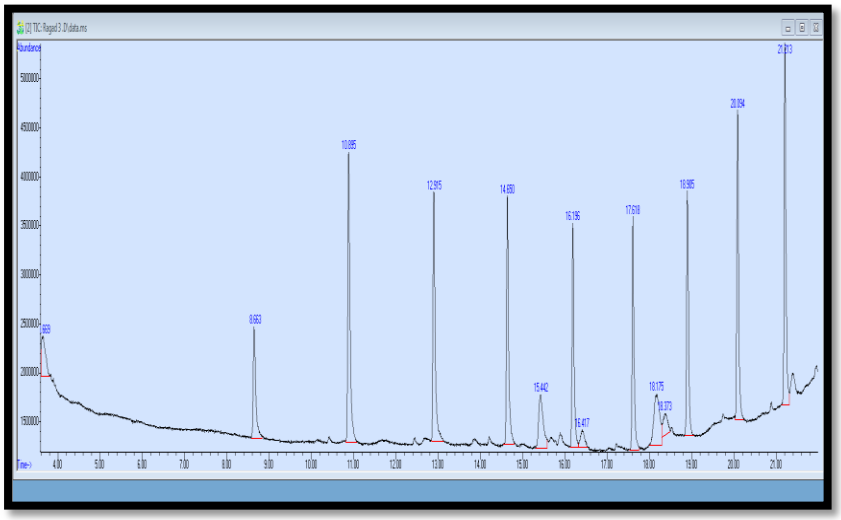
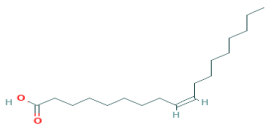
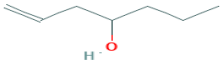
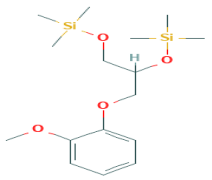
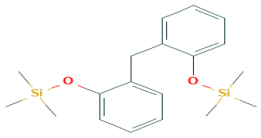
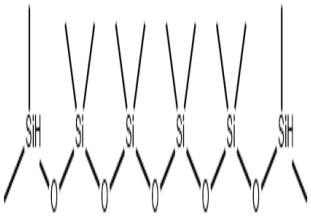
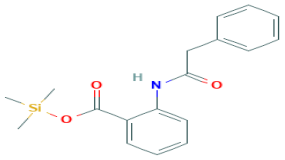
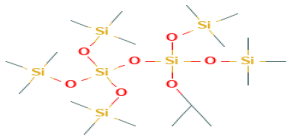
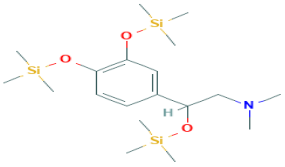
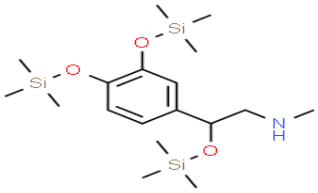
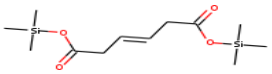
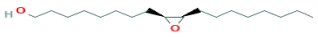
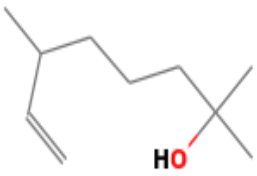
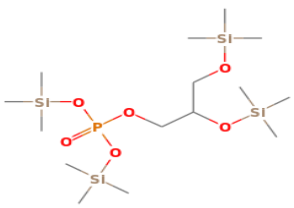


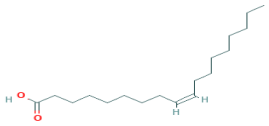
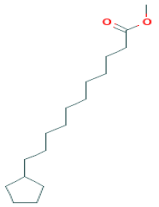
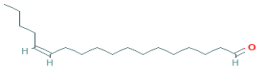
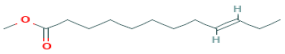
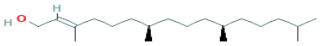
Figure (2) : Outline of chemical compounds in Methanolic extract of *Z. coccineum* leaves

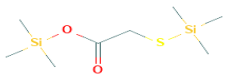
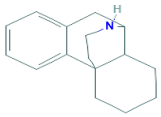
Table 2: Chemical compounds in Methanolic extract of *Z. coccineum* leaves

No of peaks	Name of compound	Retention time	Area%	Molecular weight	Molecular formula	Structural formula
1	Oleic Acid	3.669	2.90	282.5	C18H34O2	
2	Acetic acid, hydrazide 1-Hepten-4-ol	11.896	3.88	114.19	$C_7H_{14}O$	

3	Cyclohexasiloxane, dodecamethyl- Guaifenesin di-tms derivative	20.001	10.78	342.58	$C_{16}H_{30}O_4Si_2$	
4	2,2'-Bis(trimethylsilyloxy) diphenylmethane	8.660	5.16	344.6	$C_{19}H_{28}O_2Si_2$	
5	Hexasiloxane, 1,1,3,3,5,5,7,7,9,9, 11,11-dodecamethyl	10.897	11.98	430.94	C12H38O5Si6	
6	Anthranilic acid, N-(phenylacetyl) -N-trimethylsilyl-, trimethylsilylester	11.445	0.89	327.4	$C_{18}H_{21}NO_3Si$	
7	3-Isopropoxy-1,1,1,7,7,7-hexamethyl-3,5,5-tris(trimethylsiloxy)tetrasiloxane	20.333	9.11	577.2	$C_{18}H_{52}O_7Si_7$	
8	N-Methyladrenaline, tri-TMS	12.915	10.22	413.8	$C_{19}H_{39}NO_3Si_3$	
9	Phenethylamine, N-methyl-.beta.,3,4-tris(trimethylsiloxy)	12.670	8.22	512.4	$C_{18}H_{37}NO_3Si_3$	

10	Octasiloxane, 1,1,3,3,5,5 ,7,7,9,9,11,11,13,13, 15,15- hexadecamethyl	14.650	9.40	577.2	$C_{16}H_{48}O_7Si_8$	
11	trans-3-Hexenedioic acid, bis(trimethylsilyl) ester	14.556	6.34	288.49	C12H24O4Si2	
12	cis-9,10-Epoxyoctadecan-1-ol	15.441	4.45	284.5	$C_{18}H_{36}O_2$	
13	11-Tridecen-1-ol	10.906	2.23	198.34	$C_{13}H_{26}O$	
14	7-Octen-1-ol, 2,6-dimethyl	21.333	1.55	156.26	$C_{10}H_{20}O$	
15	Phosphoric acid, bis(trimethylsilyl) 2,3-bis[(trimethylsilyl)oxy]propyl ester	16.194	8.00	460.79	$C_{15}H_{41}O_6PSi_4$	

16	cis-Vaccenic acid	16.418	1.39	282.5	C18H34O2	
17	Cyclopentaneundecanoic acid, methyl ester	13.045	4.55	268.4	$C_{17}H_{32}O_2$	
18	Octadecenal, (Z)--13	18.174	5.51	266.5	C18H34O	
19	9-Dodecenoic acid	11.443	6.78	212.33	$C_{13}H_{24}O_2$	
20	Phytol	18.371	1.81	296.5	$C_{20}H_{40}O$	
21	Hexadecane	19.284	11.73	382.7	$C_{16}H_{34}$	

22	9-Octadecenoic acid (Z)-, methyl ester	18.905	8.52	296.48	$C_{19}H_{36}O_2$	
23	Mercaptoacetic acid, bis(trimethylsilyl)-	20.095	10.38	236.48	C8H20O2SSi2	
24	Morphinan	21.213	12.29	227.34	C16H21N	

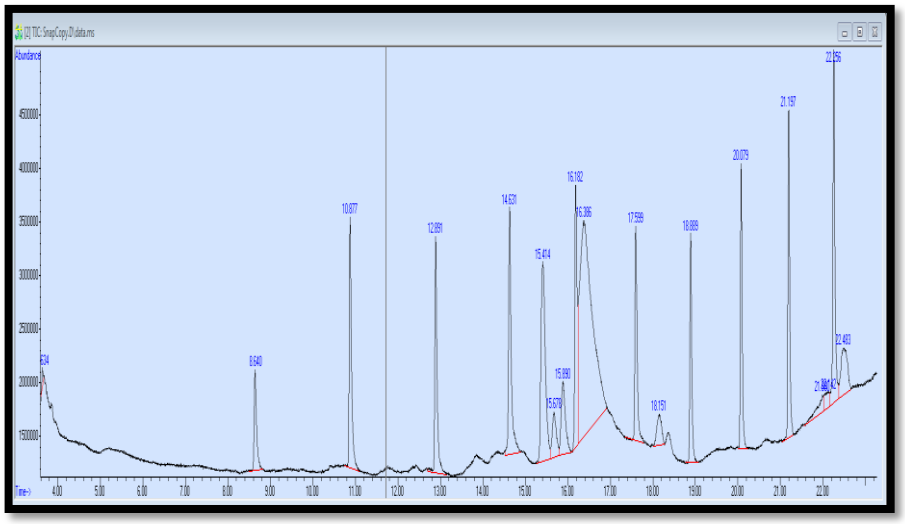
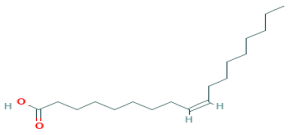
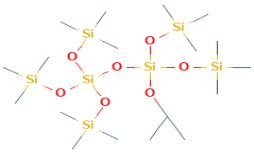
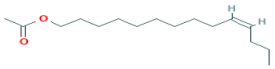
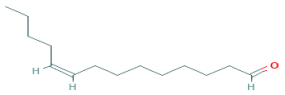
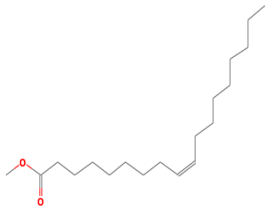
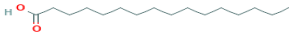
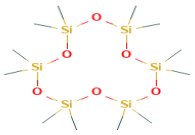
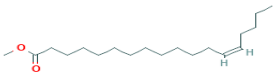
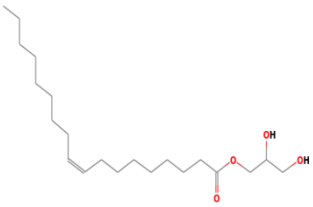
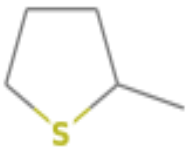


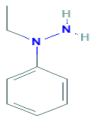
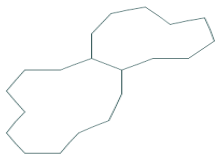
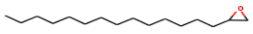
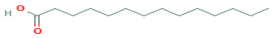
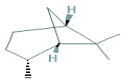
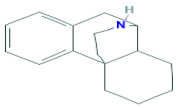
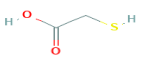
Figure (3) : Outline of chemical compounds in Methanolic extract of Z. fabago leaves

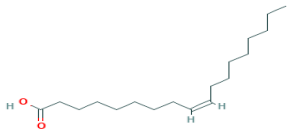
Table 3: Chemical compounds in Methanolic extract of *Z. fabago* leaves

No of peaks	Name of compound	Retention time	% Area	Molecular weight	Molecular formula	Structural formula

1	Oleic Acid	10.875	5.72	282.5	$C_{18}H_{34}O_2$	
2	Octadec-9-enoic acid	22.484	3.04	287.8	$C_{12}H_{30}O_2$	
3	Hexasiloxane, tetradecamethyl	20.078	5.01	458.99	$C_{14}H_{42}O_5Si_6$	
4	3-Isopropoxy-1,1,1,7,7,7-hexamethyl-3,5,5-tris(trimethylsiloxy)tetrasiloxane	22.255	7.33	577.2	$C_{18}H_{52}O_7Si_7$	
5	Z-10-Tetradecen-1-ol acetate	22.140	0.79	254.41	$C_{16}H_{30}O_2$	
6	13-Octadecenal, (Z)	12.940	0.60	266.5	$C_{18}H_{34}O$	

7	9-Tetradecenal, (Z)	21.988	1.04	210.36	$C_{14}H_{26}O$	
8	9-Octadecenoic acid (Z)-, methyl ester	17.602	4.39	296.48	$C_{19}H_{36}O_2$	
9	Hexadecanoic acid	21.197	5.89	256.42	$C_{16}H_{32}O_2$	
10	Cyclohexasiloxane, dodecamethyl	18.889	4.36	444.92	$C_{12}H_{36}O_6Si_6$	
11	cis-13-Octadecenoic acid, methyl ester	18.153	1.50	296.5	$C_{19}H_{36}O_2$	
12	9-Octadecenoic acid (Z)-, 2,3-dihydroxypropyl ester	8.638	2.47	356.53	$C_{21}H_{40}O_4$	
13	Thiophene, tetrahydro-2-methyl	16.385	27.27	102.19	$C_5H_{10}S$	

14	Hydrazine, 1-ethyl-1-(1-methylpropyl)	16.183	6.03	136.19	$C_8H_{12}N_2$	
15	Bicyclo[10.8.0]eicosane (E)	15.676	1.88	278.5	$C_{20}H_{38}$	
16	Oxirane, tetradecyl	15.889	3.15	240.42	$C_{16}H_{32}O$	
17	Tetradecanoic acid	18.630	2.66	142.24	$C_{14}H_{28}O_2$	
18	Bicyclo[3.1.1]heptane, 2,6,6-trimethyl	15.414	8.55	138.25	$C_{10}H_{18}$	
19	Morphinan	20.442	8.65	227.34	$C_{16}H_{21}N$	
20	Mercaptoacetic acid, bis(trimethylsilyl)-	14.628	6.08	92.12	$C_2H_4O_2S$	

21	cis-Vaccenic acid	12.894	5.29	282.5	$C_{18}H_{34}O_2$	

Conclusions

The present study has proven its assisting in the classification of species studied using chemotaxonomic techniques, especially the GC-MS technique, which represents a direct and fast analytical approach for the identification of phytoconstituents.

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